

# Health Care Quality-Improvement Approaches to Reducing Child Health Disparities

## abstract

Relatively few quality-improvement efforts have been aimed at reducing differences in children's care and outcomes across race and ethnicity, socioeconomic status, and insurance status. To inform quality-improvement efforts to reduce child health disparities, we summarize lessons learned from the adult disparities-intervention literature, identify interventions that have reduced disparities in pediatric asthma outcomes and immunization rates, and outline special considerations for child disparity interventions. Key recommendations for providers, health care organizations, and researchers include: (1) examine your performance data stratified according to insurance status, race/ethnicity, language, and socioeconomic status; (2) measure and improve childhood health-related quality of life, development, and condition-specific targets (such as asthma and immunizations); (3) measure and improve anticipatory guidance for early prevention of conditions (such as injuries, violence, substance abuse, and sexually transmitted diseases) and efforts to promote positive growth (such as readership programs to improve low literacy); (4) measure and improve structural aspects of care that affect child health outcomes and can reduce disparities, such as patient-centered medical-home elements; (5) incorporate families into interventions; (6) use multidisciplinary teams with close tracking and follow-up of patients; (7) integrate non-health care partners into quality-improvement interventions; and (8) culturally tailor quality improvement. A key recommendation for payers is to align financial incentives to reduce disparities. The National Institutes of Health and other funders should support (1) disparity-intervention studies on these recommendations that analyze clinical outcomes, intervention-implementation processes, and costs, and (2) creation of new child health services researchers who can find effective quality-improvement approaches for reducing disparities. *Pediatrics* 2009;124:S224–S236

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Equity is one of the Institute of Medicine's 6 pillars of quality health care, along with effectiveness, efficiency, patient-centeredness, safety, and timeliness.<sup>1</sup> However, the quality-improvement field has intersected very little with the health care disparities field. Most disparities research has documented differences in care and explored mechanisms that lead to these differences, but comparatively few interventions for reducing disparities have been implemented. In the quality-improvement field, most work has concentrated on improving general effectiveness and safety. Using quality-improvement tools to reduce disparities—that is, making equity an integral component of quality-improvement activities—is a nascent movement.<sup>2</sup>

As part of the Robert Wood Johnson Foundation's Finding Answers: Disparities Research for Change program, we recently conducted a systematic review of the adult literature on health care interventions that have reduced racial and ethnic disparities in care processes and outcomes. In addition, through our grants program that funds evaluations of disparities-reduction interventions, we have learned about some of the most innovative quality-improvement approaches to reducing racial and ethnic disparities.<sup>3</sup> However, although much can be learned from the adult experience, reducing child health care disparities entails special challenges.

In this article, we provide recommendations on health care quality-improvement approaches to reducing child health disparities and identify key areas for future research in this area. We developed these recommendations by (1) reviewing key findings from the adult literature on approaches to reducing racial and ethnic disparities in care and (2) drawing lessons from a review of interventions to

reduce racial and ethnic disparities in asthma care and immunizations in children, which are paradigmatic areas for chronic care management and preventive medicine.

We also discuss special considerations for quality-improvement approaches to reducing child health disparities.

### LESSONS LEARNED FROM THE ADULT DISPARITIES-INTERVENTION LITERATURE

In this section, we describe 6 integral components of a systems approach for reducing disparities in care. We also provide lessons learned from systematic reviews of the adult literature.

#### Integral Components of a Systems Approach for Reducing Disparities in Care

In an editorial published in the *Annals of Internal Medicine*,<sup>4</sup> we highlighted 6 necessary components of a systems approach that health care organizations can use to reduce disparities in care.

1. Examine your own performance data stratified according to insurance status, race or ethnicity, language, and socioeconomic status. Many providers do not believe that disparities exist in their own practices until they see their own objective data. They will not be motivated to work on disparity issues until they are convinced that differences in care exist in their practices.
2. Obtain training for yourself and your staff in working effectively with diverse populations. Effective disparities-education programs enable providers to examine their own biases and those that their patients bring to the provider-patient encounter. These programs also teach important communication skills such as working with patients who have limited health literacy

and individualizing care for the unique medical, sociocultural, and economic contexts in which patients live.<sup>5</sup>

3. Make reducing inequities in care for vulnerable populations an integral component of quality-improvement efforts. Some quality-improvement experts believe that a "rising tide lifts all boats," but evidence suggests that culturally tailored approaches might be more effective than generic approaches.<sup>6</sup>
4. Provide the models of care and infrastructure support that organizations need to improve quality of care for vulnerable patients. Many well-meaning health care organizations that wish to reduce disparities do not know where to start. Successful interventions are user-friendly to ensure dissemination and translation, and organizations must provide the environment, process support, and expertise necessary for program uptake.
5. Align incentives to reward providers and health care organizations for providing high-quality care to vulnerable populations. Ultimately, efforts to reduce disparities must be financially viable to be sustained.
6. Allocate and advocate for more resources for the uninsured with chronic disease. The uninsured and the safety-net providers who provide the bulk of their care require additional resources. Few incentives exist to care for the uninsured, and many overwhelmed public hospital and clinic systems are in crisis.

#### Lessons Learned From Systematic Reviews of the Adult Literature

We recently completed a systematic review of the adult racial and ethnic disparities-intervention literature for breast cancer, cardiovascular disease, depression, diabetes, cultural

tailoring, and pay-for-performance incentives.<sup>6–12</sup> On the basis of this review, we developed the following cross-cutting recommendations: (1) Most successful approaches to eliminating disparities are multifactorial interventions that address multiple leverage points along a patient's care pathway. To improve outcomes, key barriers must be addressed. If a patient cannot overcome any barrier along the pathway of screening, diagnosis, treatment, and follow-up, outcomes will suffer. (2) Culturally tailored quality improvement seems more promising than generic quality-improvement techniques. Culturally tailored approaches, many of which also incorporate generic quality-improvement approaches, tend to address more of the root causes of health care disparities. (3) Promising nurse-led interventions incorporate multidisciplinary teams and close tracking and monitoring of patients. It is unclear why many nurse-led interventions have been successful. However, possible explanations include a heavy emphasis on patient-centered care; multidisciplinary collaborative systems approaches; more time for educating, tracking, and following patients; and a nursing workforce that is more diverse than the physician workforce.

## REVIEW OF HEALTH CARE INTERVENTIONS TO REDUCE RACIAL AND ETHNIC DISPARITIES IN CHILDHOOD ASTHMA AND IMMUNIZATIONS

Significant racial and ethnic health disparities have been documented in many areas within pediatric health care. For example, disparities exist with respect to the quantity and quality of anticipatory guidance delivered to parents and adolescents.<sup>13–15</sup> Because of the differences between children and adults, we must be cautious about extrapolating lessons from the adult literature to child health disparities.

Therefore, we reviewed the literature on quality-improvement intervention studies to reduce child health disparities for 2 representative areas: asthma care and immunizations. Asthma is paradigmatic of a chronic health condition that requires ongoing, coordinated care, and immunizations represent preventive measures.

We searched PubMed and Google Scholar by using the following search terms: “intervention,” “evaluation,” “racial and ethnic,” “minority group,” “pediatric,” “childhood,” “child(ren),” “immunization,” “vaccination,” and “asthma.” We included studies published between 1997 and 2008 that focused on reducing racial and ethnic disparities in care or in which at least 50% of study participants were from racial or ethnic minority backgrounds.

### Asthma Interventions

Nineteen studies described quality-improvement interventions to decrease health disparities for pediatric asthma (Table 1). The studies varied in structure, intervention targets, and outcomes. Some studies measured processes of care such as providing an asthma action plan or prescribing inhaled corticosteroids; others measured clinical outcomes such as numbers of symptom-free days, emergency department visits, and hospitalizations. Many of the interventions were multifactorial, which made it difficult in some cases to identify the most important causative factors. Most studies showed positive changes in process or outcome measures, perhaps reflecting publication bias.

In general, studies that targeted clinic operation processes and provider education tended to show improvements in processes of care; a minority of these studies showed changes in clinical outcomes as well. Interventions resulted in significant changes in clinical outcomes when they used case man-

agement, social workers, or community health workers or when they targeted patient self-management, family, home environment, specialist clinic referrals, or school settings.

The development of written asthma action or management plans was a component of nearly all interventions that were focused on improving care processes. Overall, these interventions improved the identification of pediatric patients with asthma, increased the number of routine visits for asthma management, and reduced emergency or urgent health care use for asthma.

### Improving Care Processes in the Clinical Setting

We now describe specific organizational change and quality improvement, physician or provider prompt, provider-education intervention, specialist referral intervention, care coordination, provider-caretaker communication, and nurse-educator studies. Unless otherwise indicated, each intervention improved clinical care processes.

Four studies included planned organizational change or quality-improvement methods.<sup>16–19</sup> One study showed that a large-scale, multisite quality-improvement intervention had no effect.<sup>18</sup> The investigators cited the challenges of implementing quality-improvement strategies across multiple sites as a possible factor in the intervention's ineffectiveness.

Two studies included physician or provider prompts to improve the asthma-care process.<sup>17–20</sup> These prompts included chart reminders, asthma-visit flow sheets, and clinician pocket guides. Physician or provider education was a component of 4 intervention studies.<sup>16–19</sup> The main focus was adherence to the National Asthma Education and Prevention Program guidelines for pediatric asthma care. These studies combined provider

**TABLE 1** Quality-Improvement Studies for Reducing Disparities in Pediatric Asthma

Study Type	Intervention	n, Racial and Ethnic Composition	Follow-up	Setting	Process Measures and Patient Outcomes Measures	Summary
Controlled study, ProED, CLIN <sup>6</sup>	Provided asthma education and behavioral change, with emphasis on preventive care for asthma patients; used the Medical Home for Asthma Program and prevention, screening, and treatment protocols	I: 11 clinics; mean No. of patients, 3118 ± 1705; black, 44%; Latino, 33%; C: 11 clinics; mean No. of patients, 2487 ± 1588; black, 48%, Latino, 34%	24 mo	New York City Bureau of Child Health clinics	Identification and treatment of patients with asthma, continuity of care, use of inhaled and antiinflammatory medicines, patient education by physicians and nurses	Intervention clinics doubled identification rate for patients with asthma; rates in control group did not change; percentage of patients treated for asthma in year 1 who returned for asthma care the next year increased 10% in intervention clinics and declined 2% in control clinics; average No. of yearly visits to clinics by patients with asthma increased by 58% in intervention clinics, resulting in improved continuity of care; no change in control clinics; higher proportion of patients received indicated medications in intervention clinics; a higher proportion of patients in intervention clinics received patient education ++Process
Demonstration QI intervention using clinic-wide random cross-sectional chart reviews and longitudinal data to measure outcomes, CHWs, CLIN (ProED) <sup>17</sup>	Team-based continuous-QI process, combined with a CHW at each clinic site; clinic-tailored care-process changes implemented, including introducing asthma visit flow sheets, using asthma action plans, creating clinician pocket guides, training providers and staffs on care guidelines, and connecting with local schools and community organizations; CHW served as a link between providers, home environment, school, and community; clinics were supported by a technical-assistance team that oversaw the QI process	Cross-sectional chart review sample: 560; interview sample (longitudinal cohort): 405; chart review sample: black, 16.4% at baseline and 18.2% at follow-up; Hispanic, 66.1% at baseline and follow-up; white, 13.6% at baseline and 7.9% at follow-up; other, 3.9% at baseline and 7.9% at follow-up; interview sample: black, 14.3%; Hispanic, 81.7%; white, 2.2%; other, 1.7%	24 mo	7 southern California community clinics treating ~3000 children with asthma	Night and day asthma symptoms, use of medications, No. of ED visits, hospitalizations, and missed school days; patient and family assessment of quality of care, confidence in self-management, asthma action-plan review, influenza vaccinations, and documentation of indicators of quality of care	Less severe asthma ratings among patient population; decrease in the No. of hospitalizations, acute visits, ED visits, missed school days, and day and night symptoms; less use of rescue medications; increase in the No. of families reporting care as excellent or very good and in self-confidence in asthma management; use of CHWs could strengthen QI process, because they provide feedback on the community factors that affect whether patients meet asthma-management goals ++Process; ++outcomes
Randomized trial, ProED, CLIN <sup>18</sup>	12-mo multidisciplinary learning collaborative project; 3-member multidisciplinary teams attended breakthrough series learning sessions on chronic care model and received a model for improvement and national asthma-care guidelines; tools, such as encounter forms and electronic patient registries, provided to clinics	I: 294; black, 28%; white, 50%; other, 22%; C: 337; black, 27%; white, 43%; other, 30%	12 mo	Practices in 2 health systems in greater Boston, MA, and Detroit, MI, areas; 22 intervention practices, 21 control practices	Proportion of children who received appropriate medication therapy for asthma; proportion of families that received a written asthma-management plan for their child; daily use of inhaled-steroid and controller medications; No. of asthma hospitalizations and ED visits; No. of asthma attacks; parent report of child's activity limitations	Outcome measures of children's asthma care did not differ between intervention and control groups, possibly because of problems implementing the method in a real-world setting (poor attendance at learning sessions, low reporting levels from participating clinics) -Process; -outcomes
Matched-control design, ProED, CLIN <sup>19</sup>	QI teams attended breakthrough series learning sessions on organizational change, improving care, and incorporating asthma-care strategies into clinics	I: 385; black, 30%; Hispanic, 29%; white, 19%; other, 22%; C: 126; black, 23%; Hispanic, 22%; white, 43%; other, 12%	12 mo	13 geographically dispersed primary care clinics participating in a QI collaborative	Patient self-management; peak-flow monitoring, goal setting, and having a written asthma action plan; asthma knowledge of adolescents and parents of younger children; use of controller medications; QoL; impact on family functioning; parent satisfaction with children's care; and No. of ED visits, hospitalizations, missed school days, and parent missed work days; asthma severity, daytime and nighttime symptoms	Patients in the intervention group had better processes-of-care and QoL measure scores; patients enrolled in HMOs received consistently better processes of care than those not in HMOs ++Process; +QoL
Randomized, controlled trial, CLIN <sup>20</sup>	Clinician was prompted during office visit to assess child's asthma symptoms and severity and received treatment recommendations	I: 112; black, 63.4%; Hispanic, 26.8%; other, 28.6%; white, 8.0%; 151 recruited; C: 114; black, 64.9%; Hispanic, 32.5%; other, 23.7%; white, 11.4%	60 d	Two inner-city children's primary care clinics in Rochester, NY; hospital in South Bronx, NY	No. of physicians taking preventive measures during clinic visits; physician-developed asthma action plan, discussion of asthma with family, recommended asthma follow-up visit	Patients in the intervention group were 3 times more likely than those in the control group to receive preventive care from physicians ++Process

**TABLE 1** Continued

Study Type	Intervention	n, Racial and Ethnic Composition	Follow-up	Setting	Process Measures and Patient Outcomes Measures	Summary
Prospective randomized trial, CLIN <sup>21</sup>	Pediatric patients with asthma were randomly assigned to receive asthma care in specialty clinics or in usual primary care setting	C: 147 recruited; 60 included in final analysis; 1: 60 included in final analysis; hospital serves Hispanic (68%) and black (37%) communities I: 244; black, 86.5%; Hispanic, 9.8%; C: 244; black, 85.3%; Hispanic, 9.0%	12 mo	Pediatric medical center ED, Washington, DC	No. of visits to the ED for asthma; No. of hospitalizations for asthma	Despite higher asthma severity index, patients in the treatment group had fewer ED visits and hospital admissions ++Outcomes
Prospective randomized, controlled trial, CLIN <sup>21</sup>	Children and families educated on asthma, medication usage, environmental-trigger control, and importance of ongoing care with PCP and specialist; follow-up clinic established in ED to serve pediatric patients with asthma	I: 244; black, 86.5%; Hispanic, 9.8%; C: 244; black, 85.3%; Hispanic, 9.0%	6 mo	Pediatric medical center ED, Washington, DC	No. of unscheduled visits for asthma care; use of inhaled corticosteroids; limitations in daily QoL	Patients in the intervention group had significantly fewer unscheduled visits for asthma, more usage of inhaled corticosteroids, and fewer limitations in QoL ++ Outcomes
Randomized, controlled trial, FAM, (ProED) (CLIN) <sup>23</sup>	Children attended group asthma education sessions; SWs coached parents and guardians to improve communications with providers and families' management of child's asthma; parents and guardians attended group asthma education sessions to enhance problem-solving and asthma-management skills; families given pillow and mattress covers and taught to minimize children's exposure to tobacco smoke, pets, and cockroach allergens; PCPs received guidelines, blank action plans, spacers, and peak-flow meters for study patients; asthma counselors gave families referrals to community resources, such as smoking-cessation programs	I: 515; black, 75.9%; Hispanic, 17.1%; other, 7%; C: 518; black, 73.1%; Hispanic, 17.4%; other, 9.5%	24 mo	Multiple inner-city residents taking part in the National Cooperative Inner-City Asthma Study	Family 2-wk recall of children's No. of symptom days; family 2-mo recall of hospitalizations and unscheduled visits for asthma	Children in the intervention group had fewer days of asthma symptoms and fewer hospitalizations than those in the control group; children maintained improved outcomes throughout second year of follow-up ++ Outcomes
Randomized, controlled trial, CM <sup>24</sup>	Patients and families received asthma-management education; written asthma action plan developed for families in both study arms; asthma outreach program nurse maintained close contact with intervention families for ongoing CM	I: 29; black, 69%; Hispanic, 3%; white, 28%; C: 28; black, 46%; Hispanic, 21%; Asian, 7%; white, 25%	24 mo	Primarily urban health centers in a New England HMO; children's clinic in Seattle, WA	No. of ED visits and hospitalizations, outside health plan use, cost per patient; health care use measured by monitoring automated encounter data, chart reviews, and confirmation with families at clinic visits	Compared with those in the control group, patients in the intervention group reduced hospitalizations by 75%, ED visits by 57%, and outside health plan expenditures by 71% ++ Outcomes; + cost-effective
Pilot study, pre/post intervention comparison, CHWs, home environment (school) <sup>25</sup>	Community-based lay worker (asthma outreach worker) collaborated with pediatrician, pharmacist, and public health nurse to offer coordinated asthma care using coordinated care model; asthma outreach worker conducted home visits, acted as liaison to health care system, addressed medical care plan in families' homes by conducting home-based assessments and developing tailored asthma-care plans; home visits were coordinated with multidisciplinary asthma clinic visits; coordinated with schools and housing authority to ensure adherence to asthma management plan and placement of children in better environments; parents and guardians received education with Open Airways curriculum	I: 23 (no control); black, 87%	9 mo	Children's clinic in Seattle, WA	Health care use was measured by monitoring automated encounter data, chart reviews, and confirmation with families at clinic visits	No. of hospitalizations reduced by 56%, ED visits by 65%, unscheduled visits to clinic by 45%, scheduled visits by 60%; reductions in numbers of ED visits and scheduled clinic visit reductions were statistically significant ++Outcomes

TABLE 1 Continued

Study Type	Intervention	n, Racial and Ethnic Composition	Follow-up	Setting	Process Measures and Patient Outcomes Measures	Summary
Cost-effectiveness analysis with randomized, controlled trial, SWs, FAM <sup>16</sup>	SWs helped families gain better asthma-management skills; SWs coached families to engage with physicians; SWs provided referrals to community resources for smoking cessation, counseling, housing assistance, and health insurance assistance; 2 group sessions and monthly contact with SWs	I: 515; black, 75.9%; Hispanic, 17.1%; other, 7%; C: 518; black, 73.1%; Hispanic, 17.4%; other, 9.5%	24 mo	8 sites in Bronx, NY; Boston, MA; Chicago, IL; Dallas, TX; New York City, NY; Seattle and Tacoma, WA, areas; and Tucson, AZ	No. of self-reported days of wheezing, chest tightness, cough; No. of nights of sleep affected by asthma; No. of days of child's activity limitations; direct medical costs of self-reported health care use for asthma (ED visits, hospitalizations, scheduled and unscheduled clinic visits)	Patients in the intervention group had fewer symptom-free days; no significant difference between groups in health care system use; for intervention to save money, mean cost per child to implement intervention should be less than \$92 ++Outcomes
Controlled clinical trial, SPEC, CM (school) <sup>22</sup>	Children and families frequently using health care system received asthma-management education from a physician and a nurse; nurse maintained ongoing contact with families for ongoing management	I: 38; black, 95%; white, 2%; C: 40; black, 95%; white, 7%	12 mo	Pediatric allergy clinic in Children's Hospital, Norfolk, VA	No. of ED visits, hospitalizations, days in hospital; QoL measurements	No. of ED visits and hospitalizations decreased for all children; rates decreased at a higher rate in intervention group; significantly larger proportion of patients in the intervention group received influenza vaccine than those in the control group +Outcomes; + cost-effective
Randomized, controlled study, PTED (CLIN) <sup>27</sup>	Families received risk profile based on psychosocial barriers to asthma management and problem-solving counseling; families of children presenting in ED or hospital for asthma received access to a nurse hotline	I: 89; black, 82%; Hispanic, 0%; white, 16.8%; Asian, 1.1%; C: 86; black, 88.4%; Hispanic, 1.2%; white, 10.5%; Asian, 0%	12 mo	Pediatric hospital in Cleveland, OH	No. of symptom days; severity of symptoms; use of asthma-advice hotline; No. of ED visits and hospitalizations for asthma; asthma-related QoL	No. of symptom days and severity of symptoms decreased in intervention and control groups and did not differ significantly between groups; significantly fewer patients in intervention group had ED visits or hospitalizations for asthma; both groups showed significant improvement in asthma-related QoL; fewer than one third of the families used the asthma hotline +Outcomes
Randomized, controlled trial, FAM, PHEd <sup>28</sup>	Children treated for acute asthma symptoms with a caregiver who smoked were recruited from pediatric ED; nurse-educator provided behavioral counseling to parents and guardians about asthma and environmental tobacco exposure; children received instruction on environmental tobacco exposure through game playing	I: 44; black, 31.8%; Asian Pacific, Native American, and other, 14%; Hispanic, 6%; white, 16%; C: 43; black, 44.2%; Asian Pacific, Native American, and other, 4.7%; Hispanic, 16.3%; white, 15%	12 mo	Pediatric pulmonary service of Fresno County, CA	Urinary cotinine-creatinine ratio; No. of acute asthma visits; No. of hospitalizations; smoking restrictions in the home; amount smoked in home; family-reported tobacco exposures of children; control of asthma symptoms	Significantly fewer acute asthma medical visits in intervention group; fewer hospitalizations in intervention group, but difference between groups was not significant; intervention group had improved cotinine-creatinine ratio and reduced smoking permitted in the home; the effect was large but not statistically significant +Outcomes
Randomized, controlled trial, PRSM <sup>32</sup>	Patient education through Web-based computer program that taught self-management skills	I: 66; black, 79%; white, 8%; other, 14%; C: 68; black, 74%; white, 12%; other, 15%	90 d	Children's primary care clinic in Oakland, CA	Activity limitations; perceived asthma symptoms, No. of missed school days, peak-flow meter readings in yellow or red zone, use of health care services	No. of activity limitations and peak-flow meter readings in yellow or red zone were significantly lower in intervention group; children in the intervention group were significantly more likely to take medications without reminders ++Outcomes
Randomized, controlled trial, PRSM <sup>33</sup>	Computer program for children that taught asthma monitoring and self-management	I: 76; black, 64.3%; Hispanic 2.4%; C: 61; black, 55.9%; Hispanic 8.8%	12 mo	Hospital-based pediatric primary care clinic and community health clinic	ED and outpatient health care use for asthma; family reports of symptom severity; child function and No. of missed school days; family satisfaction with care; parent and child knowledge of asthma	Patients in the intervention group increased their asthma knowledge; no other effect in intervention group -Outcomes

**TABLE 1** Continued

Study Type	Intervention	n, Racial and Ethnic Composition	Follow-up	Setting	Process Measures and Patient Outcomes Measures	Summary
Randomized, controlled trial, FAM, home environment <sup>34</sup>	Family education about exposures to allergens and tobacco smoke, home environmental assessments; families given resources for allergen remediation (mattress covers, vacuum cleaners, air purifiers, pest-control services), at least 6 home visits per year; education and intervention tailored to each child's allergen susceptibility	I: 469; black, 37.7%; Hispanic, 40.3%; other, 22.0%; C: 468; black, 41.5%; Hispanic, 40.0%; other, 18.5%	24 mo	8 sites in Bronx, NY; Boston, MA; Chicago, IL; Dallas, TX; New York City, NY; Seattle and Tacoma, WA, areas; and Tucson, AZ	Asthma symptoms, medication use, health care use; No. of days of wheezing, tightness in chest, cough; No. of nights of sleep affected by asthma; No. of days of child's activity limitations; spirometry and peak-flow meter readings	Patients in the intervention group reported significantly fewer asthma symptoms and days with symptoms, reductions in effect on caretaker's daily routine, nights of lost sleep, missed school days, and unscheduled asthma visits; patients in the intervention group had significantly greater reduction in bedroom allergens ++Outcomes
Randomized, controlled trial, CM, PRISM, SPEC <sup>35</sup>	Asthma education video game for low-income, urban children aged 5–12 y, designed to promote asthma self-management	I: 59; black, 23.7%; Hispanic, 58.3%; other, 17.0%; C: 60; black, 20.0%; Hispanic, 56.7%; other, 21.7%	12 mo	Low-income urban areas around San Francisco and San Jose, CA	Peak-flow meter readings, No. of nights of lost sleep because of children's asthma, frequency of short-acting inhaler use, and daily asthma symptoms (wheezing, shortness of breath, cough, tightness in chest); spirometry test results; QoL measurements of physical health, child and family social activity, and child and family emotional health; parent-reported health care use (No. of ED visits, hospitalizations, and unscheduled physician visits); child and parent asthma knowledge	No significant differences in clinical outcomes between intervention and control groups; trend toward more effect on intervention group without statistical significance; significant improvements in QoL scores; intervention group self-management knowledge increased at 8 wk follow-up, but no significant difference by 1 y between intervention and control groups; intervention group parents' knowledge increased significantly at 1-y follow-up +QoL, —outcomes
Matched control, CM, PIED, PRISM, school <sup>28</sup>	Children with asthma enrolled in a school for children with chronic diseases; disease management incorporated into school day; ensured controller-medication administration in schools	I: 18; Hispanic, 33%; black, 61%; white 6%; C: 36; Hispanic, 80%; black, 14%; white, 3%; American Indian, 3%	12 mo	State of Colorado funded school for children with chronic diseases; Denver Health System	Annual rates of hospitalizations, ED visits, follow-up visits for asthma, asthma costs	Intervention cohort had 50% reduction in hospitalization rates, 55% reduction in ED visits, 76% reduction in follow-up asthma visits; rates in control group did not change; asthma costs decreased by 80% ++Outcomes

ProED indicates provider education; CLIN, changes in clinic processes; I, intervention group; C, control group; QI, quality improvement; CHW, community health workers; QoL, quality of life; ED, emergency department; HMO, health maintenance organization; PCP, primary care provider; FAM, family intervention; SW, social worker; CM, case management; SPEC, specialist clinic; PIED, patient self-management; outcomes, results for clinical outcomes; process, results for processes of care; +, positive; ++, more positive; —, negative.

education with other components of quality improvement.

Two interventions referred pediatric patients with asthma who frequently used the health care system to specialty care.<sup>21,22</sup> Patients in both treatment groups had larger reductions in numbers of emergency department visits and hospitalizations than controls. Four studies focused on improving coordination of asthma care among members of a child's care team.<sup>23–26</sup> One study cited the coordinated care model as the theoretical basis for this intervention, which included a robust multidisciplinary intervention.<sup>25</sup> Three of these interventions significantly decreased the numbers of emergency department visits and hospitalizations.<sup>23–25</sup>

Two intervention studies were designed to strengthen communication between providers and caretakers.<sup>23,26</sup> Both studies used social workers to counsel families on how to communicate effectively with their child's provider about the child's asthma symptoms. In addition, both studies included asthma education for families.

A nurse educator provided teaching and follow-up with families in 5 studies.<sup>22,24,27–29</sup> The investigators of all interventions with a nursing education or outreach component reported a significant reduction in emergency health care usage. Nurse educators stayed in close contact with families, ensured that asthma-management plans were up to date, and adjusted the plans as needed. A successful asthma-management plan intervention also assessed family psychosocial barriers to asthma management and provided problem-solving counseling.<sup>27</sup> As reported by Weil et al,<sup>30</sup> a parent or guardian's mental health problems often decrease their ability to follow asthma-treatment plans for children, resulting in a greater risk for the child of hospitalization for asthma.

### Child and Family Education

Twelve intervention studies included an education component on asthma symptom management for children, families, or both.<sup>22–26,28,29,31–35</sup> Three studies coupled family education with home environmental assessments or allergen-remediation tools.<sup>23,25,34</sup> Three studies evaluated children's computer programs or video games that taught asthma self-management techniques.<sup>32,33,35</sup> Two of these studies reported no significant difference between treatment and control groups in the children's asthma self-management skills.<sup>33,35</sup>

### Social Worker and Community Health Worker Home-Visit Interventions

In 3 studies, a clinic social worker or community health worker coordinated asthma-management plans with children's schools.<sup>17,25,29</sup> One of these interventions involved a school specifically designed for children with chronic illness and incorporated asthma-medication administration into the school day.<sup>29</sup> Children with asthma who were attending the school had less health care system use than controls. Overall, interventions that included a school outreach component demonstrated significantly less health care system use by those in the intervention groups than in the control groups.

Three studies included a home-visitation component with environmental health assessments.<sup>17,25,25,34</sup> Homes were inspected for allergens (such as cockroaches or pet dander) to which the children were susceptible. The social or community health worker educated caregivers about techniques to reduce exposures, such as cleaning methods. They provided families with concrete tools to help reduce exposures, such as vacuum cleaners and mattress covers. Providing these materials was important for low-income families, signifi-

cantly reducing the number of days during which their children had asthma symptoms.<sup>25,34</sup> Community outreach workers also improved clinical processes of care by providing information to clinic staff and physicians on the factors that affect families' ability to meet asthma-management goals.<sup>17</sup>

### Immunizations Interventions

Reports of 8 studies described quality-improvement interventions to decrease health disparities in pediatric immunizations (Table 2). Many of these studies improved immunization rates, considered here to be a clinical outcome. Some also increased the frequency of well-child visits (considered here to be a process measure).

The main strategies to improve immunization coverage were changes in clinic operation processes (5 studies), outreach to patients' families through telephone calls or mailings (5 studies), community health worker visits (primary intervention in 3 studies, adjunct strategy in 1 study), a collaborative community approach (1 study), and provider incentives (1 study).

Overall, community health worker visits and other outreach methods for families seemed to be most effective in increasing immunization rates. Interventions in the clinic setting showed mixed results that depended on how well the clinic actually implemented the changes. For example, 1 study used provider feedback and incentives to try to improve immunization rates. However, approximately half of the participating practices were unaware of the feedback program, and the investigators could not identify the proportion of providers who actually received incentive payments as a reward for their activities.<sup>36</sup> Not surprisingly, this intervention did not yield significant changes in immunization rates.

Reminders for providers and for families were the most common immuniza-

tion quality-improvement interventions. Fiks et al<sup>37</sup> found that building electronic medical record–based alert reminder systems into clinic visits for providers was associated with increased immunization rates. Hillman et al<sup>36</sup> examined a provider-assessment and feedback system coupled with financial incentives. The postintervention increase in immunizations was not statistically different between treatment and control groups. Rode-wald et al<sup>38</sup> found no evidence that physician prompting alone improved immunization coverage. The differences between these study outcomes demonstrate that the method of provider prompting has a significant impact on the likelihood of capturing immunization opportunities, thereby improving immunization rates.

Immunization interventions that included a reminder to parents of children who had not received recommended immunizations showed mixed results. When combined with visits by a lay outreach worker from the same community as the families, reminder approaches increased immunization rates.<sup>39</sup> However, mailed-letter and telephone-call reminders were less successful, because many families moved or changed their contact information.<sup>40</sup> A crucial component of the family-reminder approach could be removing the barriers to bringing families to the clinic by, for example, reducing wait times<sup>41</sup> or providing transportation.<sup>39</sup>

As in the asthma-intervention literature, lay outreach workers seemed to play an important role in reminding families to ensure that their children's vaccinations were up to date.<sup>38,39,42</sup> Interventions that incorporated a community-outreach component increased immunization coverage in low-income, minority children. A community-wide reminder and outreach intervention significantly reduced the disparity in immunization

**TABLE 2** Quality-Improvement Studies for Reducing Disparities in Pediatric Immunizations

Study Type	Intervention	n, Racial/Ethnic Composition	Follow-up	Setting	Process Measures and Patient Outcomes	Summary
Randomized, controlled trial, CLIN, ProINC <sup>36</sup>	Semiannual assessment and feedback system with financial incentives for providers	Feedback only: 15 clinic sites; feedback with incentive: 19 clinic sites; control: 15 clinic sites	2 y	Medicaid managed plan in Philadelphia	Pediatric immunization rates; compliance with pediatric preventive care	Increase in compliance scores for preventive care and immunizations in all 3 groups; differences not statistically significant; only 56% of sites were aware of program; implementation was incomplete —Process: —Outcomes Significant increases in captured immunization opportunities in intervention group; increase from 78% to 90% of well-child visits with at least 1 immunization given, and increase from 11% to 32% of sick visits with at least 1 immunization given between the control and intervention years; increase in proportion of visits in which vaccines were provided in intervention group (82 ≥90% up-to-date overall) ++Outcomes Tracking and outreach improved vaccine coverage levels, prompting added no further benefit (74% completion in control group, 76% in group with prompting only, 95% in group with tracking and outreach, 95% in group with tracking, outreach, and prompting); tracking and outreach intervention groups had more primary care visits; no evidence that prompting alone increased immunization rates or No. of primary care visits ++Process; ++Outcomes
Intervention with historical controls, CLIN <sup>37</sup>	Alerts for routine childhood vaccinations through EMR; electronic clinical reminders programmed to appear at every patient encounter with a child <2 y old, all clinical staff working with patients in office and over telephone saw alerts; provider training on EMR alerts, immunization rates, and barriers to on-time immunizations; alerts provided information on which vaccines should be updated according to child's place in dosage series and age	I: 1669; black, 82.5%; white, 7.7%; other, 9.9%; C: 1548; black, 82.0%; white, 8.9%; other, 9.0%	24 mo	r urban primary care settings in Philadelphia, PA	Rates of captured opportunities for immunizations; overall immunization rates for 2-y-olds	—Outcomes Significant increases in captured immunization opportunities in intervention group; increase from 78% to 90% of well-child visits with at least 1 immunization given, and increase from 11% to 32% of sick visits with at least 1 immunization given between the control and intervention years; increase in proportion of visits in which vaccines were provided in intervention group (82 ≥90% up-to-date overall) ++Outcomes Tracking and outreach improved vaccine coverage levels, prompting added no further benefit (74% completion in control group, 76% in group with prompting only, 95% in group with tracking and outreach, 95% in group with tracking, outreach, and prompting); tracking and outreach intervention groups had more primary care visits; no evidence that prompting alone increased immunization rates or No. of primary care visits ++Process; ++Outcomes
Randomized, controlled trial, OUIR, CHWs, CLIN <sup>38</sup>	Tracking with outreach to bring underimmunized children to providers; lay outreach workers worked with parents to bring children in for immunizations through telephone and home-visit contact; lay outreach workers were recruited from neighborhoods in which clinics were located; office policy changed to prompt providers to identify immunization opportunities; physicians received training on immunization opportunities; charts of children not up-to-date on immunizations were marked; triage nurse assessed immunization status of children at presentation and placed a card on charts as a prompt; twice-monthly feedback to providers on missed opportunities	Tracking, outreach, and prompting: 648; tracking and outreach only: 650; prompting only: 744; black, 38%; Hispanic, 8%; white, 14%; unknown, 40%; C: 719; black, 38%; Hispanic, 9%; white, 14%; unknown, 38%	18 mo	9 primary care practices in Rochester, NY	Up-to-date immunization status; No. of days immunizations are overdue; No. and type of primary care visits; No. of missed appointments with primary care provider; No. of screenings for lead and anemia	++Outcomes Tracking and outreach improved vaccine coverage levels, prompting added no further benefit (74% completion in control group, 76% in group with prompting only, 95% in group with tracking and outreach, 95% in group with tracking, outreach, and prompting); tracking and outreach intervention groups had more primary care visits; no evidence that prompting alone increased immunization rates or No. of primary care visits ++Process; ++Outcomes
Randomized, controlled trial, CHWs, OUIR <sup>39</sup>	Community-wide reminder, recall, and outreach system; lay community-based outreach workers assigned to city practices to track immunization rates of children <2 y old; outreach workers distributed mail and telephone reminders, assisted with transportation and scheduling, and conducted home visits for children who were behind on immunizations Households received weekly automated telephone calls about scheduled or needed immunizations	I: 6300 (original control population moved to intervention group); black, 33% (inner city, 58%); Hispanic, 12% (inner city, 21%); white, 49% (suburbs, 84%); Asian and other, 7% (rest of city, 10%) I: 1496; black, 36.8%; Hispanic, 6.4%; white, 16.8%; other or unknown, 39.9%; C: 1510; black, 33.9%; Hispanic, 7.7%; white, 17.8%; other or unknown, 40.6%	6 y	Inner city, rest of city, suburbs, and county in and around Rochester, NY	Immunization rates were compared for children in different geographic areas within 1 region and from different racial and ethnic backgrounds to measure disparities in immunization rates	4% disparity in immunization rates between city and suburbs at end of follow-up period, down from 18% at baseline; at end of study, immunization rates were similar between racial groups; postintervention reduction in disparities between inner-city and suburban children and between racial and ethnic groups ++Outcomes No significant difference between intervention and control groups in immunization and well-child visit rates; inaccurate telephone numbers were a barrier to successful implementation; improvement in immunization coverage was minimal —Outcomes
Randomized, controlled trial, OUIR <sup>40</sup>	Households received weekly automated telephone calls about scheduled or needed immunizations	I: 1496; black, 36.8%; Hispanic, 6.4%; white, 16.8%; other or unknown, 39.9%; C: 1510; black, 33.9%; Hispanic, 7.7%; white, 17.8%; other or unknown, 40.6%	18 mo	4 urban primary care practices in Rochester, NY	Immunization and well-child visit rates	++Outcomes No significant difference between intervention and control groups in immunization and well-child visit rates; inaccurate telephone numbers were a barrier to successful implementation; improvement in immunization coverage was minimal —Outcomes

**TABLE 2** Continued

Study Type	Intervention	n, Racial/Ethnic Composition	Follow-up	Setting	Process Measures and Patient Outcomes	Summary
Preintervention and postintervention comparison with historical controls, CLIN, OUIR <sup>41</sup>	3 reminder cards in Spanish or English sent to families of all child patients of a family health center who were not up-to-date on vaccinations; reminder cards served as physician referrals; actual doctor's visit and wait time to see the doctor were not required	Baseline: 240; postintervention: 263; family health center patient population: 75% Latino		Family health center in rural, low-income area in northeastern Colorado	Up-to-date immunizations; No. of missed opportunities during clinic visits to vaccinate	Reminder cards increased immunization rates by 12%; for every 8 families sent reminder cards, 1 child became fully immunized + +Outcomes
Community-wide intervention in which participants were tracked through immunization registry and were compared with racial and ethnic groups in National Immunization Survey, COMM, CHWs <sup>42</sup>	Immunization program incorporated into 23 existing community organizations; community organizations linked with community health care providers updated families on opportunities for vaccination; community organization staff received training on immunization basics, vaccination-card reading, educating parents, and tracking families; provider and community data integrated into shared data system to which both parties had access; parents received immunization education and reminders to have their children vaccinated	3748 enrolled parents; 199 lost to follow-up; 25 dropped out; black, 78.4% ± 4.7%; Latino 83.7% ± 4.9%		Community organizations in Harlem and Washington Heights, New York City, NY	Up-to-date immunization coverage at ages 19–35 mo for 4:3:1:3:3 series	Immunization coverage rate for participating children aged 19–35 mo increased from 46% to 81% compared with national average of 79%; community ownership of program was main contributing factor to program's success; program built on preexisting strengths of community organizations + +Outcomes
Randomized, controlled trial, CLIN <sup>48</sup>	2 interventions to improve well-child visit preventive care and immunizations; detailed lists generated of infants not up to date on preventive care and immunizations; families contacted through telephone calls, letters, postcards, and referrals to child-development services	I: 1505; black, 14%; Latino, 79%; white, 5%; other, 1.5%; C: 1160; black, 6%; Latino, 83%; white, 9%; other, 2%	12 mo	Inner-city health network in Denver, CO	No. of well-child visits attended by age 12 mo; No. of immunizations by age 12 mo; No. of ED visits, urgent-care visits, and inpatient hospitalizations	Well-child visit and immunization intervention groups had 5%–6% higher immunization rates and 7%–8% higher well-child visit rates than controls; intervention groups did not have increased up-to-date immunization rates; interventions did not affect ED visit, urgent care visit, or hospitalization rates + Modest process; + modest outcomes Automated telephone calls had same impact on immunization rates as more costly in-person calls, mailings, and home visits; limited effectiveness overall (34% compliance in control group, 40% with autodialer telephone reminder, 37% with in-person outreach, and 38% in combination group) + Outcomes
Randomized, controlled trial, OUIR (CHWs) <sup>50</sup>	Large-scale reminder recall, comparing outcomes of in-person telephone calls, mailings, and home visits with those of computer-generated calls and mailings	Combination intervention: 764; outreach: 760; autodialer: 763; black, 76%; Hispanic, 14%; white, 7% other, 3%; C: 763; black, 78%; Hispanic, 12%; white, 7%; other, 3%	24 mo	Public health clinics in Fulton County, GA	Completion of 4:3:1:3 vaccine series by age 24 mo; vaccine coverage rates; No. of valid and invalid doses provided; No. of vaccination visits; No. of missed opportunity visits; average lag time between due date and receipt of dose	Automated telephone calls had same impact on immunization rates as more costly in-person calls, mailings, and home visits; limited effectiveness overall (34% compliance in control group, 40% with autodialer telephone reminder, 37% with in-person outreach, and 38% in combination group) + Outcomes

Targets and strategies in parentheses are secondary features, not primary emphasis. CLIN indicates changes in clinic processes; ProINC, provider incentives; I, intervention group; C, control group; EMR, electronic medical record; OUIR, outreach communications; CHW, community health worker intervention; COMM, community-based intervention; ED, emergency department; 4:3:1:3:3, 4 doses of diphtheria-tetanus toxoids-pertussis vaccine/3 doses of poliovirus vaccine/1 dose of measles-mumps-rubella vaccine/3 doses of *Haemophilus influenzae* type B vaccine/3 doses of hepatitis B vaccine; outcomes, results for clinical outcomes; process, results for processes of care; +, positive; + +, more positive; –, negative.

coverage between inner-city and suburban children, as well as between white and minority children.<sup>39</sup>

## LESSONS LEARNED FROM THE CHILDHOOD ASTHMA AND IMMUNIZATION DISPARITIES-INTERVENTION LITERATURE

Pediatric asthma and immunization interventions that include a strong community outreach component are often effective. The factors that make community outreach successful vary according to intervention and between asthma and immunization. Some common components of successful interventions include (1) using lay health outreach workers from the targeted community; (2) conducting home visits to reach families and educate caregivers; and (3) integrating interventions into existing community-based organizations and services such as schools and Supplemental Nutrition Program for Women, Infants, and Children (WIC) clinics.

Lay health outreach workers establish effective links between health care clinics and patients in the community. Outreach workers can educate and inform families about their children's health conditions and care and provide coaching to improve communication with their children's health care provider. In addition, outreach workers from the community can inform providers and clinic staff of the daily struggles faced by families in bringing their children in for care. Improved communication between providers and families can increase understanding of each others' abilities, challenges, and strengths.

Interventions that engage community organizations and services strengthen the link between health care clinics and communities. When community organizations help plan interventions and have access to data systems, such as immunization registries, the re-

sponsibility for improving the care of a community's children is shared and strengthened between the health care provider and community. Resulting programs are more likely to reflect and meet community interests.

## SPECIAL CONSIDERATIONS FOR QUALITY-IMPROVEMENT APPROACHES TO REDUCING CHILD HEALTH DISPARITIES

Several important factors regarding child health and development affect how health care organizations and policy makers should use quality-improvement approaches to reduce child health disparities. First, preventive health issues are particularly prominent for children compared with adults, and most children do not have chronic health conditions. Second, developmental issues related to physical, cognitive, emotional, and behavioral health are especially critical for children. Multiple nonhealth factors, such as socioeconomic status and education, have a critical effect on health outcomes. Many of the most important developmental outcomes are apparent only over the long-term. Early intervention for many of these life-course development issues occur at key formative times and have downstream benefits that may be cost-effective, given a long-term perspective. Third, communication between parents and providers should be strengthened, and parents' psychosocial issues must be addressed in the context of the child's care. Fourth, many of the most vulnerable children have Medicaid coverage, so Medicaid policy and reimbursement have a major influence on the feasibility and sustainability of disparity interventions.

## RECOMMENDATIONS

On the basis of the lessons learned from the adult literature, our review of quality-improvement interventions for asthma and immunizations, and spe-

cial considerations for child health and development, we make the following recommendations to providers, health care organizations, researchers, and funders for using quality-improvement approaches to reduce child health disparities.

1. Examine your own performance data stratified according to insurance status, race or ethnicity, language, and socioeconomic status. Self-examination of one's own data is a critical initial step.
2. Measure and improve childhood health-related quality-of-life, development, and condition-specific targets (such as asthma and immunizations).<sup>43</sup> Improving care for specific conditions is a useful component of plans to reduce childhood disparities; however, improving condition-specific care encompasses only a small part of the overall scope of child health.
3. Measure and improve anticipatory guidance for the prevention of conditions such as injuries, violence, substance abuse, and sexually transmitted diseases.<sup>13–15,44–46</sup> Similarly, measure and improve efforts to promote positive growth such as readership programs to improve low literacy.<sup>47,48</sup>
4. Measure and improve structural aspects of the care experience that affect child health outcomes and can probably reduce disparities. For example, elements of the patient-centered medical home, such as access, care coordination, and communication, affect child health outcomes and are ripe for quality improvement. Some children, such as those with special health care needs or behavioral disorders, frequently receive fragmented care, so integration across providers and care settings is vital.

5. Incorporate families into interventions.
6. Use multidisciplinary teams with close tracking and follow-up of patients.
7. Integrate non–health care partners such as community-based social service agencies into quality-improvement interventions. Perhaps even more so than for adults, it is critical to address home and community factors that affect child well-being to improve outcomes.<sup>7</sup> We need to go beyond the traditional paradigm of limiting health care quality improvement to the clinic or hospital setting.
8. Culturally tailor quality improvement.
9. Align financial incentives to reduce disparities.
10. Funders should support more disparity-intervention studies that address these recommendations and analyze clinical outcomes, the intervention-implementation process, and costs. To reduce child health disparities, the managers

and policy makers responsible for the widespread dissemination and translation of successful interventions require this detailed information.

11. The National Institutes of Health and other funders need to support the creation of a new cadre of child health services researchers with the skills needed to find innovative quality-improvement approaches for reducing disparities. The training of these researchers should cover quality improvement, measurement, social sciences relevant to childhood health and development, collaborative transdisciplinary research teamwork, and community-based participatory research techniques.

To reduce child health disparities, we must expand our vision of what constitutes health care quality improvement. Successful efforts require transdisciplinary teams and leaders with the technical and interpersonal skills needed to bridge the medical and community worlds. Funders need to cre-

ate incentives for investigators to enter the disparities-intervention field. Funders also need to target the high-priority intervention, implementation, and translational research topics identified in this article. Quality improvement is a powerful tool for reducing disparities if we harness it creatively. Although much more research is necessary, the general principles for successful interventions for reducing disparities are known; thus, the time for action is now.

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## Health Care Quality-Improvement Approaches to Reducing Child Health Disparities

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## **Health Care Quality-Improvement Approaches to Reducing Child Health Disparities**

Marshall H. Chin, Morgen Alexander-Young and Deborah L. Burnet

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