

An Overview of Asthma - Diagnosis and Treatment

Definition of Asthma:

Asthma is a common chronic disease of children and adults. Nationally, more than 1 in 14 Americans report having asthma and as many as 1 in 8 have had asthma at some point during their lifetime. Each year the number of children, teens, and adults diagnosed with asthma increases. Asthma is associated with missed school days, missed workdays, disrupted sleep, and symptoms that interfere with play and sports.

Asthma is a complex, chronic disease characterized by airway inflammation leading to narrowing of the airways (airway obstruction), airway hyperresponsiveness, acute bronchoconstriction and mucus hypersecretion. It is characterized by various triggers, gradations of severity, and evolving treatment options. Exacerbations can be triggered by exposure to allergens or irritants, respiratory infections and exercise. We know little about the exact causes of asthma or the prevention of asthma. However, we do know how to control the symptoms and inflammation of asthma. Asthma is not currently curable, but it is treatable.

It is imperative that individuals with asthma and their families have total access to culturally appropriate primary and specialty asthma care, culturally appropriate education services, and the necessary medications and devices for effective asthma self-management. More often than not, many individuals and their families confront barriers to access quality care and educational services due to a number of social and economic issues. For other individuals, they may have access to care, but lack the coordination of care that is necessary for daily management of asthma. Improved partnerships and new strategic approaches between government agencies and health plans are vital to improve both access to and coordination of a complete circle of asthma care that will continue to reduce asthma morbidity and mortality.

Public health officials and other asthma experts still have a lot to learn about how asthma impacts Minnesotans and about the opportunities and barriers to improving asthma outcomes and coordinated asthma care delivery within our state. Anyone can develop asthma, although it is most studied in people under age 50. There is a higher chance of developing asthma if you have family members with asthma, but environmental factors certainly aggravate or, in selected situations, potentially cause asthma.

Diagnosing asthma remains a challenge, especially in young children (0-5) and the elderly. The symptoms are variable and, depending on environmental triggers and baseline health risks, may be severe and even can be fatal. Uncontrolled asthma may include wheezing, cough, shortness of breath, or chest tightness. Symptom control does not always correlate with disease control, so objective monitoring of airway obstruction with or without inflammation is important. Likewise, reduced peak flow readings or abnormal spirometry results may be due to conditions other than asthma.

Once diagnosed, it is important for the individual/family to develop a partnership with their health care providers/educators to establish an asthma control strategy that will allow the individual/family to:

- Understand basics about asthma pathophysiology
- Increase awareness of an individual's specific triggers (internal and environmental) and what preventive/avoidance steps to take to minimize exposure to them
- Use the most cost-effective medications to keep asthma under control (adjusted for severity)
- Obtain a written action plan that allows the individual/family (and any others that provide care, e.g., daycare provider) to learn and develop the skills to best manage asthma when it is out of control

Summary of National Institutes of Health Asthma Guidelines:

To assist health care professionals in bridging the gap between current knowledge and practice, the National Asthma Education and Prevention Program (NAEPP) of the National Heart, Lung and Blood Institute (NHLBI), previously convened three Expert Panels to prepare guidelines for the diagnosis and management of asthma. Published in 1991, the Expert Panel Report: Guidelines for the Diagnosis and Management of Asthma (EPR 1991) organized the recommendations for the treatment of asthma around four components of effective asthma management.

Four Components of Effective Asthma Management

- Use of objective measures of lung function to assess the severity of asthma and to monitor the course of therapy.
- Environmental control measures to avoid or eliminate factors that precipitate asthma symptoms or exacerbations.
- Patient education that fosters a partnership among the patient, his or her family, and clinicians.
- Comprehensive pharmacologic therapy for long-term management designed to reverse and prevent the airway inflammation characteristic of asthma as well as pharmacologic therapy to manage asthma symptoms.

**Excerpt from Draft - Expert Panel Report III: Guidelines for the Diagnosis and Management of Asthma*

These four principles formed the foundation for the development of the subsequent NAEPP reports and for the current draft: Guidelines for the Diagnosis and Management of Asthma (EPR – 3) to be released in 2007.¹ This report presents basic recommendations for the diagnosis and management of asthma that will help clinicians and patients make appropriate decisions about asthma care.

Key differences from previous NAEPP versions include but are not limited to:

- Key elements of assessment and monitoring are refined to include the separate, but related concepts of severity, control and responsiveness to treatment. Classifying severity is emphasized for initiating therapy; assessing control is emphasized for monitoring and adjusting therapy
- Asthma severity and control are now defined in terms of two domains:
 - Impairment
 - Risk

- The distinction between the domains of impairment and risk for assessing severity and control emphasizes the need to separately consider asthma’s effects on quality of life and functional capacity on an ongoing basis and the risks it presents for adverse events in the future such as exacerbations and progressive loss of pulmonary function
- Emphasis on the many potential points of care and sites available to provide asthma education, including patient self-management education outside the usual office setting

The complete version of the most recent NHLBI guidelines is available on the web at: <http://www.nhlbi.nih.gov/guidelines/index.htm>

Causes of Asthma:

The primary causes of asthma, and particularly the reasons for the increase in asthma, remain largely unknown. This lack of knowledge is critical: without it, the primary prevention of asthma cannot be undertaken. Funding and coordination of identifying primary causes of asthma is a federal responsibility primarily of the National Institutes of Health. At the state level, emphasis must continue to be placed on assuring public understanding, proper identification, prevention and treatment of those who have asthma.

In considering the causes of asthma, it is useful to distinguish between primary causes, i.e., those that lead to onset of new disease; and factors that exacerbate asthmatic symptoms in those that have asthma. Distinguishing these two may not always be easy. For example, if studies show that people living near congested roadways have a higher prevalence of asthma as indicated by a questionnaire, it could be that some exposure associated with the roadway (e.g., particulate levels) is actually causing new cases of asthma. Alternatively the exposure could be causing an increase in asthma symptoms and thus an increase in the likelihood that people report symptoms on a questionnaire.

The Surgeon General and the Institute of Medicine evaluated the relationship between exposure to environmental factors and asthma. The expert panels comprehensively reviewed the scientific evidence and categorized evidence for each exposure as sufficient, suggestive (“limited”), or insufficient, for both primary causes and factors leading to asthma exacerbation.

The Surgeon General report, *The Health Consequences of Involuntary Exposure to Tobacco Smoke*,² discussed a variety of health effects including asthma. Major conclusions from the Surgeon General’s Report include:

- “The evidence is sufficient to infer a causal relationship between parental smoking and ever having asthma among children of school age”
- “The evidence is suggestive but not sufficient to infer a causal relationship between secondhand smoke exposure from parental smoking and the onset of childhood asthma”
- “The evidence is suggestive but not sufficient to infer a causal relationship between secondhand smoke exposure and adult-onset asthma”
- For adults “The evidence is suggestive but not sufficient to infer a causal relationship between secondhand smoke exposure and a worsening of asthma control”

Reports from the Institute of Medicine in 2000 and 2004 reviewed available evidence regarding the relationship between environmental exposures and asthma in *Clearing the Air: Asthma and Indoor Air Exposures*³ and in *Damp Indoor Spaces and Health*.⁴ The 2000 IOM panel provided the following comments regarding the development of asthma. “Saying that a particular agent may be associated with the development of asthma does not mean it is the sole factor determining whether an individual will manifest the illness. Most scientists believe that some individuals have a prior, underlying predisposition that permits the evolution of clinical asthma. The development of this predisposition to asthma is dependent upon a complex – and at presently poorly understood – combination of factors, which are partially inherited and partially acquired later in life.”

The 2000 report considered the evidence for 27 environmental “exposures” (including biologic, infectious, and chemical agents, as well as generic exposures such as non-residential environments). The IOM panel comprehensively reviewed the scientific evidence and categorized evidence for each exposure as sufficient, suggestive (“limited”), or insufficient, for both primary causes and factors leading to asthma exacerbation. The IOM committee concluded “there is sufficient evidence of a causal relationship between exposure to house dust mite allergen and the development of asthma in susceptible children” and “there is sufficient evidence to conclude there is an association between ETS exposure and the development of asthma in younger children.”

For environmental factors leading to asthma exacerbation, the IOM committee found sufficient evidence for several factors, including house dust mites, cockroaches, rodents, cat dander, fungi, environmental tobacco smoke, high ozone levels, and rhinovirus infections in young children. It also found suggestive evidence for dogs, birds, formaldehyde, fragrances, particulate matter, indoor home dampness, certain non-residential environments, and infections with respiratory syncytial virus, chlamydia, and mycoplasma.

Damp Indoor Spaces and Health found sufficient evidence of an association between asthma symptoms in sensitized asthmatic persons and exposure to damp indoor environments. A similar association was found between the presence of mold or other agents in damp indoor environments and asthma symptoms in sensitized people with asthma. The association was not as strong between the development of asthma and exposure to damp indoor environments (limited or suggestive evidence of an association) or the presence of mold or other agents in damp indoor environments (insufficient evidence to determine whether an association exists).

Although these comprehensive reports are very useful in summarizing what we know about environmental exposures and asthma, they do not shed new light on causes for the apparent increase in asthma that was noted previously. There is no evidence that any of these factors have increased substantially in the last 20 years, and in some cases there is evidence that exposures have been reduced. While the cause for the increase is currently the subject of scientific investigation and debate, there are several theories that are worth discussing.

One theory receiving prominent attention is the “hygiene hypothesis.” According to this hypothesis, when our immune system lacks practice fighting bacteria and viruses, perhaps from an overly sanitary lifestyle, it may overreact – for example with an allergic reaction – to harmless substances like pollen. Thus one potential explanation for the increase in asthma is that

childhood infections, particularly early childhood infections, have decreased as our standard of living has increased.

Studies from formerly East and West Germany appear to support this hypothesis. Shortly after reunification, surveys in the two areas showed that East German children, who lived in a much more polluted outdoor environment, were more likely to have bronchitis and other infections; while West German children, with their cleaner environment, were more likely to have asthma and allergies. However, as conditions have improved in former East Germany, asthma and allergy rates have also risen.

On the other hand, it is not clear how this hypothesis would explain the higher prevalence of asthma in some minority populations. Studies consistently show that asthma prevalence is higher in African American populations than in both Hispanic and non-Hispanic white groups. Studies with children in daycare, where infection rates are known to be higher, have also been inconsistent, although it may be the timing of the daycare exposure that is crucial for development of asthma. At this point in time, the “hygiene hypothesis” should probably be regarded as a promising theory that needs additional clarification.

Another theory that has received widespread attention is that outdoor air pollution is responsible for increasing asthma prevalence. While certain pollutants, particularly ozone and particulate matter, have been demonstrated to exacerbate asthma as measured by an increase in hospitalizations on days that the levels are high, the question of whether outdoor pollutants cause asthma is still under investigation. In most cities in the United States, pollutants that are subject to the National Ambient Air Quality Standards have decreased over the years and air quality has improved. In addition, a 1990 study in Olmsted County showed that asthma rates had increased significantly over the past 20 years even though this county in southeast Minnesota is regarded as having relatively clean air. Another area of concern for outdoor air pollution is diesel exhaust. Recent evidence suggests that diesel exhaust from vehicles idling outside of schools may make asthma worse in school children.

Nonetheless, some have argued that while total particulate levels have decreased, fine particulates, which have not been measured until recently, may be increasing. Fine particulates are those less than 2.5 microns in diameter and are the respirable fraction of total particulates. While most scientists do not believe that particulates are responsible for the significant increase in asthma that has been seen in the past 20 years, their role deserves further investigation in asthma and other associated diseases such as emphysema and Chronic Obstructive Pulmonary Disease (COPD).

¹ National Institutes of Health (NIH), National Heart Lung & Blood Institute (NHLBI), National Asthma Education Prevention Program (NAEPP), *Guidelines for the Diagnosis and Management of Asthma* (EPR 2 1997, NIH Publication No. 97-4051, EPR3 **Draft** 2007 update): <http://www.nhlbi.nih.gov/guidelines/index.htm>

² Department of Health and Human Services. *The Health Consequences of Involuntary Exposure to Tobacco Smoke: A Report of the Surgeon General*. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Coordinating Center for Health Promotion, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2006.

³ Institute of Medicine. *Clearing the Air: Asthma and Indoor Air Exposures*, Washington, DC, Institute of Medicine, National Academy Press, 2000.

⁴ Institute of Medicine. *Damp Indoor Spaces and Health*, Washington, DC, Institute of Medicine, National Academy Press, 2004