
Community-Based Care Coordination: Practical Applications for Childhood Asthma

Sally Findley, PhD¹
Michael Rosenthal, MD²
Tyra Bryant-Stephens, MD³
Maureen Damitz, AE-C⁴
Marielena Lara, MD, MPH⁵
Carol Mansfield, PhD⁶
Adriana Matiz, MD¹
Vesall Nourani, BA⁶
Patricia Peretz, MPH⁷
Victoria W. Persky, MD⁸
Gilberto Ramos Valencia, DrPH⁹
Kimberly Uyeda, MD, MPH¹⁰
Meera Viswanathan, PhD⁶

Care coordination programs have been used to address chronic illnesses, including childhood asthma, but primarily via practice-based models. An alternative approach employs community-based care coordinators who bridge gaps between families, health care providers, and support services. Merck Childhood Asthma Network, Inc. (MCAN) sites developed community-based care coordination approaches for childhood asthma. Using a community-based care coordination logic model, programs at each site are described along with program operational statistics. Four sites used three to four community health workers (CHWs) to provide care coordination, whereas one site used five school-based asthma nurses. This school-based site had the highest caseload (82.5 per year), but program duration was 3 months with 4 calls or visits. Other sites averaged fewer cases (35 to 61 per CHW per year), but families received more (7 to 17) calls or visits over a year. Retention was 43% to 93% at 6 months and 24% to 75% at 12 months. Pre-post cross-site data document changes in asthma management behaviors and outcomes. After program participation, 93% to 100% of caregivers had confidence in controlling their child's asthma, 85% to 92%

had taken steps to reduce triggers, 69% to 100% had obtained an asthma action plan, and 46% to 100% of those with moderate to severe asthma reported appropriate use of controller medication. Emergency department visits for asthma decreased by 36% to 63%, and asthma-related hospitalizations declined by 26% to 78%. More than three fourths had fewer school absences. In conclusion, MCAN community-based care coordination programs improved management behaviors and decreased morbidity across all sites.

¹Columbia University, New York, NY, USA

²Christiana Care Health System, Wilmington, DE, USA

³The Children's Hospital of Philadelphia, Philadelphia, PA, USA

⁴Respiratory Health Association of Metropolitan Chicago, Chicago, IL, USA

⁵RAND Health, Santa Monica, CA, USA

⁶RTI International, Research Triangle Park, NC, USA

⁷New York-Presbyterian Hospital, New York, NY, USA

⁸University of Illinois at Chicago, Chicago, IL, USA

⁹University of Puerto Rico, San Juan, Puerto Rico

¹⁰Los Angeles Unified School District, Los Angeles, CA, USA

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The concept of care coordination is increasingly recognized as a key component in the effort to assist families in negotiating complex health care and social systems to develop effective supports and care (Fox et al., 2007; Wise, 2009). Care coordination has been applied to several chronic illnesses, including childhood asthma, but primarily via practice-based models (Clark, Mitchell, & Rand, 2009; Fox et al., 2007; Kattan et al., 2006; Lieu et al., 2004; Mitchell et al., 2005; Ochoa & Nash, 2009; Thyne, Rising, Legion, & Love, 2006; Wise, 2009). In practice-based care coordination, the health care provider identifies and refers families to the care coordination program, which is an adjunct to medical care services. The alternative approach places care coordinators in the community where they can be more effective as a bridge between families and health care providers, have better understanding of specific issues confronting families, and identify supports and services (Butterfoss et al., 2006; Friedman et al., 2006; Krieger et al., 2006; Lara et al., 2006; Parker et al., 2003; Persky et al., 2007; Rosenthal et al., 2006).

This article focuses on community-based care coordination, the care coordination model adopted by the Merck Childhood Asthma Network, Inc. (MCAN) initiative. The model embeds coordination within the context of community resources and is tailored to the particular needs of the communities served. We will describe the commonalities and variations in community-based care coordination models implemented at each site and discuss program outcomes in light of these differences and similarities.

► CONCEPTUALIZATION

Although care coordination for asthma can be seen as a general adaptation of the chronic care model (Rosenthal et al., 2006), to date there is no detailed model of care coordination to guide key community-based modifications. Therefore, the first step for developing the comparisons across sites was to create an asthma care coordination logic model. This general logic model is shown in Figure 1.

The left side of the logic model shows specific features of the community context that shape asthma risk in the community, including health disablers, community features that make asthma management difficult, and

health enablers, resources making it easier for families to manage asthma. The blend of these factors shapes the population in need of asthma care coordination, shown in the box describing families with high asthma risk. The care coordination intervention is structured to most effectively reach the families with risk factors and link them to community organizations and health system institutions to address their particular risk factors and improve asthma management.

The critical inputs provided by care coordination are highlighted in the central box of the logic model:

- Outreach and enrollment of eligible families
- Establishment of asthma management goals with family
- Facilitation of interactions with health care system
- Clinical or social service referrals to address family needs/problems
- Culturally competent, tailored asthma education
 - Promoting health literacy
 - Explaining asthma medications
 - Translating asthma medication plans into everyday use
- Building social support for improved asthma management
- Assistance in reducing home environmental triggers
 - Home visits
 - Counseling on smoking cessation
 - Integrated pest management

These services are provided one-on-one, tailored to the family's needs. Care coordination necessitates having the care coordinator translate the provider's recommendations into culturally appropriate instructions and assist in overcoming barriers to improved asthma management. When implemented in the context of other community organizational resources, such as provider education programs, the care coordination process becomes self-reinforcing through, for example, improved physician-patient interactions.

► METHOD

Data were generated from descriptions of the site care coordination program features, a compilation of characteristics based on these descriptions, key process indicators supplied by each site, and cross-site data regarding asthma outcomes at baseline and follow-up. The cross-site data were derived from standardized baseline and follow-up instruments assessing critical management behaviors and asthma outcomes (Mansfield et al., 2011). The cross-site data were prepared by the project evaluation team at RTI International using Stata 11.0. In Table 1, the emergency department (ED) visit and

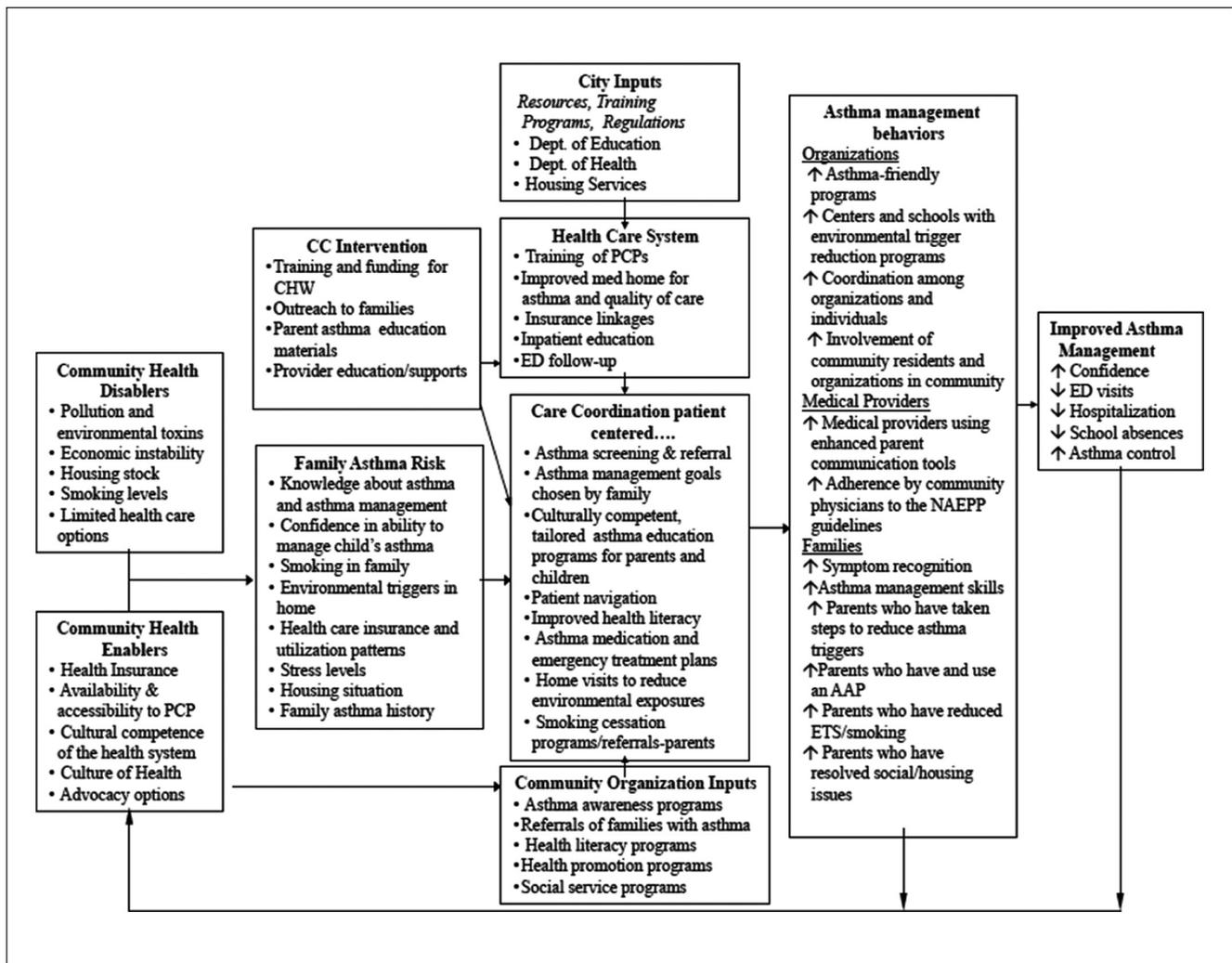


FIGURE 1 Care Coordination Logic Model

NOTE: CC = care coordination; CHW = community health worker; PCP = primary care provider; ED = emergency department; NAEPP = National Asthma Education and Prevention Program; AAP = asthma action plan; ETS = environmental tobacco smoke.

hospitalization rates pertain to all children enrolled in the program with completed baseline evaluations. Table 2 presents aggregate asthma management behavior and morbidity outcomes for each care coordination program. Table 2 includes data only for children with 12-month follow-up using the most recent version of the MCAN initiative follow-up questionnaire. The pre- and postintervention comparison of outcomes (baseline to follow-up) was assessed using the *t* test for differences in proportions, with a .01 significance level (see Mansfield et al., 2011 for a pooled cross-site analysis of individual-level data).

► RESULTS

Care Coordination Models in the MCAN Sites

All sites provided the key care coordination components described above, but implementation and adaptive methods varied for each site, depending on interfaces with community organizations and health system institutions. Table 1 summarizes the care coordination context and features of each site.

The following site-specific paragraphs describe each care coordination program: geographical and structural

TABLE 1
Characteristics of Care Coordination Programs by Site

Characteristic	Chicago	Los Angeles	New York	Philadelphia	San Juan
Ethnicity	100% AfAm	70% Latino; 22% AfAm; 8% Other	91% Latino; 9% AfAm	85% AfAm; 11% Latino; 4% Other	100% Latino
Percentage of parents with limited English proficiency	0	64	70	14.4	100
Average age of children enrolled, years	8.2	9.8	6.0	7.5	5.5
Enrollment criteria	Diagnosis of asthma and age 0-18 years	Recently hospitalized or ED visit for asthma, >10 days absent from school, or poor asthma control at school	Asthma-related hospitalization or ≥2 ED visits or 5 days absent from school	2 ED visits or one hospitalization in past year, or on controller medications	Daily or ≥2 nights of symptoms in previous 2 weeks, ≥1 hospitalization or ≥2 ED visits for asthma in past year, or daily use of preventive asthma medicine or rescue medicine ≥2 times in past week
Percentage enrolled of those contacted or referred	19	79	17	Not available	98
Percentage with ED visit in previous 12 months (baseline)	36	61	84	55	82
Percentage with hospitalization in previous 12 months (baseline)	10	15	42	38	40
CC children enrolled	387	816	360	284	245
CHW activities	NCICAS, OAS, YWC, Dr. Zeitz PBL, "Get in the Zone"	OAS, YWC	ICAS, NCICAS, YWC	ICAS, NCICAS, YWC	ICAS, YWC
EBI models for care coordination	Metropolitan respiratory health association, city health department	Schools	Hospital, CBOs, asthma coalition, city academic, community PCP organizations	Hospital, asthma coalition, city health department, MCO, regional HPC	Housing projects, community clinics at housing projects, city health department, independent practice associations

(continued)

TABLE 1. (CONTINUED)

<i>Characteristic</i>	<i>Chicago</i>	<i>Los Angeles</i>	<i>New York</i>	<i>Philadelphia</i>	<i>San Juan</i>
Recruitment location	CBO, schools, PCPs	School	Hospital, CBO, school day care center, PCPs, self-referral	Hospital, CBO, PCPs and MCOs, schools, self-referral	Community ED, PCPs, housing project
CC locus of service	City local health office	School	CBO, hospital (initial intake only)	Multiple outpatient primary care centers	2 asthma clinics at housing projects
No. of CHWs employed (FTE)	3	5 nurses	4	3	4
Average no. of participants per CHW per year	37	82.5	35	47.5	61.3
Average duration in CC, months	12.9	3.0	8.8	9.6	13
Average no. of contacts (visits or calls)	7.1	4.0	16.5	17.2	8.9
Percentage with 6-month follow-up	76	43	69	81	93
Percentage with 12-month follow-up	75	24	48	73	73

NOTE: AfAm = African American; CC = care coordination; CBO = community-based organization; CHW = community health worker; EBI = evidence-based intervention; ED = emergency department; FTE = full-time employee; HPC = Health Promotion Council; ICAS = Inner City Asthma Study; MCO = managed care organization; NCICAS = National Cooperative Inner City Asthma Study; OAS = Open Airways for Schools; PBL = problem-based learning; PCP = primary care provider; YWC = Yes We Can.

TABLE 2
Care Coordination Outcomes at 12-Month Follow-Up by Site

<i>Outcome</i>	<i>Chicago (n = 176)</i>	<i>Los Angeles (n = 201)</i>	<i>New York (n = 68)</i>	<i>Philadelphia (n = 161)</i>	<i>San Juan (n = 118)</i>
Percentage taking ≥ 1 step to reduce environmental triggers	85	87	91	92	94
Percentage obtaining an AAP from health professional	79	76	76	100	69
Percentage reporting daily controller use (if asthma moderate to severe)	79	59	82	100	46
Percentage with confidence in controlling asthma ^a	98	93	94	100	97
Percentage with any ED visit in previous 12 months	17	22	35	36	47
Percentage change in number with any ED visit (baseline to follow-up) ^b	-51	-63	-60	-36	-43
Percentage with any hospitalization in previous 12 months	2	7	12	27	14
Percentage change in number with any hospitalization (baseline to follow-up) ^b	-78	-52	-72	-26	-68
Percentage with a reduction in school absences due to asthma ^{b,c}	86	82	89	78	82

NOTE: n = children with a 12-month follow-up. AAP = asthma action plan; ED = emergency department.

a. Indicates caregiver strongly agreed or agreed with the statement "I have control over child's asthma."

b. All reductions from baseline to follow-up are significant at the 1% significance level. Comparison includes only observations on children with 12-month follow-up data.

c. Reduction in absences includes those with 0 absences at baseline and follow-up.

location of the intervention, key partnerships, evidence basis, frequencies of interactions, and retention.

Chicago, Illinois. The Addressing Asthma in Englewood Project (AAEP) was a multifaceted community-based intervention designed to reduce asthma morbidity in children residing in Englewood, an underserved, predominantly African American, community on Chicago's South Side. With much input from community residents and leaders, a previously implemented community-based Chicago asthma program (Persky et al., 2007) was adapted to offer several evidence-based interventions (see Table 1, column 1.) A total of 387 families were recruited through asthma screening conducted at neighborhood schools and other community events. Care coordination was provided by three trained community health educators located at the local City of Chicago public health clinic. They offered a home visit case management program to enhance asthma education, develop and explain the child's asthma action plan using picture tools, identify and assist in mitigating asthma triggers, and link families to needed community social services. Complementing this care coordination by community health educators were educational programs at schools,

community groups, and local agencies, and provider education for community pediatricians. Although the major focus of the project was on reducing asthma morbidity through multiple approaches, staff also identified and addressed other areas of concern affecting a family's ability to focus on asthma. Staff commitment and involvement were key elements in gaining community trust, assuring retention, and contributing to project success.

Los Angeles, California. The Los Angeles Unified School District (LAUSD) Asthma Program was a district-wide, intensive case management program. Unlike the other MCAN sites, LAUSD used five specially trained school nurses to coordinate care for students with poorly controlled asthma. All enrollment was through schools, using students' health records to identify eligible children. Altogether, 816 children and their caregivers enrolled in the program, 79% of those eligible (see Table 1, column 2). Meeting with families at home and school over 3 months, asthma nurses used a culturally sensitive and linguistically competent approach to help families understand medications and written asthma action plans and to dispel myths about asthma, triggers, or treatment. They coordinated communication with students'

providers, and if the student had no regular provider, they linked them with a community clinic or the “Breathmobile,” a mobile specialty van (Jones et al., 2007). They assisted in obtaining health insurance and other benefits (e.g., Special Supplemental Nutrition Program for the Women, Infants, and Children [WIC] program, food stamps, and other forms of social welfare). The nurses were skilled case coordinators, providing referrals to health, educational, social, and other community resources. Ultimately, LAUSD asthma nurses worked between the community, health, and educational systems to improve health, optimize learning, and enable individual academic success.

New York City, New York. New York’s care coordination program, WIN for Asthma, focused on the largely Latino immigrant, low-income community of Washington Heights and Inwood. WIN for Asthma was a hospital-academic-community partnership that provided comprehensive care coordination services through an extensive network of community partners. The four care coordinators were residents from the community who became community health workers (CHWs) at each partner community-based organization (CBO). This facilitated interactions, enhancing trust among the many immigrant families in the program. Simultaneously, the CHWs were recognized members of the hospital asthma team, with supervision shared by CBO and hospital. They regularly visited the local children’s hospital, where they met with and provided education to all families of children admitted with a diagnosis of asthma. Through both community and hospital networks, 360 children and their caregivers were enrolled, 17% of those eligible (see Table 1, column 3). The initial 3 months were the most intense period, with home visit and weekly contacts. Contacts dropped to monthly in the fourth to sixth months and to bimonthly for the remainder. During the initial meeting, CHWs helped families choose asthma management goals; subsequently, home visits focused on room-by-room assistance in implementing integrated pest management strategies. In the remaining 14 to 15 conversations with the family, the CHW helped families gain control of the child’s asthma through a combination of education, navigation of health care systems, and social support. The care coordinators’ emphasis on improving communication with the child’s doctor was supported by complementary programs at the child’s school or day care center.

Philadelphia, Pennsylvania. Targeting four largely African American neighborhoods with high asthma prevalence, the Philadelphia MCAN project built an integrated partnership based on 13 years of experience with

two community-based asthma programs, the Community Asthma Prevention Program (CAPP) of Children’s Hospital of Philadelphia (Bryant-Stephens, Kurian, Guo, & Zhao, 2009) and the Child Asthma Link Line of the Philadelphia Allies Against Asthma Coalition (Rosenthal et al., 2006; Coughley et al., 2010). CAPP’s home visit component is adapted from three evidence-based interventions, comparable to the other care coordination programs in this article, and therefore discussed here. Eligible children were referred from physicians, CBOs, the Child Asthma Link Line, and school nurses, as well as self-referrals, generating 284 enrollments (see Table 1, column 4). Three CHWs were recruited from the community and trained to provide low-literacy asthma education, environmental interventions, and care coordination for caregivers and children with asthma, including all the functions outlined above except outreach. Each family received at least 6 home visits, usually within the first 6 weeks, with biweekly follow-up visits for 1 year. Community health workers helped caregivers identify barriers to asthma management and provided linkages to resources using the developed network of partnerships. At follow-up visits, care needs were reassessed with appropriate linkages made as needed. Most commonly, these links were made with social services, managed care organizations, housing organizations, schools, and primary care practices. The extensive contacts with the families contributed to the high retention rate of the Philadelphia care coordination program.

San Juan, Puerto Rico. La Red de Asma Infantil de Puerto Rico, “La Red,” was a follow-on project to another community asthma program (Lara et al., 2009), in this case a partnership with the city health department, a provider association, and two San Juan housing projects, Luis Llorens Torres (the largest in the Caribbean) and Manuel A. Pérez. The La Red program adapted two evidence-based interventions, making adaptations of materials for this Spanish and low-literacy populations (see Table 1, column 5). The program staff and four CHWs were trained using these Spanish materials. Children and their families ($n = 245$) were recruited at local hospital EDs and the outpatient clinic of each housing project, which received referrals from local primary care providers (PCPs). Each family established its asthma management goals with their PCP and the housing project’s outpatient clinic community nurse, who then explained asthma medications and use of the asthma action plan. This education was reinforced at each visit to the clinic. During home visits, the CHWs at each housing project ensured that medication instructions were followed in everyday life. In addition, the CHWs’ home-based comprehensive educational

intervention emphasized reducing environmental triggers at home. Once families understood that controlling the home environment helped their children control their asthma, it became part of their daily lives. Many families limited smoking around their children or took steps to control pests. The high degree of localization at community housing projects, the team approach, and the intensity of the CHW follow-up visits throughout the year contributed to the high retention rate of La Red.

Comparisons Across Sites

There were variations among programs regarding the ethnic mix of the populations served. Three sites (New York, San Juan, and Los Angeles) worked with a largely Latino community, where care coordination required Spanish and/or low-literacy Spanish materials, often specifically developed by and for the program, as in San Juan and New York. In Los Angeles and New York, the care coordinators were sensitive to participants' undocumented immigration status, particularly important for referrals entailing interactions with governmental agencies. Parents' concerns about their status may have contributed to their earlier exit from the program in both sites.

All sites recruited participants at least partially through non-hospital or health care locations. Community site recruitment meant that multiple health care providers served enrolled families, posing additional programmatic challenges. In some sites (Chicago, New York, Philadelphia), the care coordination program was complemented by a physician education program targeting community PCPs. Even with those programs, the care coordinators still needed to address the difficulties of working with multiple providers to facilitate improved asthma management, help families get asthma action plans, obtain needed medication and case reviews, and assist families in receiving appropriate care (e.g., allergen skin testing) when warranted.

All but one program (Chicago) targeted children with poorly controlled asthma, as indicated by the eligibility requirement of a recent asthma-related ED visit or hospitalization. Except for Chicago, enrollment ED visit rates ranged from 55% to 84%, and asthma hospitalization rates from 15% to 42%, significantly higher than the national average for children with asthma. In New York and Los Angeles 82% to 84% of the children enrolled had been to the ED in the prior year, and 40% to 42% had been hospitalized for their asthma. This high asthma morbidity indicates a potentially great challenge for care coordination.

Care coordination was community-based in all sites. Care coordinators worked in the outpatient clinic at the

housing project (San Juan), an office in the district public health building (Chicago), community organizations (New York and Philadelphia), and the school (Los Angeles). This ready access is reflected by the high level of contacts between the care coordinators and the participants, which averaged 7.1 to 17.2 contacts or visits per year, except for Los Angeles, which had a shorter program time frame that permitted only four contacts.

Maintaining continuous service and contact with families is usually a challenge, particularly among disadvantaged populations. In all sites with a 6- to 12-month protocol (i.e., all except Los Angeles), the retention rate at 6 months was 69% to 93%, and at 12 months it was 48% to 75%. These retention rates are high, compared with many care coordination programs where the retention is 50% or less at 1 year (Rosen & Rodriguez, 2006).

Care Coordination Outcomes

Basic aggregate asthma outcomes for each program are presented in Table 2. These program-specific outcomes provide perspective on the extent to which variations in care coordination models across sites might be associated with overall program outcomes.

There were consistently strong positive outcomes across all sites. Virtually all caregivers (93% to 100%) reported having confidence in controlling their child's asthma, and approximately 90% or more had taken steps to reduce environmental triggers. More than 66% had obtained an asthma action plan from a health professional, and in Philadelphia 100% of the families received asthma action plans. Among children with moderate or severe asthma, half or more reported appropriate, daily controller use.

All sites demonstrated significant reductions ($p < .01$) in the proportion of children with any asthma-related ED visits and hospitalizations in the previous 12 months. Despite above-average asthma-related ED visit rates (36% to 84%) and hospitalization rates (10% to 42%) at enrollment, all sites had significantly lower rates at follow-up. The proportion of children with any ED visit in the previous year dropped to 36% or less at all sites except San Juan. However, San Juan had one of the highest ED visit rates at enrollment, which they reduced by 43%, similar to reductions in Philadelphia and Chicago. Three sites (Chicago, New York, and Los Angeles) achieved 50% or greater reductions in the ED visit rates of participants. The proportion with any hospitalization also dropped from 2% to 27%, with reductions by 50% or more in all sites but one (Philadelphia). Three sites (Chicago, New York, San Juan) had reductions of 68% or more. Finally, at all sites 78% to 89% of the

children experienced a reduction in asthma-related school absences.

► DISCUSSION

The MCAN care coordination programs were implemented in diverse communities, with significant variations in ethnicity and literacy of participants. Each site's program was anchored in the community and developed to address unique community features, both for recruitment and provision of services. Care coordinators worked at multiple sites, often a community organization, school, or in the home. This enhanced trust and access to families, with multiple contacts per family per year. The high level of enrollment and contacts are evidence of accessibility to program services for families.

The ability of the programs to achieve high intensity of services likely reflects the efforts of multiple stakeholders involved in developing and supporting the care coordination program. Relationships with these stakeholders made it possible for care coordinators to function in the larger community realm, provide a head start in gaining trust with participants, and make well-informed referrals. This indicates the importance of taking a long-term view for including stakeholders, creating collaborative approaches, longitudinal planning, and stepwise development of multifaceted programs to foster positive system change for beneficial outcomes (Clark et al., 2010; Friedman et al., 2006; Krieger et al., 2006).

The outcomes presented in Table 2 suggest that community-based care coordination is effective at improving caretaker confidence in controlling asthma and key asthma management behaviors, as well as improving asthma outcomes. Indeed, outcomes were remarkably consistent, given the variations in the populations served and eligibility criteria, high degree of asthma morbidity at enrollment, and site-specific differences in delivery of care coordination.

The greatest uniformity in results pertained to the asthma management behaviors, the focus of the home visits and interactions with participants. Virtually all caretakers (93% to 100%) expressed confidence in managing asthma at the end of the program. The majority (85% and above) of families had taken steps to reduce environmental triggers. Despite the fact families in each program were seen by various providers, in all programs more than 66% had obtained an asthma action plan. Among children with moderate to severe asthma at enrollment, most reported using their controller medications daily by the end of the programs. Given that care coordinators worked with families seeing different health care providers, the results suggest they were effective in improving the families' ability to

communicate with providers and that they provided follow-up to families regarding instructions given by providers.

All sites achieved significant reductions in asthma morbidity, despite having participants with very high levels of asthma morbidity at enrollment. Our results are consistent with other studies showing that care coordination improves health outcomes for chronic disease (Viswanathan et al., 2010), including care coordination specifically for asthma, whether practice based or community-based (Friedman et al., 2006; Krieger, Takaro, Song, & Weaver, 2005; Martin et al., 2009; Parker et al., 2008; Postma, Karr, & Kieckhefer, 2009; Primomo, Johnston, DiBiase, Nodolf, & Noren, 2006; Rosen & Rodriguez, 2006; Thyne, Marmor, Madden, & Herrick, 2007).

Site-specific improvements in asthma morbidity outcomes varied between large and very large. The magnitude of improvement did not appear to correlate with variations in care coordination duration, as the outcomes for Los Angeles were no less than those for other sites. Intervention intensity also was not associated with outcome variation; sites with 4 to 9 average contacts per participant (Chicago, Los Angeles, San Juan) had morbidity improvements at or above the level seen at sites with 16 to 17 contacts per participant. This suggests that the intensity of intervention may have been less important than the appropriateness of the intervention, which by design had a high degree of fit to community needs and resources developed through long-term partnerships.

In all sites, more than half the children had fewer asthma-related school absences. Most sites improved school attendance on a par with the only school-based program (Los Angeles). The care coordinators may have reduced absences through several pathways: increased confidence in managing asthma among caregivers, leading to more comfort in sending a child to school despite a flare-up; better understanding of asthma and the need to help children stay involved in school and sports; and better day-to-day management of asthma.

We believe that the projects of the MCAN initiative demonstrate the effectiveness of multisite, community-based programs, adding to the evidence from a prior small group of asthma coalition studies (Clark et al., 2010; Coughney et al., 2010). Each site applied the care coordination conceptual framework in a way that optimized inputs given their particular community resources, constraints, and project infrastructure. Our results are limited by a pre-post design as well as the use of self-report to assess behavior and outcomes. Community-specific differences in participants and systems may have influenced the outcomes of the project, but examination of these

detailed differences is beyond the scope of this analysis. In addition, MCAN programs targeted primarily children with poor asthma control, so results may not apply to all children with asthma. Nonetheless, the consistency across sites of strongly positive outcomes for these integrated, community-based care coordination programs suggests that they are effective in reducing the burden of childhood asthma.

REFERENCES

- Bryant-Stephens, T., Kurian, C., Guo, R., & Zhao, H. (2009). Impact of a household environmental intervention delivered by lay health workers on asthma symptom control in urban, disadvantaged children with asthma. *American Journal of Public Health, 99*(Suppl. 3), S657-S665.
- Butterfoss, F. D., Gilmore, L. A., Krieger, J. W., Lachance, L. L., Lara, M., Meurer, J. R., . . . Rosenthal, M. P. (2006). From formation to action: How allies against asthma coalitions are getting the job done. *Health Promotion Practice, 7*(Suppl. 2), 34S-43S.
- Clark, N. M., Lachance, L., Doctor, L. J., Gilmore, L., Kelly, C., Krieger, J., . . . Wilkin, M. (2010). Policy and system change and community coalitions: Outcomes from allies against asthma. *American Journal of Public Health, 100*, 904-912.
- Clark, N. M., Mitchell, H. E., & Rand, C. S. (2009). Effectiveness of educational and behavioral asthma interventions. *Pediatrics, 123*(Suppl. 3), S185-S192.
- Coughey, K., Klein, G., West, C., Diamond, J. J., Santana, A., McCarville, E., & Rosenthal, M. P. (2010). The Child Asthma Link Line: A coalition-initiated, telephone-based, care coordination intervention for childhood asthma. *Journal of Asthma, 47*, 303-309.
- Fox, P., Porter, P. G., Lob, S. H., Boer, J. H., Rocha, D. A., & Adelson, J. W. (2007). Improving asthma-related health outcomes among low-income, multiethnic, school-aged children: Results of a demonstration project that combined continuous quality improvement and community health worker strategies. *Pediatrics, 120*, e902-e911.
- Friedman, A. R., Butterfoss, F. D., Krieger, J. W., Peterson, J. W., Dwyer, M., Wicklund, K., . . . Smith, L. (2006). Allies community health workers: Bridging the gap. *Health Promotion Practice, 7*(Suppl. 2), 96S-107S.
- Jones, C. A., Clement, L. T., Morphew, T., Kwong, K. Y., Hanley-Lopez, J., Lifson, F., & Guterman, J. J. (2007). Achieving and maintaining asthma control in an urban pediatric disease management program: The Breathmobile Program. *Journal of Allergy and Clinical Immunology, 119*, 1445-1453.
- Kattan, M., Crain, E. F., Steinbach, S., Visness, C. M., Walter, M., Stout, J. W., . . . Mitchell, H. E. (2006). A randomized clinical trial of clinician feedback to improve quality of care for inner-city children with asthma. *Pediatrics, 117*, e1095-e1103.
- Krieger, J. W., Bourcier, E., Lara, M., Peterson, J. W., Rosenthal, M. P., Taylor-Fishwick, J. C., . . . Doctor, L. J. (2006). Integrating asthma prevention and control: The roles of the coalition. *Health Promotion Practice, 7*(Suppl. 2), 127S-138S.
- Krieger, J. W., Takaro, T. K., Song, L., & Weaver, M. (2005). The Seattle-King County Healthy Homes Project: A randomized, controlled trial of a community health worker intervention to decrease exposure to indoor asthma triggers. *American Journal of Public Health, 95*, 652-659.
- Lara, M., Cabana, M. D., Houle, C. R., Krieger, J. W., Lachance, L. L., Meurer, J. R., . . . Vega, I. (2006). Improving quality of care and promoting health care system change: The role of community-based coalitions. *Health Promotion Practice, 7*(Suppl. 2), 87S-95S.
- Lara, M., Valencia, G. R., Gavillan, J. A., Reyes, B. M., Arabia, C., Malpica, F. L., . . . Chinman, M. (2009). Reducing inequities among children with asthma in the island of Puerto Rico: Experiences of a community-based, trans-sectoral effort. *Journal of Health Care for the Poor and Underserved, 20*(Suppl. 4), 116-136.
- Lieu, T. A., Finkelstein, J. A., Lozano, P., Capra, A. M., Chi, F. W., Jensvold, N., . . . Farber, H. J. (2004). Cultural competence policies and other predictors of asthma care quality for Medicaid-insured children. *Pediatrics, 114*, e102-e110.
- Mansfield, C., Viswanathan, M., Woodell, C., Nourani, V., Ohadike, Y. U., Lesch, J. K., . . . West, C. (2011). Outcomes from a cross-site evaluation of a comprehensive pediatric asthma initiative incorporating translation of evidence-based interventions. *Health Promotion Practice, 12*(Suppl. 1), 34S-51S.
- Martin, M. A., Catrambone, C. D., Kee, R. A., Evans, A. T., Sharp, L. K., Lyttle, C., . . . Shannon, J. J., for the Chicago Initiative to Raise Asthma Health Equity Investigative Team. (2009). Improving asthma self-efficacy: Developing and testing a pilot community-based asthma intervention for African American adults. *Journal of Allergy and Clinical Immunology, 123*, 153-159.
- Mitchell, E. A., Didsbury, P. B., Kruihof, N., Robinson, E., Milmine, M., Barry, M., & Newman, J. (2005). A randomized controlled trial of an asthma clinical pathway for children in general practice. *Acta Paediatrica, 94*, 226-233.
- Ochoa, E. R., Jr., & Nash, C. (2009). Community engagement and its impact on child health disparities: Building blocks, examples, and resources. *Pediatrics, 124*(Suppl. 3), S237-S245.
- Parker, E. A., Israel, B. A., Robins, T. G., Mentz, G., Xihong, L., Brakefield-Caldwell, W., . . . Lewis, T. C. (2008). Evaluation of Community Action Against Asthma: a community health worker intervention to improve children's asthma-related health by reducing household environmental triggers for asthma. *Health Education & Behavior, 35*, 376-395.
- Parker, E. A., Israel, B. A., Williams, M., Brakefield-Caldwell, W., Lewis, T. C., Robins, T., . . . Keeler, G. (2003). Community action against asthma: Examining the partnership process of a community-based participatory research project. *Journal of General Internal Medicine, 18*, 558-567.
- Persky, V., Turyk, M., Piorkowski, J., Coover, L., Knight, J., Wagner, C., . . . Fitzpatrick, A. for the Chicago Community Asthma Prevention Program. (2007). Inner-city asthma: The role of the community. *Chest, 132*(Suppl. 5), 831S-839S.
- Postma, J., Karr, C., & Kieckhefer, G. (2009). Community health workers and environmental interventions for children with asthma: A systematic review. *Journal of Asthma, 46*, 564-576.
- Primomo, J., Johnston, S., DiBiase, F., Nodolf, J., & Noren, L. (2006). Evaluation of a community-based outreach worker program for children with asthma. *Public Health Nursing, 23*, 234-241.
- Rosen, C. M., & Rodriguez, L. (2006). The Inner-City Asthma Intervention asthma counselor program: A collaborative model between physician and social worker to help empower families.

- Annals of Allergy, Asthma & Immunology*, 97(1, Suppl. 1), S16-S19.
- Rosenthal, M. P., Butterfoss, F. D., Doctor, L. J., Gilmore, L. A., Krieger, J. W., Meurer, J. R., & Vega, I. (2006). The coalition process at work: Building care coordination models to control chronic disease. *Health Promotion Practice*, 7(Suppl. 2), 117S-126S.
- Thyne, S. M., Marmor, A. K., Madden, N., & Herrick, G. (2007). Comprehensive asthma management for underserved children. *Paediatric and Perinatal Epidemiology*, 21(Suppl. 3), 29-34.
- Thyne, S. M., Rising, J. P., Legion, V., & Love, M. B. (2006). The Yes We Can Urban Asthma Partnership: A medical/social model for childhood asthma management. *Journal of Asthma*, 43, 667-673.
- Viswanathan, M., Kraschnewski, J. L., Nishikawa, B., Morgan, L. C., Honeycutt, A. A., Thieda, P., . . . Jonas, D. E. (2010). Outcomes and costs of community health worker interventions: A systematic review. *Medical Care*, 48, 792-808.
- Wise, P. H. (2009). Confronting social disparities in child health: A critical appraisal of life-course science and research. *Pediatrics*, 124(Suppl. 3), S203-S211.