

PREVALENCE AND MORTALITY

Asthma Prevalence in Philadelphia: Description of Two Community-Based Methodologies to Assess Asthma Prevalence in an Inner-City Population

TYRA BRYANT-STEPHENS, M.D.,^{1,2,*} CAROLINE WEST, M.P.AFF.,³ CANNAE DIRL, M.S.W.,¹
TINESHA BANKS, M.P.H.,⁴ VANESSA BRIGGS, M.B.A.,⁴ AND MICHAEL ROSENTHAL, M.D.⁵

¹Community Asthma Prevention Program, The Children's Hospital of Philadelphia, Philadelphia, PA, USA.

²Department of Pediatrics, University of Pennsylvania School of Medicine, Philadelphia, PA, USA.

³Philadelphia Health Management Corporation, Philadelphia, PA, USA.

⁴Health Promotion Council, Philadelphia, PA, USA.

⁵Department of Family and Community Medicine, Christiana Care Health System, Wilmington, DE, USA.

Objectives. Local asthma prevalence, especially in high-risk areas, may vary greatly from those estimated by national or regional data and targeted, community-specific approaches may be needed to assess the burden of childhood asthma. The Philadelphia Merck Childhood Asthma Network project sought to understand the local prevalence of asthma in Philadelphia communities and schools of low-income, disadvantaged children utilizing a grassroots approach that would access traditionally hard-to-reach families. **Methods.** Two asthma-screening methodologies were implemented using the Brief Pediatric Asthma Screen. Door-to-door screening was conducted in disadvantaged neighborhoods by community health workers. School screening was implemented in each class through partnership with the school principals and teachers in disadvantaged neighborhoods within the same target area. **Results.** A total of 2368 children were screened through door-to-door methodology and 5563 children were screened in the schools. Door-to-door screening revealed asthma prevalence of 21.7%, with an additional 4.9% reporting symptoms consistent with asthma. School screening results revealed a higher prevalence with more than a quarter (27.5%) of the students screened positive for asthma. An additional 16.7% had symptoms indicative of asthma. **Conclusions.** Both methods were able to successfully identify children with asthma in hard-to-reach populations. These methods can easily be replicated in other cities and the results can be used to inform programs, services, and policy developments.

Keywords children, community, community health workers, pediatrics, schools, screening

INTRODUCTION

Although asthma screening is controversial due to questions of variations in assessment methods and cost-effectiveness of screening programs (1, 2), establishing asthma prevalence in a community can be used to understand health utilization, to gauge needed resources, and to plan effective public health interventions. Targeting expectedly high prevalence communities, identifying those at highest risk of uncontrolled asthma, and using screening programs to get children to better care and services may be beneficial (2, 3).

The utilization of different methodologies to understand the breadth of asthma prevalence in disadvantaged populations through screening and case identification can be instrumental in public health approaches to asthma care management. Traditionally, telephone surveys have been used to understand the burden of asthma. Most of our knowledge of how asthma affects quality of life and has an impact on school days and workdays has been gained through massive telephone surveys such as Behavioral Risk Factor Surveillance Survey and National Health Information Survey (4, 5). Disadvantaged populations are harder to reach using this standard methodology due to

lack of consistent availability of telephone landlines, published phone numbers, and transiency of the population (6–9). In addition, telephone surveys are not able to capture what happens in the home. Comparisons of different mechanisms for community screening may be helpful in developing approaches for identifying children with asthma and in considering targeted interventions that can link them to asthma care and support services. Information gained from innovative efforts to reach this population can be used to plan effective health interventions and thereby reduce asthma burden on families with limited resources.

School screenings have been effective in establishing prevalence in a few underserved Chicago communities in school-aged children. Wolff developed and validated the Brief Pediatric Asthma Screen (BPAS) in inner-city Chicago, which is a five-question, easily administered questionnaire in the school setting (10). Previous reports of school screening for asthma have been largely successful in establishing prevalence in school-aged children (11–13). Because most children are diagnosed by 5 years of age and most children hospitalized are between 0 and 4 years of age, it is important to identify children even earlier in order to link to evidence-based asthma services.

The Philadelphia Merck Childhood Asthma Network (MCAN) project consisted of four major interventions: The Home visit program of the Community Asthma Prevention Program (CAPP) of Children's Hospital of Philadelphia (14), the Child Asthma Link Line (Link

*Corresponding author: Tyra Bryant-Stephens, MD, Community Asthma Prevention Program, The Children's Hospital of Philadelphia, Philadelphia, PA, USA; Tel: 215-590-5020; Fax: 267-426-5774; E-mail: stephenst@email.chop.edu

Line), established by the Philadelphia Allies Against Asthma coalition (15), CAPP classes, and School asthma education. One of the goals of the MCAN project was to establish prevalence of childhood asthma in targeted sections of Philadelphia, to identify children with asthma and to encourage enrollment for children who were potentially “hard to reach” in at least one of the program’s interventions. In this article, we describe and compare two methods of screening for asthma prevalence: door-to-door screenings in targeted sections of the city and school-based screenings in corresponding neighborhoods.

METHODOLOGY

Sampling

Asthma screening was first conducted in West Philadelphia, and then in North Philadelphia. In West Philadelphia, four block groups from each of seven zip codes were randomly selected using the SPSS Random Selection procedure for inclusion in the door-to-door screening. These four block groups were selected from a sampling pool that was stratified according to total population size, so that two block groups with a smaller total population (200–1000 people) were randomly selected from each zip code (14 from 255 total block groups) as well as two block groups with larger populations (more than 1000 people) from each zip code (14 from 78 total block groups). Seventeen (17) block groups were excluded from consideration due to a population size of fewer than 200 people (Table 1).

To adjust for this problem of block groups with low proportions of children, the sampling methodology was adjusted before screening began in the North Philadelphia neighborhoods. In North Philadelphia, block groups were selected for screening based on their total population of children aged 3–18 years. The sampling pool within each zip code was then stratified into smaller block groups with 100–199 children (81 block groups) and larger ones with 200+ children (78 block groups). Four block groups of each size, in each zip code, were then randomly selected. Thirty-nine block groups were excluded from the sampling pool because they had a population size of less than 100 children between the ages of 3–18 years.

TABLE 1.—Census data.

North and West Philadelphia zip codes*	Total population	Total no. of block groups
19104	48,366	63
19120	66,864	72
19129	10,044	16
19131	44,936	50
19139	39,561	67
19141	33,328	52
19142	27,998	32
19143	66,259	80
19144	42,491	58
19151	29,849	38
19153	11,558	20

*Population based on Claritas, Inc. 2006 census estimates.

Door-to-Door Screening

Door-to-door screening was conducted between 2006 and 2008 in randomly selected census block groups in nine zip codes in West and North Philadelphia. The screening tool used was the BPAS, a five-question screening tool used to determine the presence of asthma in school-aged children. This tool was initially validated on children who attended a public school in Region 5 of Chicago. The children who did not have a diagnosis of asthma but who did have symptoms identified on the screening were then given a blinded clinical evaluation for the diagnosis of asthma. For these children, the screening demonstrated 75% sensitivity and 81% specificity for the diagnosis of asthma (10). Two community health workers (CHWs) visited all homes within each selected block group and conducted BPAS with caregivers for all children under the age of 17 years in each home. A total of 2368 children were screened in all block groups. No demographic information was collected during the door-to-door screening, in order to facilitate the speed of administration and the acceptability of the screening.

Prior to canvassing the area, the CHWs’ distributed flyers informed residents of the date of the screening. Families were given a choice of opting out of screening by calling a phone number where a voice message could be recorded. The voice mails were retrieved up to and including the night before screening by a supervisor. The addresses of the opt-outs were given to the CHW on the morning of the screenings. CHWs also observed neighborhoods to determine the best time to find people at home. This varied from early morning to early evening depending on the neighborhood. On the day of the screening, CHWs would travel in pairs along each block administering the screening. The CHWs asked each question out loud and recorded the answers of the self-identified caregivers. When positive screens were recorded, family caregivers were invited to enroll children in the CAPP home visit program or the Link Line, a telephone-based care coordination program.

School Screening

Schools were located in the same zip code areas as were the door-to-door screenings. The second screening type was conducted in 16 schools in collaboration with a project partner, the School District of Philadelphia (SDP), from four inner-city Philadelphia neighborhoods that corresponded to the targeted sections in Philadelphia, and were conducted during the same time frame as the community screenings. Schools were chosen based on their location, size, and willingness to work with the staff.

Philadelphia MCAN staff delivered screening packets to each class in each selected school. The teachers were asked to distribute the screening packets to students who then delivered them to their caregivers. Screening packets included a written form of the BPAS, a consent that gave permission for the Link Line staff to contact parents by phone and for the school nurses to receive the information if their child screened positive for asthma. Teachers

received movie packets when >70% of the children returned screens and students received basketballs, jump ropes, or movie tickets.

A total of 5563 children were screened in all 16 schools, which represented a total response rate of 62%. Children's ages were not collected in the school survey, but the age range of students in the selected schools was between 5 and 14 years.

RESULTS

Positive screening was identified as responding yes to the following questions on the BPAS:

"Has your child ever been diagnosed with asthma?"

"Has your child ever stayed over night in the hospital for wheezing?"

Probable was defined as responding yes to any of the other three questions on the BPAS.

Door-to-Door Screening

Door-to-door screening in the randomly selected block groups of targeted Philadelphia neighborhoods found a positive asthma prevalence of 21.7%, with an additional 4.9% reporting symptoms that indicated probable asthma.

Table 2 shows the breakdown of the prevalence results by zip code, including the demographics of each zip code. In total, the residents of the selected zip codes are predominantly African American (72.6%), with smaller percentages of whites (15.1%) and Latinos (6.8%); 32.8% of the children under 17 years are living below the poverty line. Due to their limited number comparison, zip codes were not assessed for significance. Additionally, household poverty data was not collected during the door-to-door screenings.

Table 2 suggests that the highest prevalence of asthma was found in the two zip codes with the highest percentage of children living in poverty (as obtained from census data), 19,104 and 19,139 (with 47.3% and 40.2% positive for asthma, respectively).

In the second phase of the door-to-door intervention that targeted North Philadelphia, age was added to the

TABLE 2.—Results of screening by zip code (door to door).

Zip code	Positive (%)	Probable (%)	N	African-American (%)	Hispanic (%)	Children below poverty (%)
19104	47.3	0.0	91	50.3	4.0	48.1
19120	22.2	7.4	609	46.8	26.9	28.5
19129	18.4	7.7	207	38.5	3.0	25.9
19131	23.6	2.0	243	78.7	2.2	30.3
19139	40.2	2.0	199	93.4	1.6	42.7
19141	29.7	1.6	185	82.2	3.2	30.6
19143	22.1	2.7	294	91.5	1.8	36.0
19144	20.4	11.2	294	82.5	2.2	31.0
19151	22.9	0.6	171	77.2	2.5	17.3
Total	21.7	4.9	2368	72.6	6.8	32.8

TABLE 3.—Results by age in North Philadelphia (door to door).

Age group (years)	n	North Philadelphia		National rates (2008 BRFSS)
		Positive (%)	Probable (%)	US prevalence (%)
0–4	259	16.6	21.2	8.0
5–9	414	22.7	4.8	14.9
10–14	389	20.6	4.4	16.2
15–17	194	29.4	2.1	16.5
Total	1256	21.8	7.6	9.0

asthma survey. Table 3 shows the results by age group and compares them to the 2008 national BRFSS data. Also this table shows that children in North Philadelphia have approximately double the prevalence of asthma in all childhood age groups compared to the national rate.

School-Based Screening

More than a quarter (27.5%) of the students screened in the schools were found to be positive for asthma, and an additional 16.7% had symptoms suggesting that they are likely to have asthma. These findings are much higher than the national prevalence rate reported by the National Health Interview Survey among 5- to 14-year olds (14.9% currently have asthma) (5).

Table 4 shows the school-specific screening results along with selected demographic characteristics of each school. The sample size of 16 schools was not large enough to allow comparison of statistical analyses, but Table 4 suggests that the schools with the highest asthma rates detected also tended, in general, to be those with the highest proportion of students from economically disadvantaged backgrounds defined as the proportion of students eligible for free or reduced-price lunches.

TABLE 4.—Screening results by school.

School	n	Positive (%)	Probable (%)	African American (%)	Hispanic (%)	Economically disadvantaged (%)
1	307	16.6	16.8	5.7	5.7	84.5
2	284	29.2	22.4	92.0	1.5	94.1
3	219	33.6	20.8	95.5	0.6	90.7
4	307	26.1	19.6	95.6	1.0	88.6
5	538	32.1	13.2	24.8	60.8	89.7
6	333	38.0	18.0	11.3	81.5	93.9
7	584	27.4	15.2	18.6	62.5	85.2
8	159	23.4	18.2	94.4	2.7	61.7
9	453	29.1	15.7	59.1	30.7	88.6
10	605	25.4	17.4	52.6	26.5	83.3
11	447	20.5	17.2	15.4	23.2	11.3
12	242	23.1	19.4	16.3	8.3	83.5
13	282	29.8	13.1	92.6	2.1	90.6
14	283	23.6	16.8	21.4	12.6	84.1
15	353	29.8	11.0	64.4	25.0	85.1
16	106	34.3	21.7	93.5	0.9	85.7
Total		27.5	16.7			

Source: School District of Philadelphia; "economically disadvantaged" defined as the proportion of students eligible for free or reduced-price lunches. https://webapps.philasd.org/school_profile

DISCUSSION

This study compares two substantially different methods for implementing local screening programs. Each method provided resources for subsequent services and care of children identified with asthma. Each method indicated similarly high levels of prevalence of childhood asthma in the targeted Philadelphia neighborhoods compared to other local, regional, and national assessments (16). Notably, the childhood asthma prevalence identified by these neighborhood screening methods were similar to the prevalence (25.7%) identified by a public school outreach program to six schools in poor and underserved areas of Philadelphia in 2001 (17). Prevalence from the school screening tended to be higher than door-to-door screening most likely due to the differences in age. Door-to-door screening included all ages of 0–18 years, whereas the school screening included only ages of 5–12 years. In the infant and preschool students, children may have several episodes of wheezing before they are given a diagnosis of asthma.

There may be variations in definitions related to asthma screening, and uniformity of definitions for screening might be helpful to reduce variation (1). Within these variations, however, there are estimated ranges of prevalence within each community, and it is evident that some communities have higher risk of childhood asthma prevalence and uncontrolled disease.

Assessment of asthma prevalence at a local level can provide information that is more specific to a community than can be provided by broader national or regional/state assessments (18). Further, approaches that incorporate information from local screenings for specific interventions to get children with asthma to evidence-based care and services may be of benefit (19, 20). Local screening can help program planners develop appropriate and targeted asthma interventions for urban and underserved populations.

Community-level screenings in other studies support our results showing a higher prevalence of pediatric asthma in disadvantaged populations living in urban settings. Crain and colleagues utilized the process of random digit dialing to conduct telephone surveys to administer screening questionnaires that assessed asthma and wheezing prevalence in children younger than 18 years of age in the Bronx, a predominately low-income neighborhood. Those children sampled who reported having a diagnosis of asthma within the past year were twice as high in the Bronx sample (8.6%) when compared with the US sample (4.3%). Overall, the total prevalence of asthma and wheezing within this sample was 12.8% with the highest rate of asthma and wheezing among low-income and ethnic minority groups (21).

McLean and colleagues (22) reported that approximately 40% of New York City's homeless children had asthma, the results of screening 740 children in three shelters. This number was six times higher than the national average for children for that year suggesting a need for asthma screenings targeting this often neglected group of children. Participants also reported frequent

utilization of the emergency department for asthma exacerbations.

The Boston Urban Asthma Coalition utilized an asthma-screening tool to survey 290 adults aged 18 years and above from street corners, grocery stores, and community centers. There was an unexpected higher prevalence of asthma among US-born African Americans than foreign-born African Americans (23). This finding further supports the need for local screening of different population subgroups, in an effort to understand asthma disparities in underserved and disadvantaged communities.

According to the American Thoracic Society, the goal of school-based asthma screenings should be to educate students in self-management and link them to appropriate clinical care (24). In its school-based screening, the Philadelphia MCAN project intended to decrease barriers to screening, maximize screening rates, and facilitate linkages to health care and self-management education. Once cases were identified, families were enrolled in Link Line care coordination activities, which helped to access needs and connect with resources. The Link Line approach has produced significant outcomes regarding decreased hospitalizations and emergency department use in children with asthma enrolled from the emergency room (15).

There are a few limitations in the study. Although the door-to-door screening design attempted to identify the best time of the day to approach families, it is possible that some families were missed in the screening. It was difficult to estimate the response rate due to our inability to identify which houses were vacant. In school-screening methodology, schools were not randomly selected, but were chosen based on factors such as size, location, and relationships developed among MCAN and SDP staff. One-third of caregivers in the schools did not return the screenings and so these families were not included in the screening results and could not be provided with asthma resources. Yet, we screened the majority of the population in 16 schools, which allowed us to reach over 5000 children in disadvantaged neighborhoods. In both screening efforts, response/participation bias may have influenced and spuriously elevated the rate of self-reported asthma found in our surveys.

CONCLUSION

Local asthma prevalence, especially in the high-risk areas, may vary greatly from those estimated by national or regional data, and targeted, community-specific approaches may be needed to assess the burden of childhood asthma. The Philadelphia MCAN project used two methods for local screenings, and, of note, they were internally consistent in identifying prevalence rates of asthma in the targeted neighborhoods that were significantly higher than other reported rates for the city (25). Door-to-door screenings provided the advantage of communicating with parents/caregivers directly and increasing enrollment in services. School-based screenings provided the ability to reach many more children, although a lower percentage of children with positive screens received services. Viewed together,

however, they provide insight into innovative methods for establishing local community prevalence rates and getting children identified with asthma to care and services. These types of approaches, used alone or in combination, provide important information that can be used to develop integration of childhood asthma care and service programs through public health approaches, community resource developments, and policies.

DECLARATION OF INTEREST

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

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