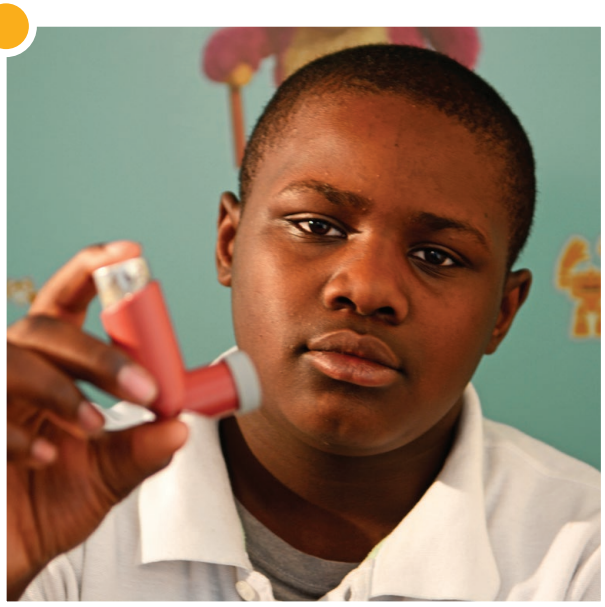
III. HEALTH BARRIERS TO LEARNING

1. UNCONTROLLED ASTHMA

The following section contains: a description of asthma and uncontrolled asthma; prevalence and unmet need for services, with a focus on disparities; and evidence on the learning consequences of uncontrolled asthma.

Definitions

Asthma is a chronic lung disease characterized by inflammation, hyperreactivity, and narrowing of the airways, blocking airflow. Asthma causes recurring periods of wheezing, chest tightness, shortness of breath, and cough. The coughing often occurs at night or early in the morning, and can be highly variable among patients and within patients over time.[28]



Asthma is classified using categories of severity and control. The term 'severity' is used to describe the intensity of the disease in terms of impairment and risk. Those with severe asthma have a high probability of morbidity if asthma is left uncontrolled.[29] The term 'control' is used to describe how well the symptoms of asthma are minimized by therapeutic intervention and the goals of therapy are met. The level of asthma control is categorized as "well controlled," "not well controlled," or "poorly controlled."[30] People with asthma can control their symptoms with appropriate treatment.[31]

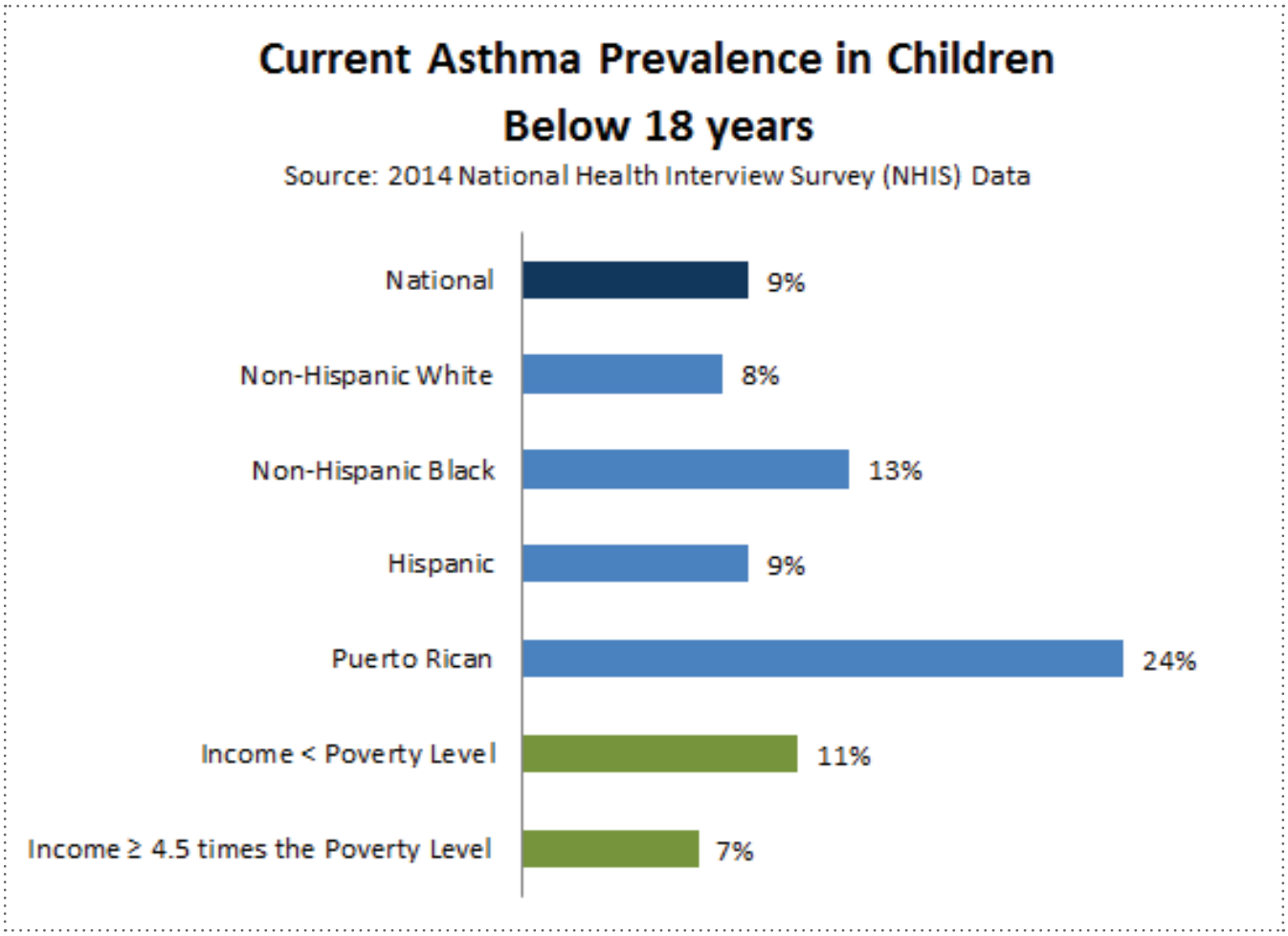
CLASSIFYING ASTHMA CONTROL:
The National Institute of Health has established clear, age-specific criteria to assess asthma control. For example, a child 5-11 years old can only be classified as 'well controlled' if they are having symptoms (including cough and wheezing) less than 2 times each week, are needing their rescue inhaler no more than 2 times each week, and are waking in the night due to cough no more than one time per month. If a child is having symptoms more frequently than this, they require further assessment and likely adjustment of their medication plan.

Source: National Institute of Health. Guidelines for the Diagnosis and Management of Asthma (EPR-3).

Prevalence

There are 2 ways of discussing asthma prevalence—current prevalence and lifetime prevalence. A person is categorized as having current asthma if they say they have been diagnosed with asthma and they still have asthma at the time they were surveyed.[32] Nationally, according to 2014 survey data reported by the CDC, almost 1 in 10 children (9%) under the age of 18 years currently have asthma. Rates are higher in black children (13%) and very high in Puerto Rican children (24%), compared to children who are white (8%) or Hispanic (9%). There are disparities by poverty level as well, with a rate of 11% among children

with family incomes below the poverty threshold versus 7% among children with family incomes at least 4.5 times above the poverty threshold. By age group, the prevalence of children who currently have asthma is: 4% for children 0 to 4 years, 11% in children aged 5 to11 years, and 10% in children aged 12 to 17 years. In total, an estimated 6.3 million children currently have asthma.[33]



A person is categorized as having lifetime asthma if they say they have been diagnosed with asthma at any point in their lives, regardless of whether they still have asthma symptoms or require treatment. Lifetime asthma prevalence among children under 18 is 14%. Prevalence in children varies by race and ethnicity, with higher rates for black (19%) and Puerto Rican (31%), children compared to white children (12%) and Hispanic children (14%). By age group, lifetime asthma prevalence is: 6% in children 0 to 4 years, 16% in children 5 to 14 years, 17% in 15 to 19 years.[34]

Some vulnerable communities have an even higher prevalence of asthma than the national estimates. For example, among children aged 0 to 12 years in Central Harlem, 28.5% have been told by a doctor or nurse that they have asthma, and 30.3% have asthma or asthma-like symptoms *(2001–2003 data).* [35] Two studies in low-income communities in Detroit also found high rates of asthma. One study on preteens (students 10 to 13 years of age) in selected Detroit middle schools in 2003 found that 32% of children surveyed met criteria for probable asthma.[36] In a study of a vulnerable population of children aged 2 to 5 years in Detroit Head Start centers, 27% of children whose parents provided information met the criteria for probable asthma.[37]

THERE ARE TWO MAJOR MEDICATION TYPES USED TO TREAT ASTHMA: relievers and controllers. All patients should have a reliever (also called a rescue or quick relief medication), which is an inhaled medication such as albuterol, that can be used to rapidly mitigate acute symptoms. Controller medications, such as inhaled corticosteroids, can greatly reduce symptoms and airway sensitivity, but generally require daily preventative use for effectiveness. Under-treated patients are those who need but aren't prescribed or aren't using/correctly using an appropriate controller medication. They typically have more frequent symptoms, need/use their reliever more frequently, and require the Emergency Department (ED) and hospitalization more frequently. Frequent use of a rescue medication without the use of a controller medication is associated with increased risk of death from asthma.

Source: National Institute of Health. Guidelines for the Diagnosis and Management of Asthma (EPR-3).

Unmet need for services

Asthma can be controlled with the appropriate treatment.

Indicators of poorly controlled asthma include Emergency Department (ED) visits, hospitalizations, missing school, nighttime awakenings, experiencing asthma symptoms frequently, experiencing asthma attacks, and using medications for quick relief frequently.

Asthma symptoms, nighttime awakenings, and use of medications for quick relief: Among children who currently have asthma, 38% report uncontrolled asthma, based on experiencing any of the following on a frequent basis: asthma symptoms, nighttime awakenings or use of medications to provide quick relief of asthma symptoms.[38] An earlier 2003-2004 four-state study on children with current asthma found that the percentage of black children (26%) and Hispanic children (19%) using quick relief medication was significantly higher than that of white children (12%). The same study found that the percentage of children with current asthma who were using medications for long-term control (which is generally the preferred treatment for keeping asthma under control) was low among all demographic groups: black children (21%), Hispanic children (22%), and white children (33%).[39]

ED visits and hospitalizations: According to a study using national data from 2007 to 2009, asthma related ED visits are 10.7 visits per 100 children with current asthma, with rates for children who are black at 15.2 visits per 100 children and Hispanics at 12.5 visits per 100 children.[40] This study also found that asthma-related hospitalizations are higher for black children than white children (2.2 vs. 1.4 hospitalizations per 100 children with current asthma).[41] An earlier study focused on childhood asthma using 2003 to 2005 national data found that compared with white children, black children have an ED visit rate that is 2.6 times higher, a hospitalization rate that is 2.5 times higher and death rate from asthma that is 5 times higher.[42] Findings were similar in a four-state study using 2003-2004 data on children with current asthma. The percentage of black children with asthma-related ED visits (39%) and asthma-related hospitalizations (12%) were double the rates for white children (18% for ED visits and 5% for hospitalizations).[43]

In some low-income communities, hospitalization rates are higher than the rates for the city. For example, certain neighborhoods in the South Bronx and upper Manhattan have much higher rates of asthma hospitalization than the rest of the city. In Hunts Point and Mott Haven in the Bronx, and in East Harlem, the asthma hospitalization rates are more than double the citywide rate (12.2, 11.4, and 5 per 1,000 children, respectively).[44] In Michigan children living in low-income areas are hospitalized for asthma 2.9 times as often as children living in high income areas. [45]

Asthma attacks: About 48% of children who currently have asthma had asthma attacks in the past year. Rates by race and ethnicity do not appear to vary much and are as follows: black (52%), white (48%), Hispanic (45%) and Puerto Rican (43%).[46]

Missing school: In 2013, 13.8 million missed school days were reported for children aged 5-17 with current asthma. Half of children (49%) with asthma reported one or more asthma related missed school days during 2013. By race and ethnicity, the rates are: 44% for white children, 53% for black children and 57% for Hispanic children.[47]

Impact on learning

Asthma has a negative impact on a child's school readiness and ability to learn once in school by causing missed school days and sleep disturbance that can affect performance in the classroom. What follows is an overview of the evidence examining the link between asthma and learning. The relationship between asthma and learning was extensively reviewed by Charles E. Basch and this summary relies heavily on his published research on this topic[48] and a literature review on asthma and school performance by Taras and Potts-Daterma.[49]

Missed school days/absenteeism

The CDC measures missed school days as 'the number of reported missed school days among children with asthma' and as the 'percentage of children with asthma who reported one or more asthma-related missed school days.' The information is based on the National Health Interview Survey data gathered in response to a parent question of "During the past 12 months, how many days of daycare or preschool, school, or work did your child miss because of his/her asthma?". In 2013, 13.8 million missed school days were reported for children aged 5-17, up from 10.4 million in 2008. Half of children (49%) with asthma reported one or more asthma related missed school days during 2013.[50]

Despite varying definitions of asthma and measurements of absenteeism in the literature, the link between asthma and higher rates of absences is well established.[51] Research by Taras and Potts-Datema reviews literature on the effect of asthma on school attendance or academic achievement. Published peer-reviewed literature from 1989 to 2004 that included school-aged children (5-18 years) was reviewed. Taras and colleagues found of 66 studies, virtually all showed a relationship between asthma and higher absenteeism rates.[52]

Another later study by Moonie et al. (published after the review by Taras and Potts-Datema) included 9000, predominately African American students in grades K-12 in a mid-west urban school district. The study compared general absenteeism (absences for any reason) between children with and without asthma and found that students with asthma were absent 1.5 days more than students without asthma. This study (Moonie et al. 2006) also found that missed school days increased with asthma severity. Children with asthma classified as "mild intermittent" missed on average 8.5 days of school in a year while children with asthma classified as "severe persistent" missed an average of 11.6 days of school in a year. Moonie et al. examined a subset of children who had illness related absences and found that 31% of absences caused by illness were from asthma symptoms. [53]

Sleep disturbance

Negative effects of asthma on learning ability and school attendance can in part be attributed to the impact of asthma on quality and quantity of sleep. Several studies examine the relationship between asthma and disturbed sleep.
A cross sectional survey by Diette et al. (2000) of 438 parents of children with asthma found 40% of asthmatic children had woken up during the night due to their asthma. Parents were also asked about school performance. Compared with children with asthma who did not have night-time awakenings, children who did have night-time awakenings missed more school days and their education suffered more due to asthma.[54]

A study by Stores et al. compared a sample of school aged children with and without asthma to measure the impact of nocturnal asthma symptoms on daytime functioning. In this study, children with asthma had significantly more disturbed sleep (based on measurements of actual sleep time, number of awakenings, number of REM cycles etc.,) and consequently a high rate of reported daytime sleepiness.[55] Another study by Desager et al. sampled 1,234 children between 6-14 years and found that those who experienced nighttime wheezing, a common symptom of asthma, had significantly more disturbed sleep due to waking up during the night and restless sleep.[56] Children with asthma have also been shown to be more likely than children without asthma to nap during the day.[57] One third of children with asthma report at least one nighttime awakening in the past month, although less common in children on controller medications.[58]

Cognition

Asthma is a relapsing disorder; due to high variability in disease control it is difficult to demonstrate the effect of uncontrolled asthma on overall academic achievement. There has been a greater focus on the demonstrating the preventable consequences of uncontrolled asthma on adult work performance, using the term “presenteeism” to describe poor performance while at work due to the direct effects of the disease or the indirect effects from sleep deprivation.[59] Despite the difficulties in investigating the association between asthma and school work, some literature supports a link.

Research conducted by Stores et al. found children with asthma had higher rates of psychological problems and were reported to have more conduct related issues by their parents, compared with children without asthma. Children with asthma also performed less well on some tests of memory and concentration.[60]

The review of literature by Taras and Potts-Datema included 36 studies addressing school performance in children with asthma. Results were mixed with a third of the literature showed lower academic performance in children with asthma. These studies primarily found this link in children with severe and persistent asthma and in children from lower income families.[61] Of interest is a study of kindergarteners that found children with asthma scored lower on school readiness measurements than children without asthma, primarily due to parent reports of asthma related sleep interruption and resulting daytime sleepiness [62].

A second study by the same research group, Halterman et al. (2006), stratified asthmatic kindergarteners by asthma severity and found children with persistent symptoms scored lower on an assessment of task orientation and shy/anxious behaviors than children with intermittent or no symptoms.[63]

Ability to function in the classroom may also be affected by asthma comorbidities. Compared with children without asthma, children with asthma are more likely to experience developmental, emotional, and behavioral problems. A random selection of over 100,000 children under the age of 18 by Blackman and Gurka found those children with asthma had higher rates of ADHD, depression, behavioral disorders, and learning disabilities. This study also found a dose-response relationship; the more severe the asthma, the higher the rate of these problems. [64]

Conclusions

Key points:

- Asthma is prevalent in low-income communities. Black children also suffer disproportionately uncontrolled asthma, based on higher rates of asthma-related ED visits, hospitalizations and use of quick-relief medications.
- Poorly controlled asthma impairs a child's ability to learn by causing absenteeism and disrupted sleep. Studies that found a link between uncontrolled asthma and school performance primarily found this link in children with severe and persistent asthma and in children from lower income families. Some studies have also found that asthma is associated with increased rates of behavioral and developmental problems.
- Asthma management programs and high quality medical care can reduce absenteeism, improve quality of life, and improve functioning in children with asthma.