

Utilizing the Community Health Worker Model to communicate strategies for asthma self-management and self-advocacy among public housing residents

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Abstract

Non-Hispanic Black children in the US experience a higher prevalence of asthma and are more likely to have severe and poorly controlled asthma than their non-Hispanic White counterparts. These disparities are particularly pronounced among those living in public housing compared to the general population. To combat these disparities, health care researchers collaborated with public housing management to deliver a year-long community health worker (CHW) asthma and healthy homes intervention to children with asthma in six public housing developments. CHWs, hired from the targeted housing developments, educated families to better manage asthma medically and address asthma triggers in the home, and served as a bridge to medical, social, and public housing services. This is the first time such a full spectrum asthma intervention has been implemented by CHWs in public housing. Fifty-nine children completed the intervention, 95% of whom were African American. Daytime asthma symptoms in the previous two weeks were significantly reduced between baseline (4.1) and 1-year follow-up (0.8). The percent of children making two or more urgent health resource utilization visits decreased significantly between baseline (42%) and 1-year follow-up (15%). Quality of life scores for caregivers of children increased significantly (by 0.7 points). The implementation of the CHW model in a public housing setting not only meets children where they live, but effectively bridges the gap between them and the health care system, reducing the disproportionate burden of asthma in these communities and improving overall quality of life.

Keywords: African Americans, Asthma, Community health workers, Health education, Pediatrics, Public housing

Introduction

Pediatric asthma, the most common chronic disease of childhood, is on the rise in the United States, currently affecting 14% of US children under the age of 18.¹ The prevalence of asthma varies by race/ethnicity, with minority children experiencing much higher rates than White children. For example, while 14% of Hispanic and 22% of non-Hispanic Black children have asthma, the rate is lower among non-Hispanic White children at 12%.¹ Black children tend to have asthma that is severe and poorly controlled, with a higher percentage using Emergency Department (ED) services, and they are also more likely to be hospitalized or die from asthma than their White counterparts.²⁻⁴

Asthma disproportionately affects poor and minority children living in inner-city neighborhoods, and Chicago is among the hardest hit cities.^{5,6} A representative population health survey conducted in six Chicago communities revealed childhood asthma rates as high as 24% in Chicago's predominantly Black West side communities.⁴ Among these children, 48% lived with a smoker, 80% did not have a controller medication, and 60% had been to the ED for asthma in the past year.⁴ Similarly, research in New York City and Boston has documented elevated rates of asthma among residents of federally assisted housing compared to the general population.^{7,8}

In addition to access to quality care,^{9,10} environmental exposures^{11,12} have been postulated as significant yet modifiable factors that contribute to severe and poorly controlled asthma. A large systematic review concluded that home-based, multi-trigger, multi-component asthma interventions that work with families of children with asthma are effective in reducing triggers and thus improving outcomes among children and adolescents with poorly controlled asthma.¹³ Community health workers (CHWs) have been an effective means of delivering such interventions, especially in poor or marginalized communities,^{14–16} and studies evaluating the efficacy of the CHW model in improving asthma outcomes have found that CHWs are able to improve asthma knowledge and disease management skills among their clients.^{17–22} Several home-based interventions have been implemented in various cities across the US, attempting to improve asthma control and adherence to National Heart Lung and Blood Institute (NHLBI) asthma guidelines.²³ However, none have combined the Community Health Worker Model with the public housing setting to deliver a full spectrum asthma intervention.^{24–26}

A recent project implemented in Chicago sought to incorporate many of these aspects into an intervention targeted at residents of six inner-city public housing developments. Taking an innovative approach to working with this challenging population, health care researchers collaborated with public housing management to deliver a CHW asthma and healthy homes intervention to children with asthma. This intervention is unique in that it is the first to employ CHWs recruited from the targeted public housing developments to deliver a full spectrum asthma intervention aimed at improving the medical management of asthma, reducing triggers in the home, and facilitating the relationship between families and medical, social, and housing services. In this paper, we describe the intervention and its results and discuss lessons learned from the unique CHW-led, collaborative approach to improving the health of children living in public housing.

Methods

Recruitment

Participants were recruited between July 2011 and September 2013 from six Chicago inner-city public housing developments. To be eligible for the intervention children had to be 2–17 years old with physician-diagnosed asthma and live in one of six participating public housing developments. Both the child and his/her caregiver were included in the study. It should be noted that initial efforts to

recruit using a door-to-door approach were unsuccessful and ultimately, case managers, employed by public housing and assigned to the specifically targeted developments, assisted with recruitment. Specifically, case managers informed residents about the asthma intervention during their scheduled interactions with residents. If the resident expressed interest in the intervention, the case manager would fax the resident's contact information to the intervention's Research Assistant (RA), who would call the potential participant to assess eligibility and set up the baseline home visit. Of the 204 children referred to the program, 85 completed a baseline visit and enrolled in the year-long intervention. Written informed consent was obtained from caregivers at the baseline visit. Children and their caregivers participated in six home visits over the course of a year. The Mt. Sinai Hospital's Institutional Review Board reviewed and approved the study protocol.

Intervention

The asthma and healthy homes intervention was primarily carried out by CHWs, as defined by the American Public Health Association.²⁷ In addition to living in the public housing communities served by the intervention, CHWs were required to have a High School Diploma or a GED and a passion for working in their communities.²⁸ CHWs are defined as trusted members of the community, and as such, it was important for the intervention to hire CHWs who were residents of the public housing developments, with an intrinsic connection to the clients they would serve and an intimate understanding of the public housing community, system, and structure. No previous experience with asthma was required. Upon being hired, each CHW participated in a rigorous 75-hour asthma, healthy homes, and core skills training facilitated by a Certified Asthma Educator (AE-C) and a senior CHW. Asthma-related training topics included asthma basics, medication and device use, triggers and trigger avoidance strategies, and warning signs and symptoms. Core competency topics included patient self-management, motivational interviewing, patient documentation and note writing, and collaboration with medical professionals. CHWs were also trained on the study's specific home visit protocol. Prior to being allowed to teach independently, CHWs underwent a standardized role-play evaluation process.

The CHWs' main objectives were to teach children and their families how to more effectively manage asthma. CHWs provided individually tailored, comprehensive asthma and healthy homes education to

participants. Children enrolled in the intervention received six home visits over the course of the year-long intervention. Following the baseline visit, visits occurred at 2 weeks, 3 months, 6 months, 9 months, and 12 months post-baseline visit. The CHWs used a standardized home visit protocol that delineates which concepts are to be prioritized at each home visit. In this order, topics taught throughout the course of the intervention, included pathophysiology of asthma, asthma symptoms and recognition, proper use of quick-relief and long-term controller medications, and recognition, mitigation, and avoidance of triggers. While the home visit protocol was standardized, content within each topic was still tailored to the individual family's unique needs. For example, all families were taught that pests are an asthma trigger; however, pest mitigation was only done in homes where pests were present.

CHWs also served as a bridge between families and the health care system, social services, and public housing staff and management. When necessary, CHWs assisted families in reporting housing issues to public housing building management, and made referrals to social services agencies and medical professionals. CHWs specifically helped facilitate relationships with primary care physicians (PCP), including ensuring each child had a consistent PCP and that the caregiver had a good relationship with the PCP. CHWs sent letters (approved by the program coordinator) to each participant's PCP following the baseline, 6-month, and 12-month home visit. In these letters, the CHW informed the PCP of medications in the home, triggers present, and what was taught at the home visit. CHWs also worked with PCPs to ensure that all children had an Asthma Action Plan on file with the PCP and the caregiver knew how to use the Asthma Action Plan. All referrals made to outside agencies were followed-up on by the CHW or the project coordinator.

Data collection

In person data collection occurred at six home visits: the baseline visit and the 2-week, 3-month, 6-month, 9-month, and 12-month post-baseline visits. Data were also collected via monthly phone calls throughout the 12-month intervention period. Data were primarily collected by an experienced RA with extensive training in data collection and significant experience working in the community being served although she herself was not from the community. The RA did not conduct any asthma teaching, though if the participant reported data that showed elevated asthma symptoms, the RA shared that information with the CHW who then reached out to the family and provided assistance. The RA

accompanied the CHW to the baseline home visit and the final 12-month home visit. The RA also collected data via monthly phone calls with caregivers over the course of the year-long intervention. The CHW collected data at the four home visits that occurred between the baseline and 12-month visit. The data collected by the CHWs were limited to information that had to be observed, such as medication technique and the presence of triggers.

Measurements

Asthma symptoms

Participants' primary caregivers were asked three standard symptom-related questions at baseline and the final home visit and over the phone every month during the intervention. The period of reference was the 2 weeks prior to the time of data collection. Specifically, symptom questions ascertained the number of days out of the past 14 days that the following occurred: (1) symptoms were experienced during daytime hours, (2) symptoms were experienced during nighttime hours, and (3) child needed to use quick-relief medicine. Data from the 2 weeks prior to baseline were compared to the 2-week average over the course of the 12-month intervention. Questions were modeled on those used in the *Behavioral Risk Factor Surveillance Asthma Survey* questionnaire.²⁹

Asthma-related health resource utilization

Information on asthma-related health resource utilization (ED visits, hospitalizations, and urgent care visits) was collected retrospectively at the baseline home visit (1-year recall) and then via phone each month during the 12-month intervention (past month recall). Twelve months of data were summed to get a 1-year time frame which was compared with the baseline recall of 1 year. ED visits, hospitalizations, and urgent clinic visits were summed to create a 'total urgent health resource utilization' variable. Questions were modeled on the *Behavioral Risk Factor Surveillance Asthma Survey* questionnaire.²⁹ All asthma-related health resource utilization variables were categorized into three groups for analyses: no visits, one visit, or two or more visits.

Caregiver asthma-related quality of life

The quality of life of the child's primary caregiver was assessed using the *Pediatric Asthma Caregiver's Quality of Life Questionnaire*,³⁰ a validated and extensively used questionnaire. The Likert scale instrument yields three scores: an overall score, an activity limitation sub-score, and an emotional function sub-score. In each case, the maximum possible score is seven and the lowest possible score is zero, with a seven indicating maximum quality of life. A change in the score of 0.5

or more has been shown to be clinically significant.³¹ Each caregiver completed one questionnaire at baseline, 6-month and the 12-month follow-up, irrespective of the number of children in the household that were enrolled in the intervention.

Asthma control

An asthma control variable was created using data collected at the baseline and the final home visits. Asthma control was defined by the NHLBI asthma guidelines,²³ which classify asthma control in three categories: (1) well controlled; (2) not well controlled; and (3) very poorly controlled. Participants were categorized based on their age (0–4, 5–11, or ≥12 years) and caregiver’s self-reported response to four symptom-related questions (daytime symptoms, nighttime symptoms, interference with normal daily activities, use of short-acting beta2-agonist).

Asthma-related triggers

A home trigger assessment was utilized to assess cigarette smoke exposure as well as five other asthma-related home triggers. Cigarette smoke exposure was a categorical variable ranging from exposed to smoke every day to only exposed once a year. The other five asthma-related home trigger variables indicated the presence (yes/no) of roaches, mice, mold, dust, and furry pets. Data were collected in-person at the baseline and 12-month final home visits. Data were based on self-report and observations by the CHW. If a trigger was identified during the home assessment it was coded as yes.

Housing modification request

Housing modification requests made by participants to public housing management were tracked by the CHWs and their supervisor. Completed requests were confirmed with public housing management and with the participant.

Data analysis

The outcome analysis was limited to children who completed the entire 12-month evaluation phase. Frequencies, means, and medians, as appropriate, were calculated for each outcome variable at baseline and the 12-month follow-up period. The analysis utilized a pre-post test design. The primary outcome variables were not normally distributed, therefore, the non-parametric Wilcoxon signed-rank test was used to assess whether observed changes were statistically significant at the $P < 0.05$ level. Two-sided tests of hypothesis were used. Data were analyzed using SAS, version 9.2.³²

Results

Between July 2011 and September 2013, 85 children were enrolled in the intervention (Table 1). Fifty-

nine children (69%) completed the 12-month intervention. A chi-square analysis comparing those who completed the intervention and those who were lost to follow-up revealed no statistical differences in demographic characteristics. The intervention was evaluated for the 59 children who completed the 12-month intervention. Data are compared from baseline to the 12-month follow-up (hereafter referred to as ‘follow-up’).

Among those who completed the intervention, approximately 95% of the children were non-Hispanic Black (Table 1). The average child participant was 9.5 years old and 51% of the children were male. The annual household income for 44% of participants was less than \$10 000. The majority of families (93%) had insurance coverage through Medicaid. At baseline, 54% of children had poorly controlled asthma, 22% had not well-controlled asthma, and 24% of children had well-controlled asthma.

When asked how many days and nights were interrupted with asthma symptoms in the 2 weeks prior to the baseline visit, caregivers reported their child had an average of 4.1 days and 3 nights (Table 2). Over the 12-month follow-up period, daytime and nighttime symptom frequencies decreased significantly to an average of 0.8 days in the past 2 weeks for each. The number of days that children needed to use their rescue medication also decreased significantly from 3.1 to 0.9.

Total urgent health resource utilization was statistically significantly reduced from baseline to follow-up (Table 3). The percent of children making two or more urgent health resource utilization visits decreased from 42% at baseline to 15% at follow-up. Similarly, the percent of children making no urgent health care utilization visits increased from 44% at baseline to 75% during the follow-up year. There was a statistically significant change in the distribution of ED visits at follow-up with the percent of children making no ED visits increasing from 56% in the year prior to the intervention to 80% in the follow-up year ($P = 0.0001$) (Table 3). Between baseline and follow-up, the percent of children making two or more ED visits decreased from 27 to 5%. Similar decreases at follow-up were seen for hospitalizations and urgent clinic visits.

Forty-two caregivers of children completed the quality of life (QOL) questionnaire at baseline and at the completion of the intervention (Fig. 1). The activity limitation and the emotional function sub-scores for caregivers of children enrolled in the intervention increased (by 0.6 and 0.8 points, respectively) between baseline and the 12-month follow-up. The overall QOL score increased by 0.7 points (from 5.4 to 6.1) between baseline and the 12-month follow-

Table 1 Child participant demographics and selected health care characteristics at enrollment.

	Total (<i>n</i> = 85)		Completed (<i>n</i> = 59)	
	<i>n</i>	%	<i>n</i>	%
Race/ethnicity				
Non-Hispanic Black	81	95.3	56	94.9
Hispanic Black	3	3.5	3	5.1
Puerto Rican	1	1.2	0	0.0
Gender				
Male	43	50.6	30	50.8
Female	42	49.4	29	49.2
Insurance				
Medicaid	80	94.1	55	93.2
Private	5	5.9	4	6.8
Age (mean, in years)	85	9.2	59	9.5
Household income				
<\$10 000	38	44.7	26	44.1
\$10 000–\$19 999	18	21.2	12	20.3
\$20 000–\$29 999	9	10.6	7	11.9
>\$30 000	8	9.4	5	8.5
Refused	12	14.1	9	15.3
Employment status of caregiver				
Employed full-time	16	18.8	11	18.6
Employed part-time	12	14.1	7	11.9
Seasonal	4	4.7	3	5.1
Disability	2	2.4	1	1.7
Unemployed	51	60.0	37	62.7
Primary care physician – % yes	84	98.8	58	98.3
Of those with PCP, % knew name of PCP	65	77.4	43	74.1
Asthma action plan – % yes	22	25.9	15	25.4
Asthma control				
Well controlled	15	17.6	14	23.7
Not well controlled	19	22.4	13	22.0
Very poorly controlled	51	60.0	32	54.2

Table 2 Symptom frequency at baseline and during follow-up year (*n* = 59).

	Baseline*	Follow-up year**	<i>P</i> -value***
Daytime symptoms			
Mean	4.1	0.8	<i>P</i> < 0.001
Median	2.0	0.6	
Range	0–14	0–6	
Nighttime symptoms			
Mean	3.0	0.8	<i>P</i> = 0.01
Median	1.0	0.5	
Range	0–14	0–5.2	
Days needed rescue medication			
Mean	3.1	0.9	<i>P</i> = 0.004
Median	1.0	0.5	
Range	0–14	0–5.7	

*Frequency assessed in the 2 weeks prior to baseline.

**Frequencies of symptoms in the past 2 weeks are averaged over 12 monthly follow-ups completed over the 1-year period.

***Wilcoxon signed-rank non-parametric test used to assess statistical significance.

Table 3 Asthma-related health resource utilization for children in the year prior to and during the intervention year (*n* = 59).

	Baseline		Follow-up year		<i>P</i> -value*
	<i>N</i>	%	<i>n</i>	%	
ED visits					
0	33	56	47	80	<i>P</i> < 0.001
1	10	17	9	15	
2+	16	27	3	5	
Hospitalizations					
0	41	69	54	91	<i>P</i> < 0.001
1	13	22	4	7	
2+	5	8	1	2	
Clinic visits – urgent					
0	48	81	51	86	<i>P</i> = 0.020
1	7	12	5	8	
2+	4	7	3	5	
Sum urgent HRU**					
0	26	44	44	75	<i>P</i> < 0.001
1	8	14	6	10	
2+	25	42	9	15	

*Wilcoxon signed-rank non-parametric test used to assess statistical significance.

**Sum of urgent health resource utilization variables (hospitalizations, ED visits, and urgent clinic visits).

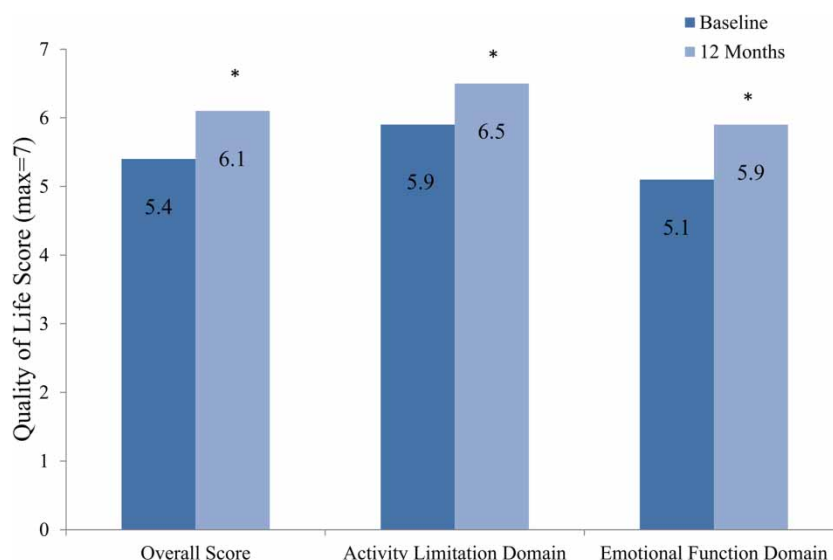


Figure 1 Pediatric asthma caregiver's quality of life at baseline and 12 months ($n = 42$).

up. All improvements in QOL were statistically ($P < 0.05$) and clinically significant (≥ 0.5 change).³¹

Another objective of the intervention was to decrease the number of asthma-related environmental home triggers that the child was exposed to in their home. An assessment of the presence of roaches, mice, mold, dust, and pets at baseline revealed that households had one trigger present on average at baseline (data not shown). At the time of the 12-month visit, the trigger number had decreased to 0.6 ($P = 0.36$). Throughout the course of the intervention, a total of 48 individual housing issues were referred to public housing management for issues such as carpet removal, mold, pests, or water damage (Table 4). The largest numbers of referrals were for carpet removals, mold, and 'other', which represented issues such as heaters and air conditioners in need of repairs and visible dust build up in the vents. All of the cracks, holes, pests, and water damage issues reported were resolved. A total of 83% of all issues reported were resolved at the close of the intervention.

Asthma control for the 59 children who completed the intervention improved significantly ($P < 0.001$) between baseline and the 12-month follow-up (Fig. 2). At baseline, 54% of children were categorized as having very poorly controlled asthma, but by the end of the intervention this number declined to 12%. The percentage of children whose asthma was considered well controlled had a three-fold absolute increase, from 24% at baseline to 78% at the end of the intervention.

Discussion

The main objectives of this study were to translate a CHW home-based asthma intervention into public housing developments on the Westside of Chicago, and evaluate CHWs' effectiveness in improving asthma management among children with asthma living in these developments. Results indicate that CHWs were successful in helping to significantly reduce daytime and nighttime asthma symptoms and urgent health resource utilization, and

Table 4 Total number of environmental home trigger issues reported across all households*.

Type of Issue	Total	Resolved		Unresolved	
		<i>n</i>	%	<i>n</i>	%
Carpet	14	8	57	6	43
Crack	5	5	100	0	0
Hole	3	3	100	0	0
Mold	10	9	90	1	10
Pests	1	1	100	0	0
Water damage	4	4	100	0	0
Bed bugs	2	1	50	1	50
Other	9	9	100	0	0
Total	48	40	83	8	17

*Some households reported more than one housing issue.

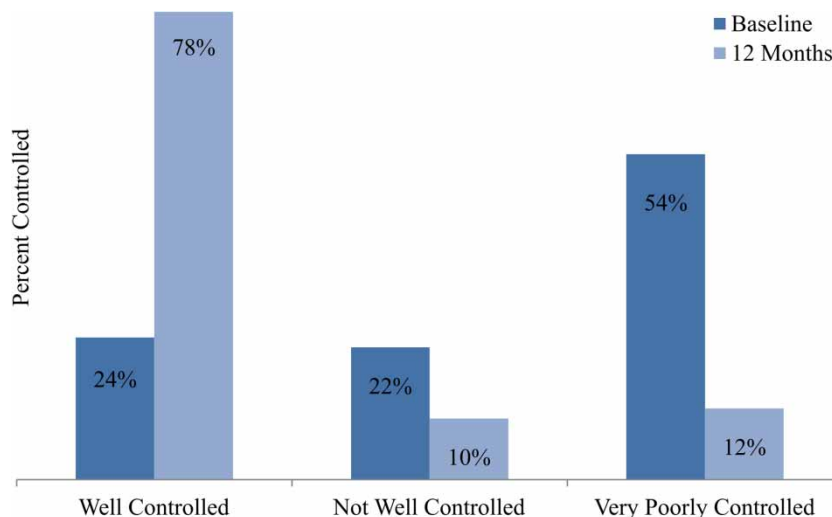


Figure 2 Child asthma control at baseline and at 12-month follow-up visit ($n = 59$).

significantly improve caregiver quality of life and asthma control for those enrolled in the intervention. These outcomes are indicative of a successful partnership to integrate a health intervention into a large public housing organization.

CHWs' primary goal was to educate children with asthma and their caregivers living in public housing, and implement an asthma and healthy homes intervention that addressed both the medical management of asthma and indoor trigger reduction. A unique feature of this intervention is that CHWs delivered all of the education provided in the home, including education on medications and proper medication technique. Through the combination of CHWs teaching about the medical management of asthma and assisting the family in mitigating triggers, children experienced an 83% reduction in daytime asthma symptoms over the course of a year. As the children's symptoms improved and their use of urgent health resources declined, the caregiver's quality of life improved dramatically. Considering these improvements collectively, the significant shift in asthma control among children between baseline and their 12-month visit speaks to the CHWs' success in ensuring participants had appropriate medications, knew how to administer them, and could recognize and avoid triggers. By the end of the intervention, 78% of the children were classified as having well-controlled asthma. These improvements can be attributed to the CHWs' approach in addressing the needs and barriers of their individual clients.

In addition to providing asthma education, CHWs served as a bridge between their clients, public housing residents, and medical and social services, as well as public housing management staff. Through these interactions, CHWs transferred

important skills to their clients, enabling them to advocate for their needs and those of their families.

As the bridge between residents and medical services, CHWs focused heavily on helping participants build a relationship with a PCP. Many clients expressed mistrust for physicians. CHWs helped address this barrier by explaining the importance of having a PCP and helping participants find a PCP if they did not have one, as well as teaching and empowering them to communicate effectively with their PCPs and other medical staff (e.g., helped formulate specific questions to ask, how to verify if they understood information correctly). In addition to teaching clients to communicate with their PCP, CHWs also communicated directly with the participant's PCP via letters that provided PCPs with an update on the participant's progress, including a draft Asthma Action Plan and a summary of medications and triggers found in the home. This direct communication between the CHW and PCP also played a part in helping build the relationship between the participant and their PCP.

CHWs served as the conduit between participants and social services by assessing the needs of the family and making referrals to social services as needed. Many of the families enrolled in the intervention experienced competing priorities, such as balancing the needs of multiple children in the home, the presence of co-morbidities, and various financial challenges. CHWs helped to address these issues by linking clients to organizations that could assist with mental health services, utility bills, and nutritional needs. Alleviating the stress of these competing priorities allowed caregivers to focus on their child's asthma and take the necessary steps to improve it.

CHWs were very successful at bridging the relationship between public housing residents and

public housing management staff, primarily through the development of a housing issue referral process designed to help address asthma-related housing issues. First, CHWs educated participants on what an asthma trigger is and then CHWs assisted participants in identifying what their personal triggers were. Prior to the intervention, many participants were not aware that certain housing issues such as mold, carpeting, and dust mites could affect their child's asthma. If a housing issue was present, CHWs demonstrated how to take the appropriate steps to refer the issue to housing management. CHWs were also in regular communication with local public housing authorities to leverage existing procedures to resolve housing issues that trigger asthma. As a result, 100% of residents who had pest issues, water damage issues, or cracks/holes in their walls had their housing issue resolved before the intervention ended. The majority of carpet, mold, and bed bug issues were resolved as well. Through this process, CHWs were able to teach participants how to complete a request for a housing issue to be resolved, giving them the skills and confidence to complete the process on their own, as well as advocate for their own and their child's health.

Thus, throughout the course of the intervention, CHWs not only communicated health information to program participants, but also taught participants strategies for communicating with those essential to managing their child's asthma – namely physicians and other medical staff, public housing management staff, and community social service agencies. These communication skills are invaluable as they can be employed by participants in a variety of settings, as well as passed on to other public housing residents.

Despite noted success in bridging relationships, CHWs faced barriers to providing participants with all necessary services related to achieving asthma control. For example, smoking cessation programs that are readily available, sustainable at low or no cost, and that provide sufficient support to those attempting to quit, are difficult to find. Smoking and second-hand smoke are key asthma triggers and therefore can be vital contributors to poor asthma control, highlighting the need for accessible smoking cessation services. In addition, as public housing authorities begin to move forward with making buildings smoke-free,³³ it will be increasingly necessary to offer smoking cessation programs to residents. Mental health services were also in high demand yet not readily available in the community. CHWs can assist in empowering participants to begin the process of making positive changes in their health behavior, but without more

accessible programs it remains a barrier to providing the best care in health interventions.

Limitations

This study is limited by its small sample size. However, it is notable that the effect size was large enough that statistical significance was achieved with a relatively small sample. In addition, the study inclusion criterion was not limited to children with severe asthma (as is typical in many asthma interventions). Any child, as long as s/he had physician-diagnosed asthma and was 2–17 years old, was offered the intervention. The resulting improvements in asthma outcomes are seen even within a sample that included children whose asthma would not be considered 'severe' or 'poorly controlled'. Therefore, the authors recommend that payers, both public and private insurers, consider providing coverage for at least one CHW home visit to all children with asthma, regardless of severity or level of control.

The study was carried out with Black children living in a small number (six) of public housing developments in disadvantaged neighborhoods of Chicago. While CHW asthma interventions have been shown to be effective with similar demographics,^{20–22,34} the findings may not be generalizable to all public housing populations. However, the findings suggest that CHW interventions in public housing may be suitable to, and should be tested for, chronic conditions other than asthma.

Another limitation of our study is that as the CHWs tailored the intervention based on a family's specific need, the intensity of the intervention varied accordingly. The analyses did not take into account variation in dosing and intervention components. Future studies should look at the efficacy by dose/intervention component to understand which dose level or intervention components are most associated with asthma management improvement.

It is important to note that the data for this study were collected via caregiver self-report and are thus subject to recall bias. Fortunately, the validity of the caregiver-reported health resource utilization has been supported by large, multicenter, randomized trials in pediatric patients with asthma.³⁵

Implications for future research and practice

CHW-based interventions are not new, but they have garnered a lot of national attention since the development and implementation of the Patient Protection and Affordable Care Act. Many CHW interventions that focus on chronic conditions have shown improvements in health^{15,17,21,36,37} and

health care savings.^{17,37–39} However, in order for the CHW model to become part of standard health care delivery, we have much further to go in terms of systematic CHW training, research, and policy development. Future studies should document how CHWs are trained, the traits they share with the communities served by the intervention, and how quality assurance in programs is assessed. This information is critical for organizations seeking to implement the CHW model. Future studies should also pay particular attention to CHWs' work in facilitating relationships between clients and medical and social services. Such processes should be rigorously evaluated. In addition, cost savings analyses should be conducted whenever possible and used to leverage future support of the CHW model.

Conclusions

The United States Department of Housing and Urban Development (HUD) puts forth an annual strategic plan that is intended to be a framework to deliver HUD's vision and mission. One of HUD's strategic goals is to 'use housing as a platform to improve quality of life', specifically to improve health.⁴⁰ The findings of this CHW-led asthma intervention suggest that the CHW model is an effective means of improving asthma outcomes and quality of life for children with asthma and their families residing in public housing. CHWs establish relationships of trust, successfully communicate health information, teach communication skills, and serve as a bridge between public housing residents and the medical, social, and housing sectors. Building on this evidence, a sustainable approach to improving the health and quality of life of public housing residents would be to more formally incorporate the CHW model, specifically hiring CHWs who are public housing residents, into the public housing system. Since Medicaid is the main insurer of public housing residents and the CHW model has been shown to be cost-effective,^{17,20,22} it makes sense for HUD and Medicaid to partner to pay for the incorporation of the CHW model. CHWs would be a part of the system, but have an intimate relationship with fellow residents, ultimately breaking down barriers that impede residents from ensuring their own financial stability, improved health, and quality of life. Through interventions such as these, the large racial disparity in asthma prevalence can hopefully be eliminated.

Acknowledgements

This work could not have been done without the dedication and time of several staff members of

the Sinai Urban Health Institute, especially Jeanette Avila, Research Assistant and Kim Artis, Community Health Worker. We are grateful to our partners at the Chicago Housing Authority, specifically Andrew Teitelman and our program officer at HUD, Rachel Riley. Lastly, we thank all participating families whose invaluable feedback helped shape and inform our interventions, enabling us to better serve the community. This research was funded in part by grant US Department of Housing and Urban Development (Grant Number: ILLHH0223-10). Additional support for the staff involved in this research has been provided by The Michael Reese Health Trust, Roe Health Policy Fund.

Disclaimer statements

Contributors The authors of this paper have all contributed significantly to the preparation and writing of the manuscript. Specifically, Melissa Gutierrez Kapheim secured grant funding, served as project director of the intervention, contributed to study design and evaluation plan, analyzed outcomes data, and contributed to the writing of the manuscript. Jessica Ramsay served as the intervention coordinator and CHW supervisor, hired and trained CHWs for the project, and significantly contributed to the writing of the manuscript. Tala Schwindt analyzed outcome data and contributed to the writing of the manuscript. Bijou Hunt made significant contributions to the development and writing of the manuscript. Helen Margellos-Anast secured grant funding, served as principal investigator on the study, contributed to the study design and evaluation plan, and contributed to the writing of manuscript.

Funding US Department of Housing and Urban Development (Grant Number: ILLHH0223-10) and the Michael Reese Health Trust, Roe Health Policy Fund.

Conflicts of interest None of the authors have any relationships that could be viewed as presenting a conflict of interest to declare.

Ethics approval The Sinai Health System Institutional Review Board approved all components of the study. All participants signed a written consent form prior to participating in the study.

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