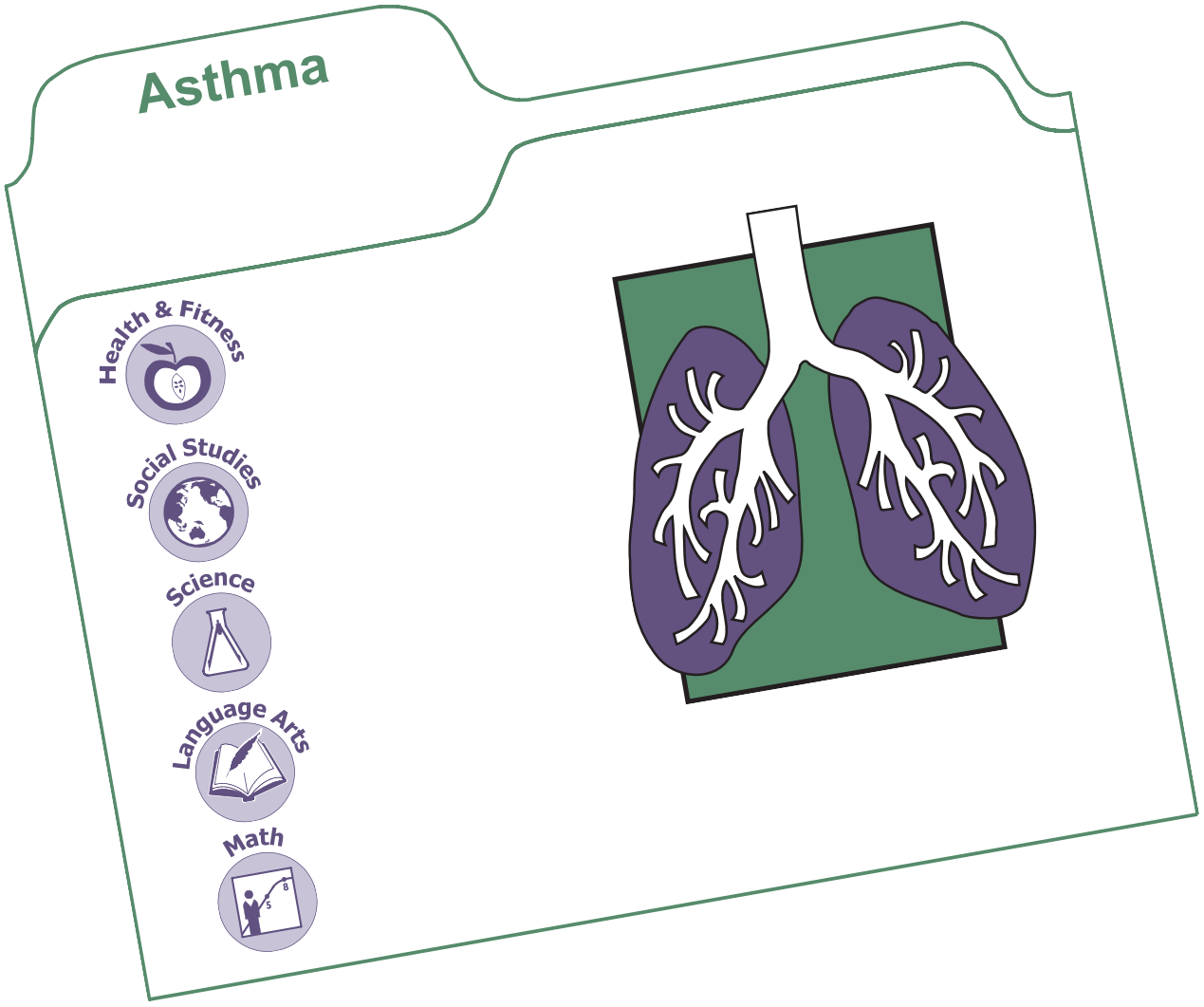
Environmental Health

Fact File



IEHMSP
INTEGRATED ENVIRONMENTAL HEALTH
MIDDLE SCHOOL PROJECT

Asthma

Interdisciplinary Environmental Health Curriculum for Middle School Students

IEHMSP

INTEGRATED ENVIRONMENTAL HEALTH MIDDLE SCHOOL PROJECT

These materials are produced by the NIEHS Center for Ecogenetics & Environmental Health at the University of Washington, Seattle. Funding provided by the Integrated Environmental Health Middle School Project (NIEHS grant ES 10738 and ES 07033). Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the authors and do not necessarily reflect the view of the funding agency.

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Master Copies of Student Handouts

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Introduction to the Environmental Health Fact Files

How to Use the Fact Files

This FACT FILE was created for use by teachers participating in the Integrated Environmental Health Middle School Project (IEHMSP). The IEHMSP is funded by the National Institute of Environmental Health Sciences (NIEHS). The project introduces middle school teachers and students in Washington State and New Mexico to the field of environmental health and facilitates the teaching of environmental health topics across the middle school (grades 6-8) curriculum.

Every FACT FILE produced for the project is designed to make it easy for teachers to team teach a specific environmental health-related topic. Teachers who are interested in teaching an environmental health topic across the curriculum can use these lesson plans and resources to help them integrate environmental health themes into their individual subject areas. By integrating these topics across subject areas, teaching teams demonstrate to students the interdisciplinary nature of the field of environmental health and help break down artificial barriers between subjects. Each lesson plan includes a Student Handout which encourages content-area reading. Many of the Student Handouts include Check Your Understanding Questions to assess your students' reading comprehension skills.

Each FACT FILE provides subject area specific lesson plans to teachers of social studies, science, language arts, math and health and fitness. At least two lessons are provided for each subject. Additional resource materials are also included to help school librarians who are facilitating student research projects. A companion web page is available with annotated links to related web sites (see **"Resources for the Librarian"** section for the website address).

In order to provide students with a foundation of knowledge about the topic, every FACT FILE includes a **Student Introduction** section that introduces the basics of environmental health and shows how the specific topic relates to the field. This page should be given to students before they embark on any of the subject specific lesson plans. It can be used across disciplines and should be distributed by the first teacher in the team to introduce the topic.

Teachers wishing to learn more background information about the topic should use the **"Resources for the Librarian"** section and the associated web page.

The lesson plans included in the FACT FILES are designed to be stand alone units – the only assumption is that the students will have been introduced to the information contained in the **Student Introduction** section. This allows teaching teams to mix and match lessons and present them in any order that is convenient to their particular situation and constraints.

We hope you find these lesson plans useful and that the experience of using environmental health as an integrating context for teaching is a rewarding one. Please feel free to contact us with your questions, comments, and suggestions. Contact information can be found on page 16.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Special Note: Teaching about Asthma

The most important environmental health topics to share with students are those that have a direct impact on them and the things that they have control over in their lives. By being aware of an environmental health issue in their own community, students can become empowered with that knowledge to reduce their personal risks and lessen their opportunities to come in contact with the hazard.

In a classroom of 30 children, about three are likely to have asthma. As one of the most common chronic childhood illnesses, it is likely that many of your students have asthma. With an understanding of the causes, triggers, and treatments of the disease, students can learn how to protect themselves and their family members from this health hazard. The prevalence of this disease makes it an important topic for the middle school curriculum.

Integrating asthma into your curriculum is not only pertinent to children with asthma; educating all of your students about asthma will help them to understand the disease, and to be sensitive and helpful toward their classmates with asthma. When teaching about a health issue such as asthma, it is important to keep in mind that some of the students in your class will be personally impacted by asthma. Middle school students often want nothing more than to fit in with the crowd. Be sensitive to this by avoiding pointing out students in your class that have asthma. Rather, let them bring their experience to the discussion, if they choose to do so.

Students may at first be uncomfortable discussing some of the content covered in the FACT FILE lesson plans, including the anatomy of asthma, use of medications and medical tools, disease and death rates, and the economic cost of asthma. For this reason, in your role as the teacher it is important that you moderate activities with basic classroom rules of respect. Emphasizing mutual respect will create an atmosphere that will allow students to share experiences and ideas on topics that may have impacted them personally.

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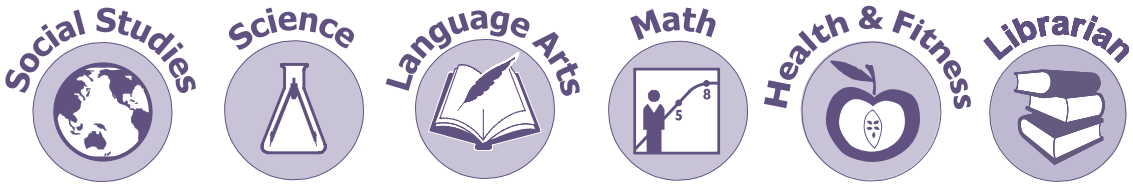
Key to Symbols

Each FACT FILE contains six sections. Icons clearly indicate the SUBJECT AREA for which the lesson plan was created.

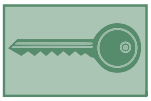


This icon indicates points in the lesson plan that provide good **Opportunities for Student Assessment.**

This icon indicates a handout that should be **Copied and Distributed to Students**.

Student Handout

This icon indicates a **Teacher's Answer Key for a Student Handout**.



Teacher Key

This icon indicates content that relates to the core environmental health concept of **Exposure.**

This icon indicates content that relates to the core environmental health concept of **Toxicity**

This icon indicates content that relates to the core environmental health concept of **Dose/Response**.

This icon indicates content that relates to the core environmental health concept of **Individual Susceptibility**.

This icon indicates content that relates to the core environmental health concept of **Risks and Benefits**.

This icon indicates content that relates to **Environmental Justice**.

This icon indicates content that relates to **Community Resources and Action.**

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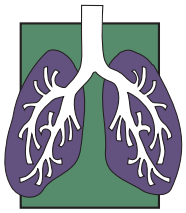
Lessons at a Glance



Student Introduction: ENVIRONMENTAL HEALTH AND ASTHMA

The **Student Introduction** provides students with the background knowledge they need about environmental health and asthma before proceeding with any of the discipline-specific lessons in this curriculum. The **Student Introduction** should be presented by the first teacher in the team to introduce the topic. The reading is divided into three sections each of which is accompanied by **Check Your Understanding** questions that can be used to assess student comprehension of the material. Enrichment activities are also provided for a more in-depth investigation of environmental health and asthma.

Suggested Grade Levels: 6 – 8
Curriculum Connections: Environmental health, asthma, human biology

Social Studies Lesson One: ARSENIC, CROCODILE DUNG AND CHICKEN SOUP – The History of Asthma Treatments around the World

Lesson Overview: Students read a passage about the history of asthma treatments throughout the world. They then answer questions about the reading to check their understanding and create a timeline based on the reading.

Suggested Grade Levels: Grades 6-7
Curriculum Connections: World history, timelines, medical history
***EALRs:** History 1.1.2a, 2.1.2, and 2.2.2; Social Studies Skills 1.1.2e and 3.1.3e

Social Studies Lesson Two: THE GEOGRAPHY OF ASTHMA

Lesson Overview: Students read a short description of a study of asthma rates in the United States. They then answer questions about the reading to check their understanding and do a mapping exercise based on the data set from the study.

Suggested Grade Levels: Grades 7-8
Curriculum Connections: Population studies, American geography, mapping, interpreting statistics
EALRs: Geography 1.1.2b and 1.2.2a; Social Studies Skills 1.1.2e

***EALRs:** Washington State Essential Academic Learning Requirements

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Science Lesson One: WHAT IS ASTHMA?

Lesson Overview: This lesson helps students understand asthma as a chronic disease of the respiratory system. Students participate in a simple simulation of what it is like to have reduced lung capacity from asthma. Then, students mix up a batch of homemade mucus similar to the mucus that floods the lungs during an asthma episode. Students also work in small groups to build a working model of the respiratory system using everyday items.

Suggested Grade Levels: Grades 6-8
Curriculum Connections: Human body, biology, respiratory system, exploring models
EALRs: Science Human Biology 1.2, Science Environmental and Resource Issues 1.3, and Science Modeling 2.1

Science Lesson Two: HEALTHY BUILDINGS – Asthma and Indoor Air Pollution

Lesson Overview: This lesson examines the links between asthma and indoor air pollution. Students first create a map of a room in their home or at school. Students plot both potential asthma triggers and air quality helpers on the map. Then, students conduct an experiment where they swipe different surfaces around school and grow mold on bread or potato slices.

Suggested Grade Levels: Grade 6-7
Curriculum Connections: Indoor air pollution, environmental science, asthma triggers, mold, mapping, conducting investigations
EALRs: Science Environmental and Resource Issues 1.3, and Science Designing and Conducting Investigations 2.1

Science Lesson Three: FIRE AND SMOKE

Lesson Overview: This lesson explores smoke as an outdoor air pollution problem that can trigger asthma episodes. Students explore several demonstrations that illustrate the link between particulate matter created by incomplete burning of fuel and how temperature inversions can worsen air pollution problems. Students also read about the link between wood smoke, agricultural field burning, wildland fires and asthma.

Suggested Grade Levels: Grade 7-8
Curriculum Connections: Outdoor air pollution, combustion, weather patterns, environmental science, asthma triggers, exploring models
EALRs: Science Environmental and Resource Issues 1.3 and Science Modeling 2.1

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Language Arts Lesson One: ATHLETES WITH ASTHMA – Biography Boxes

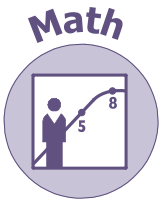
Lesson Overview: In this lesson, students are encouraged to research the lives of professional athletes who have asthma. Students then design cereal boxes similar to the WHEATIES® cereal boxes that feature athletes. Each biography box includes a cover illustration featuring the athlete, a description of asthma and a short biography of the athlete.

Suggested Grade Levels: Grades 7-8
Curriculum Connections: Biographies, research, publishing
EALRs: Writing 2.3 and 3.5; Reading 3.1

Language Arts Lesson Two: READING ABOUT ASTHMA

Lesson Overview: Students choose from a list of young adult literature that features a main character with asthma. Students then write a book report and reflect on how the character's asthma impacted his or her life and how the character dealt with the asthma.

Suggested Grades: Grades 6-8
Curriculum Connections: Book reports, writing about literature, media studies
EALRs: Reading 3.3 and 4.3; Writing 2.3



Math Lesson One: ASTHMA DIARIES

Lesson Overview: This lesson uses an asthma diary as a source of information on peak flow readings. Students take the information from the diary and create a line graph to display the information. They also interpret the information to answer questions about the individual's health.

Suggested Grades: Grades 6-7
Curriculum Connections: Percentages, line graphs, interpreting graphs
EALRs: Math 1.1, 1.4 and 4.3

Math Lesson Two: THE COST OF CHILDHOOD ASTHMA

Lesson Overview: In this lesson, students examine data from a research study on the costs of childhood asthma. Students interpret information from a data chart and statistics, including calculating percentages. Students also investigate how statistics can be used to express different points of view.

Suggested Grades: Grades 7-8
Curriculum Connections: Percentages, statistics, economics, populations
EALRs: Math 1.1, 1.4 and 5.3

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Health and Fitness Lessons:

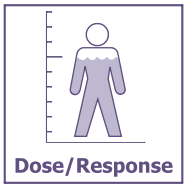
Lesson Overview: This lesson provides lessons, activity ideas, and resources for Health and Fitness teachers to integrate the topic of asthma into their curriculum.

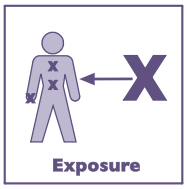
Suggested Grades: Grades 6-8
Curriculum Connections: Diseases and disorders, growth and development, air pollution, tobacco, physical fitness, community health, social and emotional health.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

IEHMSP Student Learning Outcomes

The Student Learning Outcomes are provided to give you a sense of the overall learning goals of the IEHMSP. By teaching the EH Fact File: Asthma, your students will meet some of the overall learning outcomes for the project. These learning outcomes are aligned to the Washington State Essential Academic Learning Requirements (EALRs).





1. **Students will understand the relationship between human health and the environment.**

   - Students will understand that the inherent properties of a substance (toxicity) and overall amount of that substance that gains entry into the body (dose/response) are critical factors in determining whether the substance has an effect either positive or negative on health.

     EALRs: Science 1.2 and 1.3; Heath & Fitness 3.1

   - Students will understand that duration, frequency and routes of exposure are critical factors in determining whether a substance has an effect either positive or negative on health. Students will be able to describe the three ways in which a chemical can enter the human body: by inhalation (breathing), ingestion (swallowing), and dermal absorption (contact with skin). Students will also be able to identify which body systems (respiratory, nervous system, etc.) are impacted.

     EALRs: Science 1.2 and 1.3; Health & Fitness 3.1

   - Students will understand how individual factors (for example genetics, age, gender, and body size) can affect the overall impact of environmental exposures on health.

     EALRs: Science 1.2 and 1.3; Health & Fitness 2.3, 3.1 and 4.1

2. **Students will investigate the roles that individuals, communities and governments play in decisions that can affect human health.**

   - Students will understand that we make decisions by weighing the risks and the benefits of a particular action. A student's ability to critically ask the right questions (such as 'what is the route of exposure?', 'what is the dose?' and 'are there specific individual susceptibilities to consider?') and assess these factors is fundamental.

     EALRs: Health & Fitness 3.1, 3.2 and 4.1

   - Students will acquire the skills to reduce their environmental health risks at home, school, work, and in the community.

     EALRs: Math 5.2 and 5.3; Health & Fitness 2.3, 3.1 and 4.1

   - Students will recognize that some groups of people are exposed to more environmental pollution than others are, and may suffer higher rates of health problems. These groups often have less economic and political impact on the development of public policy and decision-making.

     EALRs: Health & Fitness 3.1; Civics 4.1 and 4.3; Geography 3.1 and 3.3

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

- Students will understand that it is important to consider ethical, legal and social implications of environmental health research and community health issues.

  EALRs: Science 3.2; Health & Fitness 3.1 and 3.3; History 3.3

- Students will recognize that different groups of people have different beliefs and opinions about environmental health issues depending upon their interests (economic, cultural, spiritual, etc.).

  EALRs: History 1.3 and 3.3; Geography 3.1, 3.2 and 3.3

- Students will be able to effectively research an environmental health issue by gathering information and data from government agencies, community groups, businesses, scientists and scientific articles, and individual citizens with relevant knowledge.

  EALRs: Math 4.1 and 5.2; Health & Fitness 3.1 and 4.1; Geography 3.1.2a; History 2.1; Social Study Skills 1.1 and 3.1; Reading 3.1

- Students will be able to describe the information or data that already exists about an issue and identify what data or information still needs to be collected in order to address the problem.

  EALRs: Science 2.1; Math 4.1, 4.2, 4.3 and 5.3; History 2.1; Social Study Skills 1.1 and 3.1; Reading 3.1

- Students will identify appropriate local civic forums (community council, newspapers, etc.) that they may approach to address issues, present findings and seek change.

  EALRs: Civics 4.2; Social Study Skills 2.1; Communications 2.1, 2.2, 2.3, 2.4, 2.5 and 3.3

- Students will understand that problem solving and decision-making occurs at the personal, local, state, national and international level.

  EALRs: Civics 4.1 and 4.2

- Students will be able to clearly and effectively communicate their findings to their peers and other audiences (teachers, parents, community members, etc.).

  EALRs: Math 4.2, 4.3 and 5.3; Social Study Skills 1.1; Communications 2.1, 2.2, 2.3, 2.4 and 2.5; Writing 2.1, 2.2 and 2.3

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Connecting to the Washington State Essential Academic Learning Requirements (EALRs)

Environmental Health Fact File: ASTHMA	**Introduction:** Introduction to Environmental Health	**SS Lesson 1:** The History of Asthma Treatments	**SS Lesson 2**: The Geography of Asthma	**Science Lesson 1:** What is Asthma?	**Science Lesson 2**: Asthma and Indoor Air Pollution	**Science Lesson 3**: Fire and Smoke	**LA Lesson 1**: Athletes with Asthma-Biography Boxes	**LA Lesson 2**: Reading about Asthma	**Math Lesson 1**: Asthma Diaries	**Math Lesson 2**: The Cost of Childhood Asthma
Social Studies- History										
1.1.2a Group events and individuals by historical eras and develop timelines.		X								
1.3 Examine the influence of culture on U.S., world and Washington State history.		X								
2.1 Investigate and research. Locate and obtain sources of information.			X				X			
2.1.2 Explain the origin and historical context of major ideas.		X								
2.2.2 Interpret how changing technologies have shaped ideas and attitudes.		X								
3.3 Understand how ideas and technological developments influence people, resources and culture.		X								
Social Studies-Geography										
1.1.2b Use data and a variety of symbols and colors to create maps and graphs.			X		X					
1.2.2a Locate physical and human features and events on maps and globes.			X							
3.1.2b Explain how the actions and interactions of human societies affect and are affected by the environment.	X					X				
3.2 Analyze how the environment affects people.	X		X		X	X				
Social Studies-Economics										
1.1.2a Provide examples of how groups and individuals face economic choices.										X

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Social Studies- Skills										
1.1.2e Take notes, paraphrase, summarize and enter data.		X	X							
1.1.2f Create a product that uses social studies content to support findings; present product in appropriate manner.			X					X		
3.1.3d Analyze and evaluate the impact of ideas, events, and/or people on groups, environments, economic systems, and/or subsequent events.		X	X							X
3.1.3e Group human and natural events into broadly defined eras and construct related timelines.		X								
Science										
1.2 Identify human life functions and organ systems (Human Biology).	X	X		X					X	
1.3 Explain how human societies' use of natural resources affects quality of life and the health of ecosystems (Environmental & Resource Issues).	X			X	X	X				X
2.1 Communicate scientific procedures, investigations, and explanations in a variety of formats (Communication).					X					
2.1 Develop abilities necessary to do scientific inquiry (Explanations).					X					
2.1 Design, conduct and evaluate investigations (Investigations).					X					
2.1 Correlate and test models (Modeling).				X		X				
2.2 Identify and examine common, everyday challenges or problems in which science/technology can be or has been used to design solutions.	X									X

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Health and Fitness										
2.2 Describe health care practices that result in early detection, treatment and monitoring of non-communicable diseases.		X					X		X	
2.3 Anticipate risky situations and demonstrate behavior to reduce risks.	X					X	X			
3.1 Understand how environmental factors affect one's health.	X	X			X	X		X	X	X
3.2 Gather and analyze health information. Identify ways people make healthy and unhealthy decisions.	X	X	X	X	X	X	X	X	X	X
3.2 Distinguish between safe and unsafe use of health-care products.		X								
4.1 Identify workplace health and safety issues.	X						X			
Reading										
1.1 Use word recognition and word meaning skills to read and comprehend text.	X	X	X	X	X	X		X	X	X
1.3 Build vocabulary through reading.	X	X	X	X	X	X		X	X	X
2.1 Comprehend important ideas and details. Demonstrate comprehension.	X	X	X	X	X	X		X	X	X
3.1 Read to learn new information.	X		X	X	X	X	X	X	X	X
3.4 Read for literary experience in a variety of forms.								X		
4.2 Develop interests and share reading experiences.							X	X		
Writing										
1.2 Use style appropriate to the audience.		X					X	X		
1.3 Write clearly and effectively. Apply writing conventions.	X	X					X	X		
2.1 Write in a variety of forms for different audiences and purposes.		X					X	X		

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Writing (con't)										
2.3 Write in a variety of forms. Write research reports.							X	X		
3.5 Publish. Produce a final product.		X					X	X		
Communication										
3.2 Work cooperatively as a member of a group. Contribute to group.				X	X					
Math										
1.1 Demonstrate understanding of integers, fractions, decimals, percents, place value of decimals and properties of the rational number system (Number and Numeration).			X	X					X	X
1.4 Identify how statistics can be used to support different points of view (Statistics).			X							X
1.4 Understand and make inferences (Prediction and Inference).									X	X
4.1 Gather information. Read, listen, and observe to access and extract mathematical information.			X						X	X
4.3 Represent and share information using both everyday and mathematical language (Represent and Share Information).			X						X	
5.2 Use mathematical thinking and modeling in other disciplines.			X							
5.3 Relate mathematical concepts and procedures to real-life situations.			X							X

About the IEHMSP

The Center for Ecogenetics and Environmental Health (CEEH) at the University of Washington and the New Mexico Center for Environmental Health Sciences at the University of New Mexico, received funding from the National Institute of Environmental Health Sciences (NIEHS) for a collaborative seven-year project. The Integrated Environmental Health Middle School Project (IEHMSP) trains middle school teachers in environmental health, giving them the expertise to help students identify and research environmental health issues in their communities. The IEHMSP is part of a national Environmental Health Sciences as an Integrating Context (EHSIC) program funded by the NIEHS. The IEHMSP involves teachers from a variety of subjects, as well as school librarians and technology coordinators. Students and teachers from several school districts in Washington and from several schools in New Mexico are participating in the project.

Participants complete a training workshop and are given a set of detailed materials and resources to help them integrate environmental health topics into their teaching. Web-based teaching modules are also being developed to help teachers introduce environmental health to their students. All materials are being developed and evaluated with regional and cultural diversity in mind.

About the Sponsoring Centers

The University of Washington (UW) **NIEHS Center for Ecogenetics and Environmental Health** strives to understand and communicate how genetic factors influence human susceptibility to environmental health risks. Center researchers study the biochemical and molecular mechanisms underlying human variability in response to environmental exposures. The Center's more than 50 core investigators hold appointments in 15 departments within the UW Schools of Medicine, Public Health and Community Medicine, Law, and Pharmacy as well as the Fred Hutchinson Cancer Research Center. The Center's organizational structure encourages collaboration among these distinguished scientists.

For more information, go to: http://depts.washington.edu/ceeh/

The New Mexico Center for Environmental Health Sciences is an NIEHS funded center at the University of New Mexico (UNM) Health Sciences Center and Lovelace Respiratory Research Institute. The Center addresses the needs and concerns of Southwestern communities relating to environmental health issues and conducts basic and transnational research on regionally-relevant environmental public health issues. Many New Mexico and Tribal communities in the Southwest have historically borne a disproportionate share of exposure to a wide variety of environmental toxicants in the air, water and soil, and recent evidence raises concerns that members of many communities are suffering adverse health effects from environmental exposures. The theme of this NIEHS Center is "Environmental Disease and Health Promotion in Susceptible Southwestern Populations."

For more information, go to: http://hsc.unm.edu/pharmacy/iehms

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Authors and Reviewers

Primary Authors:
Kristen Clapper Bergsman, Center for Ecogenetics & Environmental Health
Jon Sharpe, Center for Ecogenetics & Environmental Health

Layout and Design:
Diane Tchakirides, Graphic Designer

Content Contributors:
Kris Freeman, Information Specialist
Kate Reed, Graduate Research Assistant

Scientific Content Reviewers:
Thomas M. Burbacher, PhD, COEP Director,
Center for Ecogenetics & Environmental Health

David L. Eaton, PhD,
Director, Center for Ecogenetics & Environmental Health

Jane Q. Koenig, PhD, Professor,
Department of Environmental and Occupational Health Sciences; Director, Northwest Center for Particulate Air Pollution and Health

Teacher Reviewers:
Terri Harpster, Social Studies Teacher, Explorer Middle School, Mukilteo, WA

Gayle Millard, Math Teacher, Harbour Pointe Middle School, Mukilteo, WA

Margaret Morgan, Science Teacher, Horizon Middle School, Ferndale, WA

Shanna Nelson, Science Teacher, Harbour Pointe Middle School, Mukilteo, WA

Emily Russin, Language Arts and Social Studies Teacher, Horizon Middle School, Ferndale, WA

Brenda Thorsen, School Nurse at Harbour Pointe Middle School and Horizon Elementary, Mukilteo, WA

IEHMSP Staff:
Katie Frevert, Program Manager

Lyle Rudensey, Resource Teacher

Chetana Acharya, COEP Manager

Kristen Bergsman, Curriculum Developer

Jon Sharpe, Curriculum Specialist

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How to Contact Us

As the organizers of the IEHMSP, we are here to serve as resources for students and teachers involved in the project. Please feel free to contact us with any questions, concerns or comments you have about this Fact File.

IEHMSP Staff:

Katie Frevert, Program Manager
(206) 616-7557, kfrevert@u.washington.edu

Lyle Rudensey, Resource Teacher
(206) 616-7557, lylecroc@u.washington.edu

Kristen Bergsman, Curriculum Developer
(206) 685-5378, crowtalk@u.washington.edu

IEHMSP Mailing Address:

CEEH-COEP
4225 Roosevelt Way NE, Suite 100
Seattle, WA 98105

IEHMSP Web Site: http://depts.washington.edu/iehmsp/

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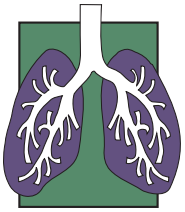

Student Introduction: ENVIRONMENTAL HEALTH AND ASTHMA

Introduction Overview

The **Student Introduction: Environmental Health and Asthma** provides students with the background knowledge they need about environmental health and asthma before proceeding with any of the discipline-specific lessons in this curriculum. The **Student Introduction** should be presented by the first teacher in the team to introduce the topic. The reading is divided into three sections that are accompanied by **Check Your Understanding** questions that can be used to assess student understanding of the material. Enrichment activities are also provided for a more in-depth investigation of environmental health and asthma.

Suggested Grade Levels: 6-8
Topics: Environmental health, asthma and human biology

Procedure

The **Student Introduction** is divided into three sections along with **Check Your Understanding** questions. You can assign the entire reading and the questions, or assign one section at a time. The questions will help guide students' reading and will help you to evaluate student understanding of the material. The **Teacher Key** provides sample answers to all of the questions.

You may want to assign the **Student Introduction** as homework or as an in-class reading. Additionally, students can work in small groups to read aloud and discuss the questions. Alternatively, you may ask for student volunteers to each read aloud a short section of the reading to the entire class. You may want to approach the **Check Your Understanding** questions as a written assignment or a class discussion. Students may be able to check their own work after the class discusses the answers.

A PowerPoint presentation is available for introducing key environmental health concepts to your students. The PowerPoint presentation can be presented along with the student reading. You can download the presentation at: http://depts.washington.edu/iehmsp/.

If you have time, you may want to involve students in one or more short activities related to the **Student Introduction**. A list of suggested activities is provided below. These activities will help your students deepen their general understanding of asthma and environmental health before you proceed to the subject-specific lesson plans.

Student Assessment

Student work can be assessed in the following ways, for a total of 100%.

25%	Did students read the **Student Introduction: Environmental Health and Asthma**?
50%	Did students correctly answer the **Check Your Understanding Questions**?
25%	Did students view the **PowerPoint Presentation: What is Environmental Health?**

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Extension Activities

Environmental Health Collage: Create a collage of environmental hazards and environmental health-related jobs.

Classroom Speaker: Ask an environmental health professional from your community to visit your class to talk about his or her job. Also consider asking your school nurse or a public health nurse from your local health department to speak to your class about asthma.

Hazards in Your Community: Make a list of possible environmental hazards in your community. Discuss what you can do to protect yourself from the hazards. Explore how you might be able to reduce or eliminate the hazards.

Life-size Mural: Draw a life-size respiratory system mural. Draw and label the parts that are affected during an asthma episode. Write a sentence about each part explaining its function.

Card Games: Create a deck of cards with "true or false" questions related to asthma. Use the cards to play a simulated version of "Hollywood Squares." You can also create cards with answers on them and play a round of "Jeopardy," where students must provide the correct question to go along with the answer on the card.

Asthma Awareness: Create asthma awareness posters to post around your school during Allergy and Asthma Awareness Month (May) or plan specific activities for World Asthma Day.

Asthma and Sports: Create an informational brochure on asthma and sports to give to the coaches and student athletes at your school.

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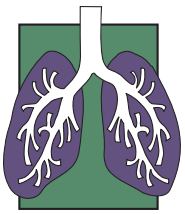
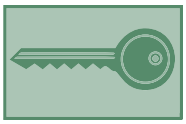


Student Introduction: ENVIRONMENTAL HEALTH AND ASTHMA



Teacher Key

What is Environmental Health?

Your health depends on the environment around you. **Environmental health** is the study of how the environment affects human health. It differs from the study of how humans affect the environment, because it focuses on people's health. An environmental scientist might study how water pollution is hurting fish. An environmental health scientist would study what happens to the health of people when they catch and eat those fish. Environmental health is not just about the health of the environment – it always comes back to you and whether the environment you are part of is helping you stay healthy, or making you sick.

Environmental Health: How the environment affects human health.

Hazard: Something that can harm the health of humans or the environment.

Chemical: Any substance that is made from elements combined into molecules.

Every day, you come in contact with things in your environment that can help you or hurt you. Some of these things are important for keeping you healthy, such as oxygen or medications. However, some of these things may be harmful to your health, such as tobacco smoke or snake venom. Things in the environment that are harmful are called **hazards** and include things like **chemicals,** disease-causing bacteria, loud noises and even stress. Hazards can be natural or human-made.

People working in the fields of environmental health do many different jobs. They work to identify environmental hazards, and prevent people from being harmed by them. Some are scientists working in laboratories. Some work for the government writing regulations and studying pollution. Some work for corporations to help make sure that workplaces are safe and that the environment is kept as clean as possible. Most of these jobs require a solid understanding of science and math, knowledge about history and the law, and good communication skills.

To understand the field of environmental health, you need to understand seven core concepts: **Toxicity, Exposure, Dose/Response, Individual Susceptibility, Risks & Benefits, Environmental Justice, and Community Resources & Action**.

Toxicity: A measure of how dangerous a chemical is.

Toxicity

Most people working in environmental health-related jobs have taken classes in the science of **toxicology**. Toxicology is the study of how environmental hazards, such as natural and human-made chemicals, can enter our bodies and make us sick.

Toxicology: The study of the harmful effects of chemicals on living things.

When scientists study different chemicals in the environment to see if they might be dangerous to humans, they are trying to understand the **toxicity** of those chemicals. Toxicity is a measure of how dangerous a chemical is. The greater a chemical's toxicity, the less it takes to make a person sick or even kill them. The Environmental Protection Agency, for example, uses the following scale to rate the toxicity of products commonly used in the home.

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Toxicity Rating	Word and symbols that appear on product's label	Approximate amount need to kill an average size adult
1 – Highly Toxic	DANGER or POISON 	A few drops to one teaspoon
2 – Moderately Toxic	WARNING 	One teaspoon to one ounce
3 – Slightly Toxic	CAUTION	More than one ounce
4 – Not Toxic	none	

A bottle of bleach, for example, will have the word DANGER on the label, because it is highly toxic if ingested (toxicity rating = 1). Borax powdered cleaner, however, is rated as slightly toxic (toxicity rating = 3) and will have the word CAUTION on the label. This is just one example of a system used to measure the toxicity of hazards.

Source of Exposure:
A hazard's point of origin, such as cars, industry, or a volcanic eruption.

Environmental Pathways:
How a hazard travels from its source to humans. These include air, water, food, and soil.

Exposure:
The total amount of a chemical that comes into direct contact with the body.

Inhalation:
Breathing. When chemicals enter the body through this route of exposure, they can get stuck in the lungs and/or be taken up into the bloodstream.

Ingestion:
Swallowing (usually by eating or drinking). When chemicals enter the body through this route of exposure, they can easily be taken up into the bloodstream.

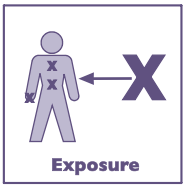
Dermal Absorption:
Absorbing a chemical through any part of the skin, including the eyes. When chemicals come in contact with the skin, they can sometimes enter the bloodstream through this route of exposure. However, for many chemicals the skin provides good protection of your body.

Routes of Exposure:
The ways in which a chemical can enter the human body. The three main routes of exposure are inhalation, ingestion, and dermal absorption.

Dose:
The total amount of a chemical that gets into a human or other living thing, relative to the individual's body weight.

Duration of Exposure:
The length of time you are in direct contact with a hazard.

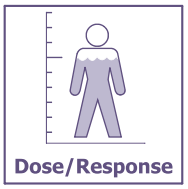
Frequency of Exposure:
How often you are in direct contact with a hazard.



Exposure

We all know what it means to be "exposed" to something like a cold or a flu. Everyday our bodies are exposed to all sorts of environmental hazards, such as bacteria, viruses, and the sun's ultra-violet (UV) rays. Some of these hazards exist naturally and some of them are the result of human activities. There are many possible **sources** of hazards, such as cars, industry, even volcanic eruptions. In order for us to be exposed, however, the hazard has to get from the source to us. To do this, it travels along an **environmental pathway.** Pathways include the air we breathe, the water we drink, the food we eat, and even the soil we work in, play in, and use to grow much of our food.

Environmental health scientists use the term **exposure** to describe the total amount of a hazard that comes in direct contact with your body. Once you have come into contact with a hazard, it can get into your body through different routes. You can breathe it in (**inhalation**). You can eat or drink it (**ingestion**). You can get it directly on your skin or in your eyes (**dermal absorption**). You can also get it directly into your body through an injection. Inhalation, ingestion, and dermal absorption are the three main **routes of exposure**. Things that help us stay healthy, like vitamins, nutrients, and medications, enter the body through these routes of exposure, but hazards can use these same routes to enter the body and make us sick.



Dose/Response

Imagine that someone has been exposed to a hazardous chemical through one of the three possible routes of exposure. They have now received a **dose** of that chemical. Dose is the amount of the hazard that actually enters your body. The amount someone gets into their body (their dose) depends on many factors, including how long you are exposed, how often you are exposed, and how big or small you are. For instance, if someone is exposed over a long period of time to a hazard, their dose will be larger. For example, 30 minutes spent under the bright summer sun would give you a much smaller dose of UV rays than 4 hours spent under the sun. This is called the **duration of exposure**. The **frequency of exposure** can also influence the dose. If someone works in a factory and is exposed to a chemical every day at work, their dose might be larger than someone who is only exposed once.

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Dose can also depend on how big or small you are. When a doctor prescribes a medication for you, he or she calculates the amount of the medicine you should have based on your body size. The doctor can then give you the correct dose of the medicine for your body weight. While a teaspoon of medicine might be right for an adult, it may be far too large of a dose for an infant.

The dose you receive can influence how your body responds to a hazard. For most hazards, the larger the dose, the more extreme the **response** will be. The smaller the dose, the more mild the response will be. Drinking one can of a caffeinated soda might be fine. Drinking three cans in a row may make you jittery. Drinking five cans of soda might make you feel light-headed and sick.

Response:
The reaction to an exposure or dose of a hazard. A response can be anywhere from mild (e.g. headaches, a rash) to severe (e.g. brain damage, cancer).

Individual Susceptibility

Some people are more likely than others to get sick when they are exposed to environmental hazards. This might be because of their **genetics**, body size, age, gender or general health. This is called their **individual susceptibility**.

Genetics:
Information that is contained in the genes (DNA) of a person's cells. Genetic information is passed down from parents to their children.

Individual Susceptibility:
Differences in the ways that individuals react after exposure to the same amount of a hazardous chemical. Differences in susceptibility can be caused by differences in body size, age, genetics, gender and general health.

For example, some people are more likely than others to get sick when they are exposed to certain kinds of pesticides, just because of their genes. We all know that genes help determine things like hair color and eye color, but they also lead to some important (and invisible) differences in the way bodies work. It turns out that some people have a more extreme response to certain pesticides because of their genes. These people are said to be more "individually susceptible" to pesticide poisoning. Someone who lives or works on a farm where pesticides are sprayed might want to know how susceptible he or she is in order to avoid exposure and stay healthy.

Risks and Benefits

We live in an industrial society that depends on the use of both natural and human-made chemicals to function. The use of these chemicals results in **benefits** to society as well as **risks**. Pesticides, for example, make it easier to grow fruit. Unfortunately, in some cases, pesticides can make people sick. Most of us have heard that we can reduce the risk of getting sick without giving up the health benefits that fruit offers by washing or peeling the fruit before we eat it.

Benefit:
Something that results in increased well-being or good health.

Risk:
The likelihood that a harmful consequence will occur as a result of exposure to a hazard.

Scientific researchers and government officials measure the risks and benefits that we face when we manufacture or use certain products. They work to explain what they have learned to the public and create safety standards that help people protect themselves from unnecessary risk. Their goal is simple – to help us enjoy the greatest benefits from the products that we manufacture, while exposing ourselves to the least possible risk. By understanding the risks and benefits that we face each day, we can make decisions that reduce our risk and keep us as safe and healthy as possible.

Environmental Justice

Everyone has the right to live in an environment that does not make them sick, regardless of their race, culture, or income. This is called **environmental justice** (EJ).

Environmental Justice:
The fair treatment of people regarding the development of environmental laws, regulations and policies.

Unfortunately, some neighborhoods or communities are exposed to more environmental hazards than others, and may suffer higher rates of health problems. These communities often have less economic or political power in society when decisions are made. For

example, toxic waste dumps, polluting factories, and busy highways are often built in lower-income neighborhoods or communities of color. Communities recognize this as an environmental health issue and work to seek environmental justice.

Community Resources and Action:
An individual's ability to access resources and act on new information in order to create positive change in their own community.

Community Resources and Action

Where can you go in your own community to collect information about an environmental health issue? You can learn more about specific issues, understand environmental laws or seek environmental justice by using community resources. Community resources include places like the library and city hall. You could search the Internet for local, state, or federal agencies that can give you information about your issue. You can also talk to environmental health scientists at local universities or health departments, and ask your teachers and family members what they know about the issue.

Once you have gathered your resources and studied the issue carefully, it is time to take action! First, ask yourself what you as an individual can do to help solve the problem. If you are concerned about air pollution, for example, you might decide to walk to school instead of getting a ride in a car. Next, ask yourself how you can share what you have learned with others so that they can help too. Maybe you could write a letter to the editor of your local newspaper or speak to your community council or school board. Maybe you could create a flyer to hand out in your neighborhood. There are many great ways to get the word out and make positive changes in the world – use your imagination and be creative!

Check Your Understanding

1. Name one product that can be found in your home that might be considered to be highly or moderately toxic. ***Answers will vary, but may include bleach, ammonia, furniture polish, nail polish remover, weed killer, rat poison, motor oil, antifreeze, etc.***

2. List the three routes of exposure. For each one, give an example of an environmental hazard to which you could be exposed through that route. ***Inhalation (e.g. tobacco smoke), ingestion (e.g. drug overdose), dermal absorption (e.g. acid).***

3. Explain how the concept of "exposure" is different from the concept of "dose." ***Exposure is a measurement of how much of a hazard your body comes in contact with, while dose is a measurement of how much of the hazard actually enters your body.***

4. Pick four vocabulary words from the margin on the previous pages and use each one in a complete sentence. ***Answers will vary.***

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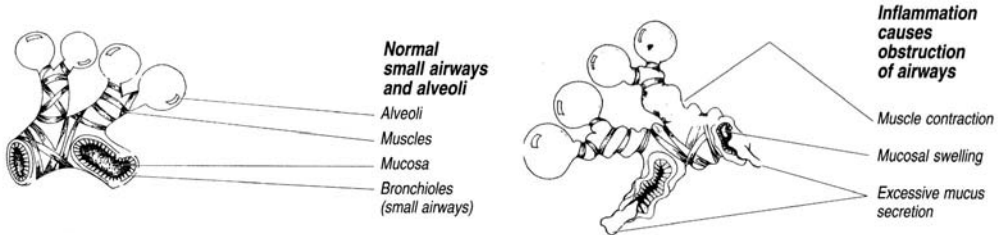
What is asthma?

Asthma is a condition that causes the airways of your lungs to become inflamed and obstructed making it hard to breathe. The airways also flood with thick mucus. Asthma can make you wheeze, cough, and have difficulty breathing. When this happens, it is called an asthma **episode** or **attack**. If not properly treated, it can be fatal. Each year, approximately 500,000 Americans are hospitalized because of asthma, and 5,000 Americans die from the disease.



How do people get asthma? You cannot catch asthma from someone like a cold. It is not **contagious**. Asthma is usually caused by a combination of genetics and environment.

You may have asthma because it was passed to you through your genes. You cannot inherit asthma itself, but you can inherit a tendency to develop asthma. Then, if you come in contact with certain things in the environment, you may develop asthma.

Sometimes an **allergy** may cause an asthma episode. Allergies to pollen, furry or feathered pets, dust mites, mold or foods like peanuts may cause an asthma episode.

Another way the environment may contribute to your asthma is by irritating your **respiratory system**. These **irritants** may cause you to get asthma, or if you already have asthma, they may cause an asthma episode to occur. These irritants include dust, car exhaust, strong perfumes, household chemicals, tobacco smoke, and cold air.

There are two types of medications that people with asthma may use to control their asthma. Many people take daily long-term control medications that help prevent an asthma episode from occurring. This type of medication is taken daily and helps keep airways from becoming swollen or tight. When an asthma episode is occurring, many people use quick-acting or rescue medicine to stop the episode from becoming worse. The quick-acting medicine relaxes the muscles in the lungs to help the person breathe easier. Asthma medications may be taken as pills, or through the use of inhalers, spacers or nebulizers (tools used to deliver the medicine deep into the lungs). You or someone you know may use an inhaler. If an asthma episode is severe and does not get better after taking rescue medicine, a trip to the emergency room for more powerful drugs might be necessary.

Some people get the symptoms of asthma when they are very young, less than a year old, and others do not have the signs and symptoms of asthma for many years. There is no cure for asthma, but it is treatable. With proper education and medication, people can control their asthma and live active, healthy lives.

Asthma:
A condition that causes the airways of the lungs to become inflamed, constricted and filled with mucus, making it hard to breathe.

Asthma Episode/Attack:
A flare-up of asthma symptoms that may include wheezing, coughing, shortness of breath, or difficulty breathing.

Contagious:
An infection or disease that can be passed from one person to another, such as a cold.

Allergy:
People who have allergies get sick due to the presence of a certain kind of antibody around things that do not make most people sick. Things that cause allergies are called **allergens**. Common allergens include pollen from plants, furry animals, and tiny dust mites.

Respiratory System:
The system of organs involved in breathing. This includes the nose, mouth, throat, bronchial tubes, and lungs.

Irritant:
A chemical that can aggravate the skin, eyes, or respiratory system.

Some important facts about asthma:

- Fifteen million people in the U.S. now have asthma — that is twice as many as were reported having asthma twenty years ago.
- One out of every fourteen Americans has asthma. That means that a friend or relative of yours probably has asthma. You might have asthma.
- 4.9 million or 9.2% of school-age children in the U.S. have asthma.

Source: Epidemiology and Statistics Unit. Trends in Asthma Morbidity and Mortality. NYC: ALA, April 2004.

Check Your Understanding

1. Your friend is having an asthma episode. What symptoms might he have? ***Wheezing, coughing, shortness of breath, or difficulty breathing.***

2. When might someone use an asthma inhaler? Why? ***An inhaler is a tool used to deliver quick-acting or rescue medicine that is needed when an asthma episode is beginning. The quick-acting medicine works to relax the muscles in the lungs that become tight during an asthma episode.***

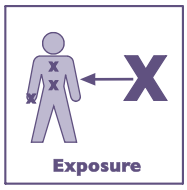
What does asthma have to do with environmental health?

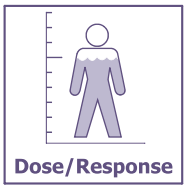
Even though genetics plays an important role in causing someone to develop asthma, it is not the only cause. Things in the environment can cause someone to get asthma, or lead to an asthma episode for someone who already has the disease. Environmental causes of asthma include dust mites and tobacco smoke.

Trigger:
A substance (e.g. pollen, pets, dust) or condition (e.g. having a cold) that causes an asthma episode.

Something in the environment that causes an asthma episode is called a **trigger**.
Four common triggers include:

- Viral infections (cold or flu)
- Allergies (pollen, furry or feathered pets, dust mites or mold)
- Irritants (cold air, tobacco smoke, household chemicals, perfumes, dust, or car exhaust)
- Exercise





Let's answer a few basic environmental health questions about asthma.

- *What is the main **route of exposure** for most asthma triggers?*
  Asthma is a condition that affects the respiratory system, so you will not be surprised to learn that people with asthma are usually exposed to triggers when they breathe them in. This means that the main route of exposure for substances that trigger asthma is inhalation.

- *What does **dose** have to do with asthma?* People who have asthma learn to limit the dose they get of the things that trigger their symptoms. For instance, people whose asthma is triggered by being around cats learn to avoid cats. They also know that being around one cat for five minutes will not cause as bad a response as being around ten cats for fifty minutes. The bigger the dose and the longer the exposure, the worse they feel. Dose is also important for the medication used

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to control asthma. If the dose is too small, it may not control the asthma. If the dose is too large, the medicine itself can be dangerous.

- *What does **individual susceptibility** have to do with asthma?* Genetics are what makes each of us unique. No two people (except identical twins) have the exact same genetic code. Some individuals are more likely than others to develop asthma because of their genes. These people are more susceptible to allergies and react more strongly to the irritants that trigger asthma. Kids are more likely to develop asthma than adults are. This means that kids are more susceptible to asthma than adults.

- *What environments put people with asthma at **risk**?* Children whose parents smoke are more likely to develop asthma. Children who live in cities with air pollution problems are more likely to develop asthma. Air pollution can make people who have asthma feel even worse. Adults who are exposed to certain irritants (like chemical fumes or dust) at work are more likely to develop asthma. All of these things are called asthma "risk factors."

- *What does **environmental justice** have to do with asthma?* People of color and people from low income households may be exposed to higher than average levels of air pollution. This may be because they live in cities with outdoor air pollution problems or houses with indoor air pollution problems. These increased exposures to air pollution can make people of color and low income people have an increased risk for having asthma.

Check Your Understanding

1. How are allergies related to asthma? ***A person's asthma triggers may be things that they are allergic to, such as pets, pollen or mold. If a person is allergic, that means that their body is sensitive to the substance. Breathing in the substance may trigger an asthma episode.***

2. How can a person with asthma control their exposure to asthma triggers? ***A person with asthma learns to avoid completely or limit the time they are around a trigger to limit their exposure.***

3. If your friend, who you know has asthma, begins to show signs of an asthma episode, what would you do? ***Answers will vary, but may include: ask an adult for help, move away from any asthma triggers and encourage him or her to use his/her inhaler.***

4. Pick four vocabulary words from the margin on the previous pages and use each one in a complete sentence. ***Answers will vary.***

Student Assessment:
Have students answer these questions individually or in pairs.

Lesson One: ARSENIC, CROCODILE DUNG AND CHICKEN SOUP

Lesson Overview

The History of Asthma Treatments around the World

Students read a passage about the history of asthma treatments from pre-history to modern times. They then answer questions about the reading to check their understanding and create a timeline based on the reading. Extension activities are also included for additional classroom work or homework assignments.

Suggested Grade Levels: 6 & 7
Curriculum Connections: World History, timelines, medical history.

EALRs Addressed

This lesson addresses the following Washington State Essential Academic Learning Requirements (EALRs). The benchmarks listed are for grade 8 in social studies.
In this lesson, the student is asked to:

- Group events and individuals by broadly defined historical eras and develop related timelines. (History 1.1.2a).
- Explain the origin and historical context of major ideas and their impact on societies. (History 2.1.2).
- Interpret how changing technologies have shaped ideas and attitudes, and analyze the impact of ideas and technological developments on society and culture. (History 2.2.2).
- Take notes, paraphrase, summarize, enter data. (Social Studies Skills 1.1.2e).
- Group human and natural events into broadly defined eras and construct related timelines. (Social Studies Skills 3.1.3e)

Teacher Background

To prepare to teach this lesson, read or review the handout entitled, **Student Introduction: Environmental Health and Asthma**. Next, read the materials in this lesson. That should give you all the information you will need to teach the lesson. For a more in-depth understanding of the history of asthma treatment, consult the following resources that were used to prepare this lesson:

- "History of Asthma," chapter 2 in Asthma, edited by P.J. Barnes, M.M Grunstein, A.R. Leff, and A.J. Woolcock, (1997).
- Interactive History of Medicine Timeline
  http://www.schoolscience.co.uk/content/4/biology/abpi/history/index.html
- The Breath of Life online exhibit examines the history of asthma and the experiences of people with asthma.
  http://www.nlm.nih.gov/hmd/breath/breathhome.html

Teacher Preparation

- **Materials:** Copies of **Student Handout #1**; scissors, colored pencils or pens; and rulers.
- If you are the first teacher in your team to use this FACT FILE, make copies of the student handout entitled, **Student Introduction: Environmental Health and Asthma**. Ensure that students have read the handout and mastered the content and vocabulary.

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Procedure

- Tell students that just like other aspects of culture, people's attitudes about health and medicine change over time. In this lesson, they will look at one particular disease (asthma) and see how treatments for that disease have varied throughout history and between cultures.
- Distribute **Student Handout #1** for this lesson.
- The reading, entitled **Arsenic, Crocodile Dung, and Chicken Soup: The History of Asthma Treatments Around the World**, is divided into four major sections (Introduction and Ancient History, the Middle Ages, the Renaissance, and the Modern Era). Each section is followed by short questions to help the students check their understanding of what they have read. The reading can be done in class in small groups, or individually as homework. One or more sections can be assigned at a time.
- The timeline activity should be assigned once the reading has been completed and the follow-up questions have been reviewed in class. It can be done in pairs. Provide students with whatever art materials are available (scissors, colored pencils, pens, rulers, etc.) and have them complete the activity and share their products with the class.

Student Assessment

Student work can be assessed in the following ways, for a total of 100%.

20%	Did students read the **Student Handout #1** and correctly answer the **Check Your Understanding** questions?
80%	Did students create **timelines** that include the required elements? • 10% drawing timeline to **scale**. • 10% Labeling **B.C.** and **A.D.** and including a title. • 25% **Correct placement** of each event/person in chronological order including the date of each event or person's lifespan. • 30% Brief description of **importance** of each event or person's relation to the history of asthma treatments. • 5% **Neatness** and **color**.

Extension Activities

Student Assessment:
The extension activities provide for more in-depth assessment of student understanding.

These activities will allow your students to learn more about some of the people, events, places and periods from the reading.

Diary Entry
- Choose one of the periods of history mentioned in the reading. Imagine that you are a person living at that time who suffers from asthma. Write a diary entry for a day when you go visit a doctor to get help with your asthma. Include as many historical details as possible.

Historical Drawing
- Choose one of the periods of history mentioned in the reading. Do a drawing of a patient being treated for asthma. Use details from the reading as well as research on clothing, architecture, etc. from the period to make your drawing as realistic and interesting as you can.

Biography
- Write a short biography of that person one of the people mentioned in the reading.

Monologue
- Dress up as one of the people mentioned in the reading. Deliver a monologue that explains the rationale for the recommended treatment for asthma during that time period. Consider how the culture of the time period influenced the treatment options.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

THE HISTORY OF ASTHMA TREATMENTS
Student Handout #1

Teacher Key

Arsenic, Crocodile Dung, and Chicken Soup: The History of Asthma Treatments around the World

Introduction

What do arsenic, crocodile dung, and chicken soup have in common? They have all been used at various times and in various places to treat **asthma**. Unfortunately, asthma is nothing new. People throughout history and around the world have suffered from this disease. Asthma symptoms, like wheezing, coughing, and difficulty breathing, can be quite dramatic and even scary. As a result, healers long ago recognized the importance of treating this disease. Asthma is described in some of the oldest medical books ever written.

Asthma: A disease of the lungs that usually results in difficulty breathing and can be life-threatening.

In the past, doctors came up with all sorts of things to try and make those suffering from asthma feel better, but only a few of these treatments actually worked. Many doctors actually hurt patients instead of helping them. Chinese doctors were the exception. Five thousand years ago, Chinese doctors successfully treated asthma sufferers using a powerful herb. Doctors still use chemicals extracted from that herb in medicines today.

The Ancient World

Prehistoric humans (before 3000 BC) left no written records, so we do not know very much about how they treated injury and disease, including asthma. From bones found at archeological sites, however, we know that they treated some illnesses by drilling holes in the skull of the sick person. This process is called **trepanation**. It is possible that severe asthma would have been treated this way, but without more evidence, medical historians cannot be sure.

Trepanation: Drilling a hole through the skull as a treatment for illness.

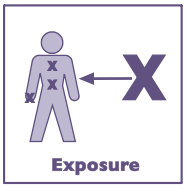
Ephedrine: A chemical derived from the herb Ma Huang that has been used successfully in the treatment of asthma.

Hieroglyphics: An ancient Egyptian system of writing that used picture symbols.

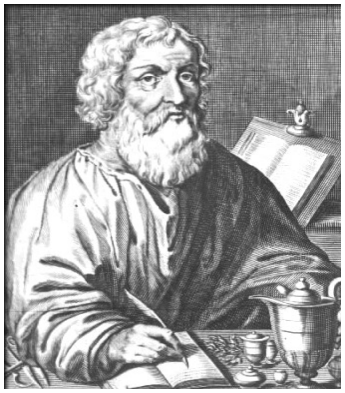
Respiratory System: The system of organs involved in breathing, including the nose, mouth, throat, bronchial tubes, and lungs.

According to early written records, doctors in Ancient China used an herb that helped people with asthma and other ailments. It is called Ma Huang and it was in use as early as 3,000 BC. In the 1900s, scientists isolated the chemical component of Ma Huang that helped treat asthma. They called it **ephedrine**. This "new discovery," known for thousands of years in China, proved a popular and effective treatment for asthma for a long time and is still used in certain medications today. Most over-the-counter medications used to treat the symptoms of the common cold contain chemicals very similar to ephedrine.

In Ancient Egypt, records of daily life were recorded in **hieroglyphics** on paper made out of the leaves of the papyrus plant. Some of these records are medical texts. One particular text from around 1500 BC describes treatments for diseases of the **respiratory system**, which would have included asthma. One treatment required the asthma sufferer to swallow a mixture of figs, grapes, beer, frankincense, and even camel or crocodile dung! The text also describes a treatment in which an extract made



from a plant called henbane was heated on a brick. The asthma patient would then inhale the rising vapors.



Hippocrates

The people of Ancient Greece were the first to use the word asthma to describe difficult or painful breathing. The word asthma actually means shortness of breath in Greek. Many Greeks believed that the gods were responsible for disease and that only the gods could cure a sick person. One Greek philosopher named Hippocrates, however, had a different idea. He lived from about 460 to 377 BC and is considered to be the father of Western medicine. He wrote that the body is made up of four "humors," substances like phlegm and bile that have to be kept in perfect balance for a person to stay healthy. He does not seem to have discovered any effective asthma remedies, but he was the first person to suspect that asthma might be an inherited disease. We now know that he was right – the **genes** we inherit from our parents definitely play an important role in making us susceptible to asthma.

Genes:
Genes are pieces of DNA that are found in every cell of the body. They are inherited from our parents and help determine our individual traits.

The doctors of Ancient Rome (509 BC to 476 AD) adopted many of the medical beliefs of the Ancient Greeks and further developed them. They also were the first culture to recognize the connection between dirt and disease. In order to help people stay healthy, they built sewers to deal with waste, bathhouses to help people stay clean, and aqueducts to supply cities with clean drinking water. Unfortunately, they did not make much progress in treating asthma. Medical texts from the period recommend treating asthma with a variety of things, including vinegar, millipedes, and ground up fox lungs.

Student Assessment:
Have students answer these questions individually or in pairs.

Check Your Understanding - Ancient World

1. What is Ma Huang?
An herb used by Ancient Chinese doctors as long ago as 3,000 BC to treat asthma.

2. What two routes of exposure did the Egyptians use to get medicine into the patient's body?
Ingestion and inhalation.

3. What did Hippocrates correctly suppose was one of the causes of asthma?
Heredity or genetics.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Woodcut showing a woman being bled from the arm

After the Roman Empire fell in 476 AD, the period known as the Middle Ages began in Europe. During this period, much of the medical knowledge of the Greeks and Romans was lost or forgotten. People lived in poorer and dirtier conditions than before. They were less healthy and lived shorter lives. Asthma was treated with complicated potions containing exotic ingredients like animal bones, pearls, and goose dung.

Although the European part of the Roman Empire collapsed in 476 AD, the eastern half survived for a thousand years. It was called the Byzantine Empire (476 to 1453 AD) and much of the knowledge of Ancient Greece and Ancient Rome was preserved there. Paulus Aegineta was a Byzantine doctor who lived from about 625 to 690 AD. He wrote a medical encylopedia that included treatments for asthma. One recommendation was to "bleed" the patient. In this treatment, a doctor would cut open a vein in a patient's arm and let it bleed. The idea was that bleeding would take whatever was making the patient sick out of the their body. Instead, it just made patients weak, tired, and even sicker. **Bleeding** was used as a treatment as late as the 1800s, even though it hurt people rather than helped them. Byzantine doctors also recommended blistering a patient's skin with strong chemicals. The blisters were supposed to pull bad substances out of the patient's body.

Bleeding:
Intentional cutting of a vein as a medical treatment.

During the Middle Ages, Arab physicians had many supposed cures for asthma, including the use of arsenic as a treatment. Arsenic is a powerful poison and would have just made asthma sufferers feel worse. One Jewish doctor who was the court physician to an Egyptian king, however, had different ideas. Maimonides, who lived from 1135 to 1204 AD, acknowledged that he had no magic cure for the disease. Instead, he suggested the patient move to a dry climate, avoid polluted city environments and eat certain foods, including chicken soup! Maimonides was one of the first doctors to document that asthma may be related to the environment.

Check Your Understanding - Middle Ages

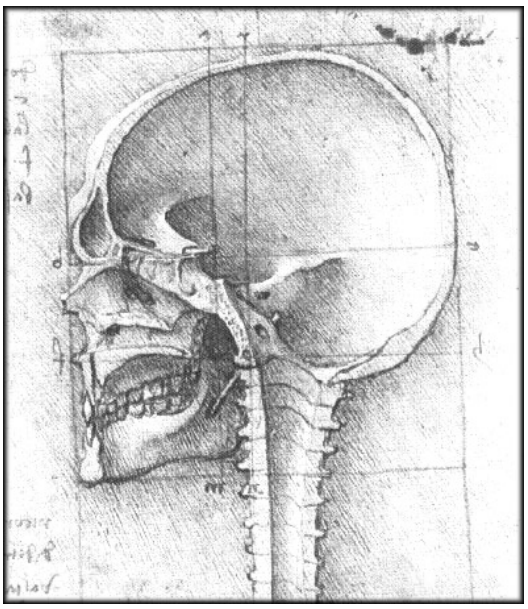
1. After the fall of the Roman Empire, what changes happened in Europe that affected human health? ***Much of the medical knowledge of the Greeks and Romans was lost and people lived in poorer and dirtier conditions.***

2. Why did Byzantine doctors "bleed" patients? ***They believed that by bleeding the patient they would get rid of whatever was making the person sick.***

3. Who recommended a change of climate and chicken soup as treatments for asthma? ***Maimonides.***

Student Assessment:
Have students answer these questions individually or in pairs.

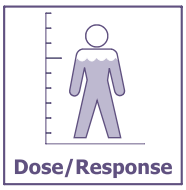
The Renaissance



A drawing of the skull by Leondardo da Vinci

The period following the Middle Ages is called the Renaissance. It began in Italy about 1350 and lasted until about 1600. An important part of the Renaissance was the rediscovery of Greek and Roman knowledge about all sorts of things, including science and medicine. Scientists of the Renaissance also began to dissect human corpses for the first time. Great thinkers like Leonardo da Vinci (1452-1519) drew detailed pictures of human **anatomy**. This helped them better understand how human bodies worked.

Anatomy:
The structure of a plant or animal.



One Renaissance doctor with a very long name was so convinced that old ideas about medicine were wrong, that he publicly burned certain ancient medical books to make his point. Philippus Aureolus Theophrastus Bombastus von Hohenheim, better known as Paracelsus, lived from 1493 to 1541. He believed that medicine should be based on experiments, observation and reason. He was the first person to document that any substance could be poisonous if the dose were high enough. Even salt is deadly if you eat too much! Because of his writing on this topic, he is considered the founder of the study of poisons, or **toxicology**. Dose is still a very important concept to understand, whether treating a headache or asthma.

Toxicology:
The study of the harmful effects of chemicals on living things.

One asthma patient during the Renaissance was so famous, that his case got a lot of attention from the doctors of the period. The Archbishop John Hamilton, a very rich and important church leader in Scotland, was very sick with asthma. One doctor thought that the archbishop's problem was that he was too cold. He told the archbishop to avoid fresh air and sit next to a fire of peat or coal at all times. Peat and coal fires are very smoky and probably made the Archbishop's asthma much worse. Cold air can worsen asthma, so the doctor may have made a correct diagnosis but suggested a misguided treatment.

Allergies:
People who have allergies get sick around things that do not make most people sick. Things that cause allergies are called **allergens**. Common allergens include tobacco smoke, pollen from plants, furry animals, and tiny dust mites.

Another doctor, Gerolamo Cardano, was called in to help. Cardano lived from 1501 to 1576, and was Europe's most famous physician. Cardano decided that the Archbishop was sick because he was too hot. He told the Archbishop to go out into fresh air again and stay away from smoky fires. The doctor also told the Archbishop not to sleep on a feather mattress because it would make him too hot. The Archbishop got better. The fact that Cardano's approach worked was mostly accidental. The doctor did not understand about **allergies** or realize that the Archbishop might be allergic to feathers or hurt by breathing in coal smoke.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Check Your Understanding - Renaissance

1. What did Renaissance scientists do that helped them better understand human anatomy?
They dissected human corpses and drew detailed pictures of human anatomy.

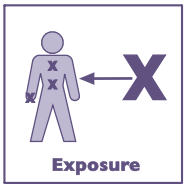
2. Paracelsus is considered the founder of what field of scientific study?
Toxicology, or the study of poisons.

3. How did Gerolamo Cardano help his asthma patient, John Hamilton, get better?
He told him to stay away from smoky fires and get more fresh air. He also told him not to sleep on a feather mattress.

Student Assessment:
Have students answer these questions individually or in pairs.

The Modern Era

During the 18th and 19th century, the Industrial Revolution and new ideas about government changed the world dramatically. Ideas about asthma also changed. An English doctor named John Floyer (1649-1734) had a very good reason to study asthma – he suffered from the disease himself. He studied the disease carefully and made an accurate list of the things that could cause asthma or make it worse. His list included heredity, exercise, air pollution, tobacco smoke, some occupations, and infections. However, even though Dr. Floyer understood the things that caused asthma, he did not know how to cure it. He told patients to put strong chemicals on their skin to make blisters. He also told them to take a lot of cold baths.



Spirometer

During this period, doctors began to better understand how the respiratory system worked. They also invented new tools to help diagnose asthma. The stethoscope, invented by a French doctor in 1816 named R.T.H. Laennec, made it possible to hear what the lungs sounded like during an asthma episode. In 1844, a British surgeon named John Hutchinson (1811-1861) invented a machine called a **spirometer**. This machine measures the maximum amount of air the lungs can inhale and exhale and is an important tool for identifying problems with lung function, such as asthma.

Spirometer:
An instrument for measuring the volume of air entering and leaving the lungs.

Although diagnosis was improving, however, treatments for asthma during the 1800s were still ineffective and even harmful. Doctors often told people with asthma to drink alcohol, smoke tobacco, or eat garlic. They also prescribed dangerous poisons like mercury. Bleeding was still popular too; either by applying live leeches to the skin or by cutting open a vein.

Fortunately, 20th century Western scientists made many new discoveries that helped find better treatments for asthma. In the 1930s, doctors proved that asthma and allergies were connected, leading to a better understanding of what triggers asthma episodes. Scientists also discovered many new and effective drugs to replace the old treatments. Chemicals were discovered that reduced asthma episodes by relaxing the muscles in the **bronchial tubes**, making it easier to breathe. These chemicals are called bronchodilators. The **inhaler** was also invented, making it easier for someone suffering from an asthma episode to get the medicine they need, when they need it.

Bronchial tubes:
Part of the respiratory system - the windpipe divides into two main bronchial tubes, one for each lung.

Inhaler:
An inhaler is a device that gives your lungs a puff of medication in a measured dose. The medication is quickly absorbed into the bloodstream through the lungs.

As we begin the 21st century, there is bad news and good news. The number of people with asthma is greater than ever, and we now know that air pollution is a big part of the problem. We also know that low-income people and certain minorities are more likely to get asthma. That is the bad news. Fortunately, doctors and scientists have developed simple ways for people to avoid these triggers. New asthma medicines are now available, and people with asthma are living healthier lives.

Student Assessment:
Have students answer these questions individually or in pairs.

Check Your Understanding - Modern Era

1. What six things were included on John Floyer's list of the causes of asthma?
Heredity, exercise, air pollution, tobacco smoke, some occupations, and infections.

2. Name two medical tools invented in the 1800s that helped scientists better understand how the respiratory system works.
The stethoscope and the spirometer.

3. How do the chemicals called bronchodilators help people with asthma feel better?
They relax the muscles in the bronchial tubes, making it easier to breathe.

Timeline Activity

Using what you now know about the history of asthma treatment, construct a timeline to help you understand the order in which the events mentioned in the reading took place.

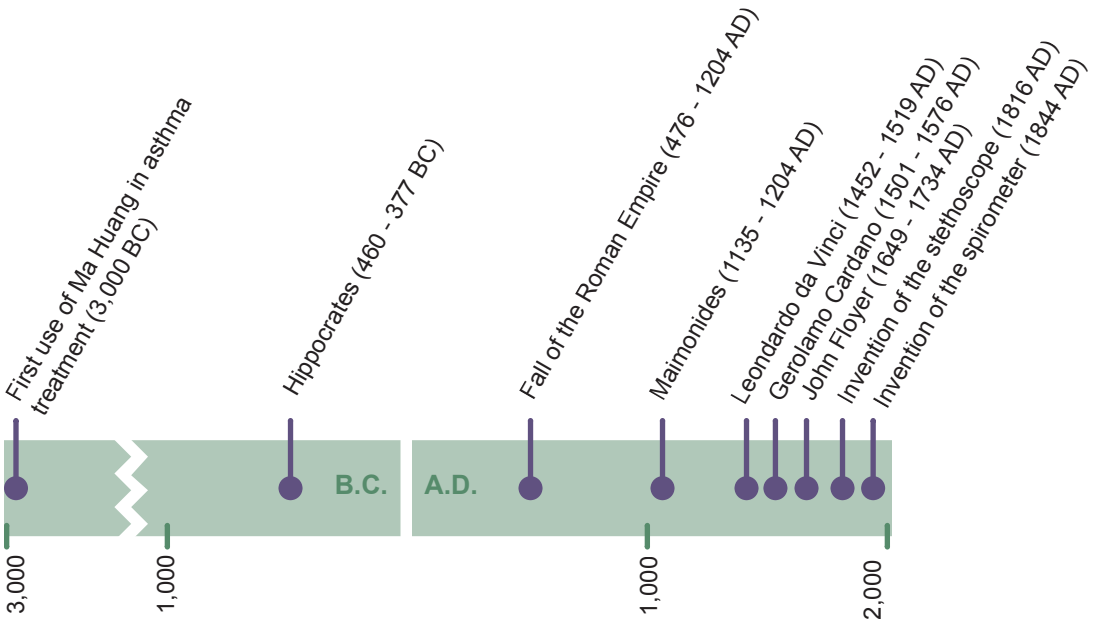
Include the events listed below on your timeline. In the space below the timeline, describe briefly how each event or person relates to the history of asthma treatment. Be sure to include BC and AD on your timeline and the correct dates for each event or for each person's lifespan. Also, be sure to give your timeline a title.

- First use of Ma Huang
- Hippocrates
- Fall of the Roman Empire
- Maimonides
- Leondardo da Vinci
- Gerolamo Cardano
- John Floyer
- Invention of the stethoscope
- Invention of the spirometer

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Asthma Treatments Through History

Timeline Activity



First use of Ma Huang in asthma treatment (3,000 BC). Ephedrine, a component of the herb, is still used in medicines today.

Hippocrates (460 – 377 BC). He was the first person to document that asthma might be an inherited disease.

Fall of the Roman Empire (476 AD). Much of the medical knowledge of the ancient world was lost after the fall of the Roman Empire and people lived in poorer and less healthy conditions.

Maimonides (1135 – 1204 AD). Maimonides, a Jewish doctor, treated asthma with climate change and chicken soup.

Leondardo da Vinci (1452 – 1519 AD). Da Vinci, like other great thinkers of the Renaissance, drew detailed pictures of human anatomy that helped them better understand how human bodies worked.

Gerolamo Cardano (1501 – 1576 AD). Cardano, a very famous physician in Europe, discovered that fresh air and staying away from a feather mattress helped his asthma patient.

John Floyer (1649 – 1734 AD). John Floyer was a doctor who also suffered from asthma. He made an accurate list of things that could cause asthma or make it worse.

Invention of the stethoscope (1816 AD). Invented by a French doctor, the stethoscope helped doctors better understand how the respiratory system worked. It also helped them better diagnose asthma.

Invention of the spirometer (1844 AD). Invented by the British doctor John Hutchinson, the spirometer becomes an important tool for diagnosing asthma.

Student Assessment:
Did the students' timelines include the required elements?

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Lesson Two: THE GEOGRAPHY OF ASTHMA

Lesson Overview

Students read a short description of a study of asthma rates in the United States. They then answer questions about the reading to check their understanding and complete a mapping exercise based on the data set from the study. Extension activities are also included for additional classroom work or homework assignments.

Suggested Grade Levels: 7&8
Curriculum Connections: Population studies, American geography, mapping, interpreting statistics.

EALRs Addressed

This lesson addresses the following Washington State Essential Academic Learning Requirements (EALRs). The benchmarks listed are for grade 8 in social studies.

In this lesson, the student is asked to:

- Use data and a variety of symbols and colors to create thematic maps, mental maps, and graphs depicting geographic information. (Location, Place, Region) (Geography 1.1.2b).
- Locate physical and human features and events on maps and globes. (Location, Place, Region) (Geography 1.2.2a).
- Take notes, paraphrase, summarize, enter data. (Social Studies Skills 1.1.2e).

Teacher Background

To prepare to teach this lesson, you should read or review the handout entitled, **Student Introduction: Environmental Health and Asthma**. Next, read the materials in this lesson. That should give you the necessary background information to teach the lesson.

For a more in-depth understanding of the study presented in this lesson, consult the following resources that were used to prepare this lesson:

"Self-Reported Asthma Prevalence and Control Among Adults – United States, 2001." The article was published by the Centers for the Disease Control and Prevention (CDC) in May 2003, and is available online at:

- http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5217a2.htm

If you are interested in having the students compare the changes in asthma rates over time, you can use data reports from 2000 and 2001. An extra data table, blank map, and teacher key are included for use with the 2000 data.

"Self-Reported Asthma Prevalence Among Adults – United States, 2000." The article was published by the Centers for Disease Control and Prevention (CDC) in August 2001 and is available online at:

- http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5032a3.htm

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Teacher Preparation

- **Materials:** Copies of **Student Handout #1**; colored pencils or pens; and sticky notes.

- If you are the first teacher in your team to use this FACT FILE, make copies of the student handout entitled, **Student Introduction: Environmental Health and Asthma**. Ensure that students have read the handout and mastered the content and vocabulary.

Procedure

- **Introduction**
  Tell the students that they will be reading about asthma statistics. Consider having a brief discussion about statistics and decision-making. Discuss the ways in which statistics enable decision-makers (politicians, doctors, lawyers, etc.) to understand complex patterns more easily and use this understanding to make decisions. Consider bringing in examples of statistics (charts, graphs, tables, etc.) from newspaper and magazine articles. Ask students to look through newspapers for examples of statistics.

- Once you have introduced the topic of statistics, distribute **Student Handout #1**.

- **Reading**
  The reading, entitled "A Survey of Asthma Rates in the United States for the Year 2001" is a short summary of a study published in 2003. In that study, experts used data collected from a phone survey called the 2001 Behavioral Risk Factor Surveillance System (BRFSS) to estimate asthma rates by state. The survey was a random-digit-dialed survey of adults over 18. It asked for information about a wide variety of health issues, including asthma. The article explains why this information was helpful and provides a table of the study results.

- Because these data are in table form, it is not immediately clear how the numbers relate to geography. For example, just looking at the table of numbers does not give a clear picture of any geographical patterns that might exist in the data. Are the states with the highest or lowest rates near one another? How does Washington State rank compared to the nation as a whole? Explain to the students that sometimes we can learn new things from data by presenting it in a new form. In this case, they will be asked to overlay the asthma data onto a map. This will result in a graphic representation of the data that is more useful and user-friendly.

- The reading can be done in class in small groups, or individually as homework. Once the students have read the summary of the study, have them answer the follow-up questions in pairs, groups, or as individual homework.

- **Data Presentation Game**
  Begin by playing a quick data presentation game in class. Assign each student a few states to represent by "counting off" around the class until all states are taken. On the board, draw a continuum of asthma rates from lowest (8%) to highest (13.4%). Give each student a few sticky notes. Have the students write the names of their states and the corresponding asthma rates on sticky notes – one state per note. Have the students come up one at a time and place their sticky notes on the asthma rate continuum. When all the states have been placed on the continuum, discuss how this way of presenting the data might make it easier to see relationships between the numbers. For example, it

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makes it much easier to answer the follow-up question regarding which states have the lowest estimated asthma rates. However, this presentation does not help answer questions related to the geographical distribution of asthma across the country.

- **Mapping Activity**
  Once you have completed the reading, follow-up questions, and continuum group activity, have the students do the mapping activity in pairs or as individual homework. If the activity is done in class, provide students with whatever drawing materials are available (color pencils, markers, etc.). A blank U.S. map is provided. Begin by asking the students to fill in the names of the states. This is a good opportunity for them to practice their U.S. geography knowledge. The directions for the mapping activity are outlined on **Student Handout #1.**
- Have students compare their finished products for accuracy. Ask students to describe how presenting the data in map form may be useful to decision makers

Student Assessment

Student work can be assessed in the following ways, for a total of 100%.

20%	Did students read the **Student Handout #1** and correctly answer the **Check Your Understanding** questions?
10%	Did students participate in the **Data Presentation Game**?
70%	Did students create **maps** that include the required elements? • 30% Correctly labeled with **state names**. • 5% Including a **key** using symbols or colors. • 30% Accurately representing each state's correct **percentage**. • 5% **Neatness**.

Extension Activities

Asthma Awareness

- Now that you know how Washington State's asthma rate compares to the rest of the country, use that information to prepare an asthma awareness advertisement or commercial for use in Washington. Your ad or commercial should include a description of what asthma is, how it is treated, and what you can do to help people with asthma. Make sure it is visually appealing and that it makes people want to learn more!

Evaluating Survey Accuracy

- The data in the study described in this lesson are from a phone survey. How accurate do you think this information is? Do you see any weaknesses with the method they used to collect this data? Describe in detail how you would conduct a study to get more accurate data.

Community Asthma Survey

- Take an asthma survey of your school, neighborhood, or community. Find out how many people have been diagnosed at some point in their lives with asthma. Do not forget to collect information that might be helpful when you compare and analyze your data, such as age, gender, and family history of asthma. Compare your results to the results for Washington State described in this lesson. Create a report or presentation on your findings.

Asthma Bill of Rights

- People with asthma need to carry their lifesaving asthma medications with them, but some school policies and state laws do not allow students to carry and self-administer medications. A variety of resources are available to involve students in researching this topic. Students could be challenged to write a position paper, a letter to the editor, or to participate in a debate on this topic.

Student Assessment:
The extension activities provide for more in-depth assessment of student understanding.

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The Allergy and Asthma Network/Mothers of Asthmatics website contains information on **State Statutes Protecting Student Rights to Carry and Use Prescribed Asthma and Anaphylaxis Medication**. The website lists states that protect student rights tto possess asthma medications, states that have pending legislation, and states that do not have statutes. State of Washington House Bill 1904 and Senate Bill 5841 an Act related to the prevention, diagnosis, and treatment of asthma passed the legislature and became effective in July 2005.

http://breatherville.org/cityhall/ch_childrights.htm

The American Lung Association has created a **Kids with Asthma Bill of Rights**, to be presented to the president of the United States. The document includes: “The right to attend an asthma-friendly school, where there’s a school nurse, they can use their medicine when they need it, and all the adults know enough about asthma to help them if they get in trouble.”

http://lungusa.org/site/pp.asp?c=dvLUK9O0E&b=186670

THE GEOGRAPHY OF ASTHMA
Student Handout #1

Teacher Key

In this lesson, you will read about a study that includes **statistics** about asthma across the U.S. You will then answer questions about the study to make sure you understand what you have read. Finally, you will complete a mapping exercise that will help you better understand the **data** presented in the reading.

Statistics: A collection of numerical information.

Data: Information organized for analysis or decision-making.

A Survey of Asthma Rates in the United States for the Year 2001

Asthma is a condition that causes the airways of your lungs to become inflamed, constricted and filled with sticky mucus, making it hard to breathe. Asthma can make you wheeze and cough. When this happens, it is called an asthma episode.

Unfortunately, more people in the U.S. have asthma than ever before. From 1980 to 1994, the number of people who said they had asthma increased 75%. People with asthma must work hard to control their disease by educating themselves and taking medication. Every time a student misses school, she misses out on the education that will help her succeed in life and give back to her community. We can all help society by learning more about asthma, too. If someone with asthma has to stay home from work, it means that person is not able to contribute to society by repairing a road, teaching a class, or running a business. When someone has to be hospitalized for asthma, the costs are high. In the year 2000 asthma caused 1.8 emergency room visits and 10.4 million doctor office visits in the U.S.

Community Resources & Action

Since asthma is a problem that seems to be getting worse, people working in state government and health care need to know how much money to budget for asthma related expenses. To do this, they need an accurate estimate of how many people in their state have asthma. This helps ensure that hospitals will be prepared to treat people with asthma and also helps fund programs that teach people with asthma how to manage the disease and stay healthy.

Federal government agencies like the National Institute of Health (NIH) and the Centers for Disease Control and Prevention (CDC) also want to know how many people have asthma. In 2001, scientists used information gathered by the Centers for Disease Control and Prevention (CDC) to estimate how many people in each of the fifty states suffered from asthma. They based their estimates on information gathered from a survey conducted in the year 2001. The survey was a phone survey that randomly dialed phone numbers looking for adults (aged 18 and above) that were willing to answer a series of questions about their health. A few of those questions related to asthma. The table on the next page shows the percentage of people in each state that answered “yes” to the question: “Have you ever been told by a doctor that you have asthma?”

Phone surveys are a good way to get information from a large group of randomly selected people. This phone survey provided a good method to get some sense of the disease rate, but it is important to be aware of the survey’s shortcomings. The scientists did not check to make sure that those who answered “yes” really had asthma. They had to trust that those people taking the survey were telling the truth and that their

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doctors had correctly diagnosed their condition. Also, the survey was limited in who it reached. The surveyors did not contact people in the military or adults who were institutionalized, such as people in mental health facilities, hospitals, nursing homes or prisons. In addition, since the survey was given over the phone, people who did not have telephones or did not speak English are not represented.

Why is it important to gather these kinds of data? State and federal officials use this information to budget for asthma treatment and prevention programs. Health care professionals also use the data to ensure that hospitals and clinics are prepared to treat the rising number of asthma sufferers around the nation. Finally, collecting this information every year allows experts to see patterns in asthma rates around the country. This helps answer questions like “Do more people have asthma this year than last year?” and “Are asthma rates higher in one part of the country than another?” This knowledge might one day lead to ways to lower asthma rates by identifying and controlling the things that cause asthma.

Data Chart

Percentage of adults by state that answered that they have been diagnosed with asthma, 2001

Alabama	9.7	Montana	11.8
Alaska	11.5	Nebraska	8.4
Arizona	12.4	Nevada	13.3
Arkansas	10.6	New Hampshire	12.5
California	12.4	New Jersey	9.4
Colorado	12.1	New Mexico	10.8
Connecticut	12.3	New York	11.1
Delaware	12.0	North Carolina	10.1
Florida	9.9	North Dakota	9.1
Georgia	11.0	Ohio	9.8
Hawaii	12.2	Oklahoma	10.1
Idaho	11.7	Oregon	13.0
Illinois	11.3	Pennsylvania	10.7
Indiana	11.3	Rhode Island	12.1
Iowa	9.7	South Carolina	10.8
Kansas	11.7	South Dakota	7.7
Kentucky	10.9	Tennessee	9.3
Louisiana	9.1	Texas	9.6
Maine	12.6	Utah	10.7
Maryland	11.1	Vermont	12.1
Massachusetts	13.1	Virginia	11.4
Michigan	12.4	Washington	12.0
Minnesota	10.1	West Virginia	12.5
Mississippi	9.2	Wisconsin	10.9
Missouri	12.0	Wyoming	11.6

From: “Self-Reported Asthma Prevalence and Control Among Adults, United States, 2001.” MMWR, Centers for Disease Control & Prevention, 2003.

Check Your Understanding

1. What was the percent increase in the number of people with asthma in the U.S. between 1980 and 1994? ***75%***

2. For every 1000 people with asthma in 1980, how many more would have the disease by 1994? ***750***

3. Give two examples of why asthma costs society so much money. ***People with asthma miss work and school. Hospital, physician and medication costs.***

4. Who uses asthma estimates and what do they use them for? ***People working in state government and health care use asthma estimates to decide how much money to budget for asthma related expenses. Experts use the data to see patterns in asthma rates around the country that might help them identify and get rid of things that cause asthma.***

5. Who participated in the random phone survey described in the reading? ***Adults 18 or older who agreed to answer the health questions over the phone, not including institutionalized adults, the military, or people without telephones.***

6. Which state had the lowest estimated asthma rate for 2001? ***South Dakota.***

7. What state had the highest estimated asthma rate? ***Nevada***

Student Assessment:
Have students answer these questions individually or in pairs.

Mapping Activity

Use the blank map of the United States on the following page to complete this activity.

- Label each state with its name.
- Select a color to represent each of the following percentage ranges:

☐	7.0 to 8.9%
☐	9.0% to 10.9%
☐	11.0% to 12.9%
☐	13.0% to 14.9%

- Create a key at the bottom of the map that shows what colors you have assigned to the percentage ranges above.
- Color in each state to indicate the approximate percentage of the population of that state that has been diagnosed with asthma.

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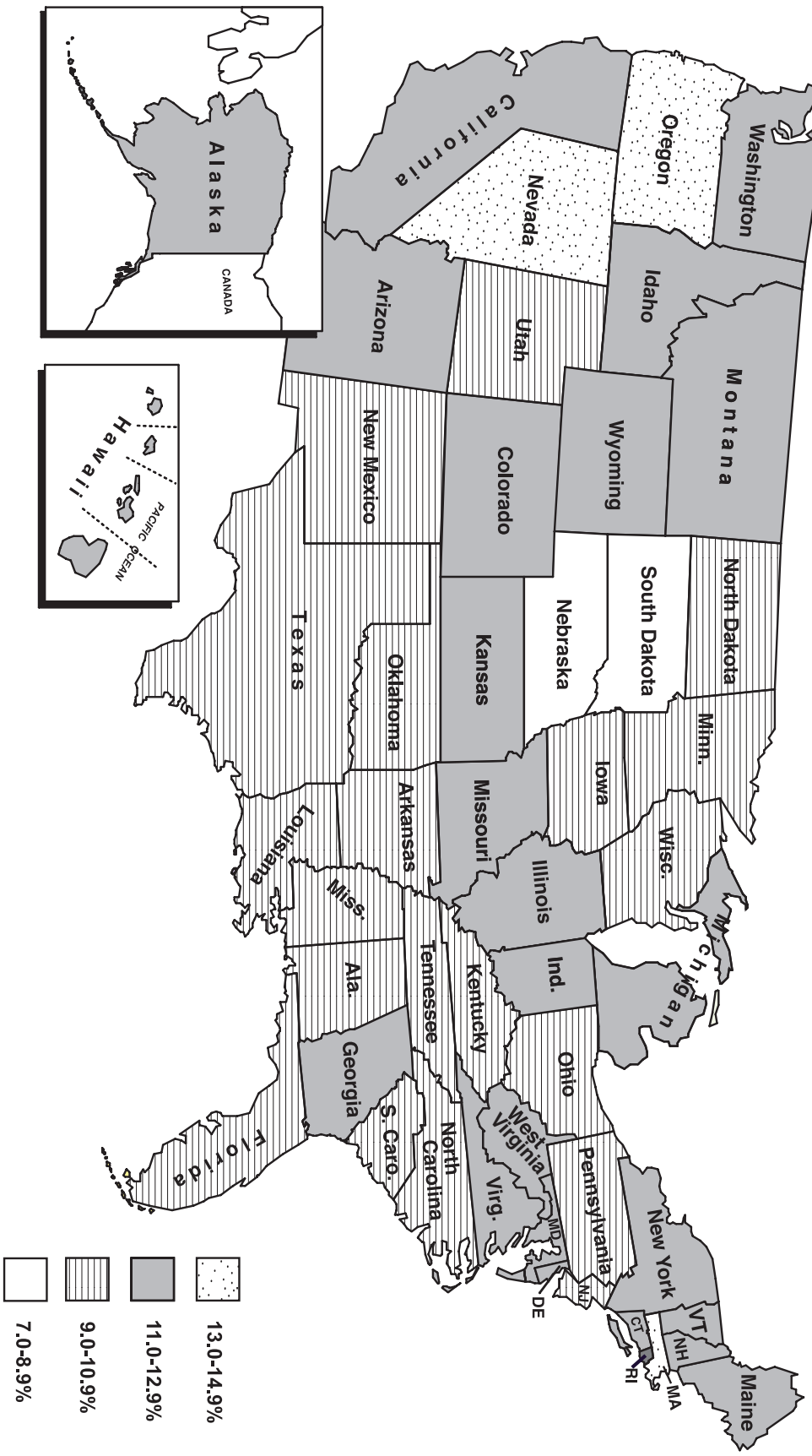
Teacher Key

Percentage of adults by state that answered that they have been diagnosed with asthma, 2001



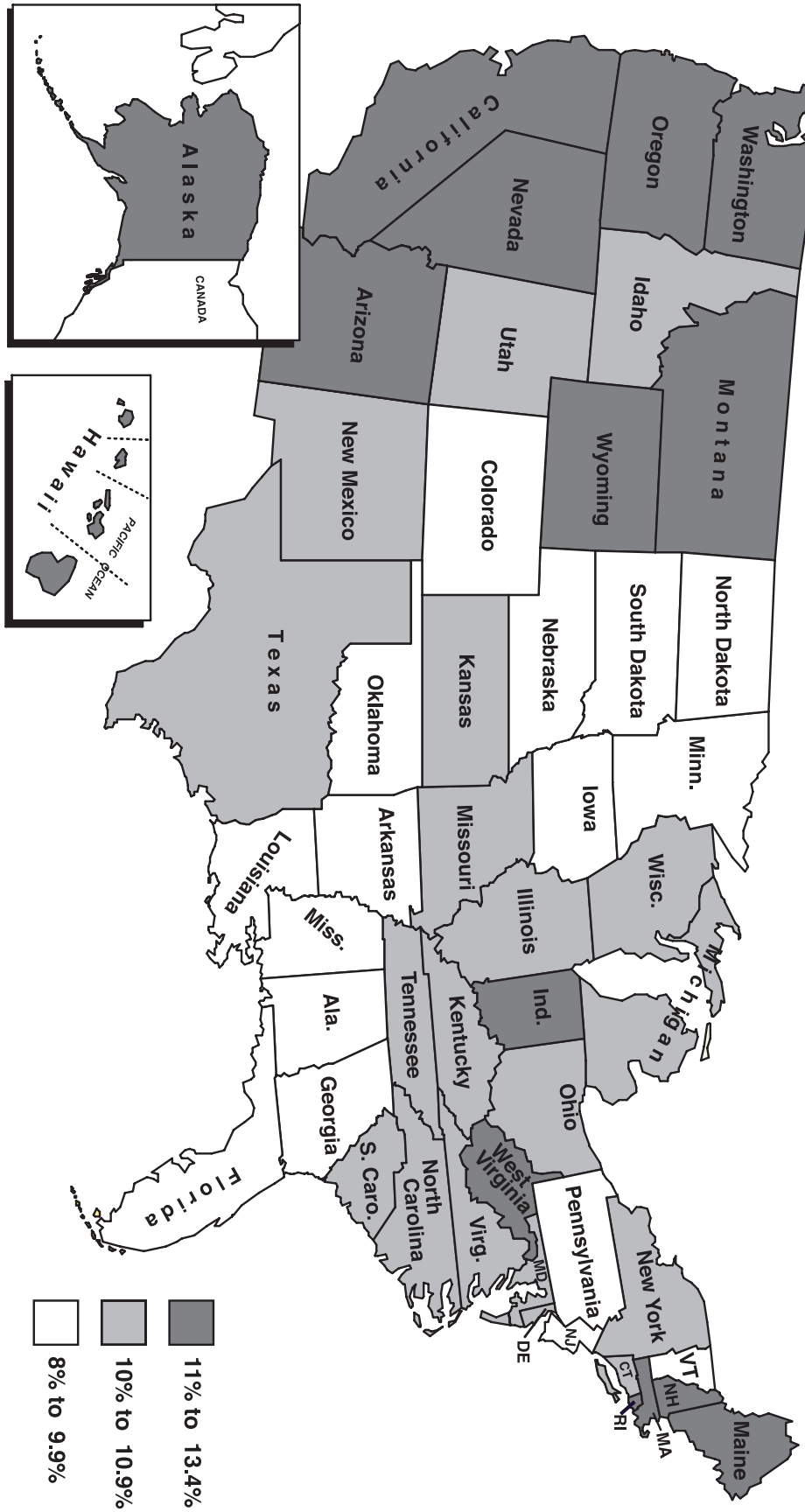
Percentage of adults by state that answered that they have been diagnosed with asthma, 2000

Alabama	9.1	Montana	11.4
Alaska	11.3	Nebraska	8.7
Arizona	11.1	Nevada	13.4
Arkansas	9.9	New Hampshire	12.0
California	11.5	New Jersey	8.7
Colorado	9.5	New Mexico	10.0
Connecticut	10.8	New York	10.7
Delaware	10.4	North Carolina	10.1
Florida	9.1	North Dakota	9.2
Georgia	9.6	Ohio	10.9
Hawaii	11.4	Oklahoma	9.2
Idaho	10.8	Oregon	12.1
Illinois	10.5	Pennsylvania	9.3
Indiana	11.2	Rhode Island	11.7
Iowa	8.5	South Carolina	10.4
Kansas	10.9	South Dakota	8.0
Kentucky	10.7	Tennessee	10.4
Louisiana	8.0	Texas	10.5
Maine	12.5	Utah	10.3
Maryland	10.6	Vermont	9.7
Massachusetts	11.9	Virginia	10.5
Michigan	10.3	Washington	11.9
Minnesota	9.5	West Virginia	11.8
Mississippi	9.9	Wisconsin	10.6
Missouri	10.6	Wyoming	11.8

From: "Self-Reported Asthma Prevalence Among Adults, United States, 2000." MMWR, Centers for Disease Control & Prevention, 2001.

Teacher Key

Percentage of adults by state that answered that they have been diagnosed with asthma, 2000



Lesson One: WHAT IS ASTHMA?

Lesson Overview

This lesson helps students to understand asthma as a chronic disease of the respiratory system. Students participate in a simple simulation of what it is like to have reduced lung capacity from asthma. Then, students mix up a batch of homemade mucus, similar to the mucus that floods the lungs during an asthma episode. Students work in small groups to build a working model of the respiratory system that simulates an asthma episode. Extension activities are also included for additional classroom work or homework assignments.

Suggested Grade Levels: 6-8
Curriculum Connections: Human Body, biology, respiratory system, exploring models.

EALRs Addressed

This lesson addresses the following Washington State Essential Academic Learning Requirements (EALRs). The benchmarks listed are for grade 8 in science.

In this lesson, the student is asked to:

- Identify and describe human life functions, and the interconnecting organ systems necessary to maintain human life, such as digestion, respiration, reproduction, circulation, excretion, movement, disease prevention, control, and coordination. (Science Human Biology 1.2).
- Explain how human societies' use of natural resources affects quality of life and the health of ecosystems. (Science Environmental and Resource Issues 1.3).
- Correlate models of the behavior of objects, events, or processes to the behavior of the actual things; test models by predicting and observing actual behaviors or processes. (Science Modeling 2.1).

Teacher Background

This lesson focuses on asthma as a disease of the respiratory system. Therefore, it would make sense to teach this lesson during a unit on the respiratory system. The activities in this lesson can be used to enrich and reinforce your students' understanding of the respiratory system's parts and functions. A good way to introduce this activity is to examine a diagram or model of the respiratory system with your students. As you point out the different parts of the respiratory system, explain how they function normally and during an asthma episode. You can assess students' understanding by having them label a blank diagram of the respiratory system and write a sentence about the function of each part. Another way to assess students' understanding is to have them write a description that contrasts what happens in the respiratory system in a person with asthma to a person without asthma.

The model the students will be building represents how the respiratory system functions. It does not show what the lungs and other parts of the respiratory system really look like. You may want to share photographs or models of lungs and other parts of the respiratory system with your students.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

How does the respiratory system work?

Each breath begins with a nerve impulse from the brain. The diaphragm, a dome-shaped muscle, contracts. This causes the diaphragm to flatten and lower, drawing air into the lungs. Also, the intercostal muscles between the ribs contract, lifting the rib cage up and out. The increase in volume also causes an increase in pressure, which draws air through the mouth or nose into the trachea and down to the lungs. This entire process allows you to inhale and fill your lungs with air. While inhalation is an active process, exhalation is a passive process. When the lungs are full and inhalation stops, the diaphragm and the muscles around the rib cage relax. The diaphragm rises and the chest walls fall slightly inward. This change in volume and pressure causes the air to be pushed out of the lungs with an exhale. Exhalation can be an active process if the exhalation is forced.

Safety Note

One of the mucus recipes for Activity #2 requires the use of powdered Borax Natural Laundry Booster. Borax is a naturally occuring mineral composed of sodium, boron, oxygen and water. This product is intended to be used for a variety of household cleaning purposes. If you would like more information, a Material Safety Data Sheet for 20 Mule Team© Borax can be obtained at: http://www.prosarcorp.com/dialconsumer.

For a more in-depth understanding of asthma and the respiratory system, consult the following resources that were used to prepare this lesson:

- **American Lung Association**
  http://www.lungusa.org
- **What's Asthma All About Video**
  Informative animated video on the respiratory system, asthma and medications.
  http://www.whatsasthma.org
- **Brain Pop Website**
  Check out the animated videos explaining "Asthma" and the "Respiratory System" in the Health section.

  http://www.brainpop.com
- **Boogers Website**
  http://www.kidzworld.com/site/p3267.htm

Teacher Preparation

Materials:

Activity #1 – For each student:

- One drinking straw and one cocktail straw.

Activity #2 – For each group:

- Powdered Borax laundry booster (from your grocery store's laundry detergent aisle); white glue; water; food coloring; re-sealable plastic bag; measuring cup and teaspoon –OR— about 1/2 cup of corn starch; 3 packets of gelatin; water; and a 1-cup measuring cup.

Activity #3 – For each group:

- One 2-liter soda bottle; construction paper (pink or gray); 4 cotton balls; 2 straws; 2 round balloons (9"); plastic shopping bag; 6" of thin gauge wire; transparent tape; 3 rubber bands; and scissors.
- Make enough copies of **Student Handout #1 and #2** for each student or group to have a set. Master copies of the handouts are included at the back of this book.
- If you are the first teacher in your team to use this FACT FILE, make copies of the student handout entitled, **Student Introduction: Environmental Health and Asthma**. Ensure that students have read the handout and mastered the content and vocabulary.
- If possible, place a poster or model of the respiratory system in the classroom for students to examine.

Procedure

Activity #1: What does it feel like to have asthma?

- This simple activity will help students understand what it feels like to have reduced lung capacity from asthma. Hand out a regular plastic drinking straw and a cocktail straw to each student.
- Ask students to close their lips around the regular drinking straw and slowly breathe in and out through the straw. Some students may need to pinch their nose shut. It should be fairly easy to breathe through the straw.
- Then, ask students to continue breathing through the straw, but to use their fingers to pinch the straw in the middle so that it is mostly closed. Is it more difficult to breathe this way? The pinched straw represents having reduced lung capacity from asthma.
- Now, have students close their lips around the cocktail straw and try to breathe in and out. This represents what it feels like during a mild asthma episode, when the airways become constricted and it is difficult to breathe. What does it feel like? Did anyone feel nervous or anxious about breathing through the straw? What would it be like if the straw was filled with a thick mucus?

Activity #2: Making mucus

- In this activity, students whip up their own batch of mucus using common household materials. Please see the attached recipes and directions for making mucus. The first recipe results in a product that closely resembles real mucus in color and texture. However, this recipe requires heating water, the mucus is quite sticky, and the effect only last for about ten minutes. The second recipe is quite easy and the product will last for several days if kept refrigerated. The product is fun and easy to handle. However, it does not resemble actual mucus as much as the first recipe. You are encouraged to try out both recipes and decide what will work best for your teaching situation.
- Have students work in small groups to create their own batch of mucus. Encourage students to think about how this mucus makes breathing difficult during an asthma episode. What is actually happening inside the respiratory system? Why is it important to drink a lot of water each day, especially following an asthma episode?
- It is important to deliver this activity with sensitivity to students with asthma and other respiratory diseases. Make sure your students understand that mucus is a normal body process that helps keep particles out of the lungs. Mucus also coats the stomach to protect it from digestive acids. However, during an asthma episode, the excess of mucus combines with other factors to make it difficult to breathe. Everyone experiences times when their body produces an excess of mucus, such as during a cold or sinus infection. Everyone makes mucus, not just people with asthma.

Activity #3: Respiratory system model

- Students work in small groups to build a simple model of a respiratory system. Then, students manipulate their models to see what actually happens during an asthma episode. Please see the attached directions for making the respiratory model. Encourage students to identify the different parts of the respiratory system as shown on their model.

The straw breathing exercise is adapted from the National Heart, Blood and Lung Institute's *Asthma Awareness: Curriculum for the Elementary Classroom*.
http://www.nhlbi.nih.gov/health/prof/lung/asthma/school/index.htm

The respiratory system model activity is adapted from a lesson plan posted on ADPRIMA Student Lesson Plans.
http://www.adprima.com/sci-respsystem.htm

Student Assessment

Student work can be assessed in the following ways, for a total of 100%.

5%	Did students read the **Student Handout #1** and correctly answer the **Check Your Understanding** questions?
10%	Did students participate in the **Activity #1 What Does it Feel Like to Have Asthma**?
25%	Did students participate in **Activity #2 Making Mucus,** including the required elements? • 5% Cooperating and actively participating in **small groups**. • 15% Following one or both of the **recipes** on Student Handout #1, adaptiing the recipe as needed to make the correct consistency of mucus. • 30% Accurately representing each state's correct **percentage**. • 5% Following your classroom's proper **Lab Protocol**.
25%	Did students participate in **Activity #3: Respiratory System Model**, including the required elements? • 5% Cooperating and actively participating in **small groups**. • 15% Following the directions on Student Handout #2, to **build** a working model? • 5% Following your classroom's proper **Lab Protocol**.
10%	Did students complete the **Check Your Understanding** question on Student Handout #2, demonstrating their understanding of what happens during an asthma episode?
25%	Did students accurately complete **Student Handout #3**, by correctly identifying the parts and describing the functions of the respiratory system?

Extension Activities

The extension activities provide for more in-depth assessment of student understanding.

Asthma Anatomy Hike
In this "blind walk" activity students experience simulated parts of the respiratory system to gain understanding of breathing anatomy and asthma episodes. Available in Chaper One: Anatomy Activities of *Asthma Adventures: Asthma Camp Activities*. Available at http://www.asthmacamps.org.

Quest for the Code™ Asthma Game
Challenge students to this engaging and educational computer game where they must defeat a team of villains on a mission to convince kids they cannot manage their asthma. The Lung Simulator offers an inside look at what happens inside the respiratory system during an asthma episode. Free copies of the game can be ordered from the Starbright foundation at http://www.starbright.org. An English and a Spanish version are included on the CD-rom. **Note:** Does not work on Mac computers.

Lung Capacity Olympics
Test your lung capacity using a homemade device comprised of an inverted glass jug in a basin of water. Students take measurements of their own lung capacity and their breathing rate at rest and after exercising. A complete lesson plan, "Lung Capacity and Air Pressure" for this fun activity can be found on the NASA Explores website. http://www.NASAexplores.com

Living Murals
Create a life-size human body mural by tracing a student's outline on butcher paper. Then, challenge students to draw and label the parts of the respiratory system. They can also label the route of oxygen as it travels through the respiratory system to the bloodstream. As students study other body systems, they can add these onto their human body murals as well.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

WHAT IS ASTHMA?
Student Handout #1

Teacher Key

Making Mucus

Have you ever stopped to think about your own amazing **mucus**? Your body makes mucus that coats your nose and sinuses, grabbing pollen and dust and keeping it from getting into your lungs. Thick mucus even coats your stomach, protecting it from your powerful digestive acids.

Mucus: A thick, slippery liquid secreted by the mucus membranes in the respiratory system. During an asthma episode, mucus floods the lungs and makes it difficult to breathe.

What is mucus? While it is mostly water, mucus also contains sugars, proteins and salts. Mixed together, these ingredients make a substance that is sticky, gooey and stringy. You are constantly recycling your own mucus. Did you know that the average person swallows about a quart of their own mucus a day?

Think about the last time you had a cold. As your body attempted to get rid of the virus making you sick, it produced lots of thick mucus, giving you a stuffy or runny nose. When you have a sinus infection, sometimes your mucus even turns yellow or green in response to the bacteria, letting you know that you need to go to the doctor. One of the reasons you need to drink a lot of fluids when you are sick is to help flush the excess mucus from your body.

Mucus can also cause trouble. During an asthma episode, the muscles around the bronchial tubes in the lungs contract and inflame. The bronchial tubes also flood with thick mucus, making it difficult to breathe. It is important to drink a lot of fluids after an asthma episode to help flush the mucus from the lungs.

Go ahead and mix up some fake mucus. As you examine the fake mucus, imagine what it would feel like if your lungs were filled with this thick substance.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Mucus Recipes

Fake Mucus Recipe #1

Materials:

- 1/2 cup water
- 3 envelopes of unflavored gelatin
- 1/2 cup of light corn syrup
- 1/2 cup measuring cup
- Fork
- Saucepan or microwave-safe bowl
- Bowl

Safety:

Make sure you follow lab safety rules when using a heat source (stove, microwave oven, etc.) to heat up the water.

Directions: (makes about 1 cup)

1. Heat water until it boils. Remove from heat. Carefully pour into a bowl.
2. Sprinkle in three packets of gelatin. Wait several minutes, then stir with a fork.
3. Add 1/2 cup of light corn syrup. Stir with a fork.
4. Use a fork to lift out long strands of mucus. Touch it with your fingers.
5. As the mucus cools and thickens, add water, a little at a time.

Real mucus is made up of water, sugars, proteins and salt. Your fake mucus has the same ingredients, they just come from different sources. The corn syrup provides sugar and the gelatin provides protein.

Fake Mucus Recipe #2

This recipe makes a substance that is opaque and thicker than actual mucus. To keep for longer periods, place mucus mixture in a re-sealable plastic bag and store it in the refrigerator.

Materials:

- 1 teaspoon powdered Borax.
- 1/2 cup white glue, such as Elmer's Regular Glue
- Water
- Food coloring (optional)
- Re-sealable plastic bag
- 1/4 and 1/2 cup measuring cups
- Teaspoon

Safety:

This mucus should not be eaten! This mucus can stain fabric, so take care to keep it from carpets, furniture and clothing.

Directions: (makes about 1 cup)

1. Measure 1/4 cup of warm water in a measuring cup. Add 1 teaspoon of Borax. Stir until completely dissolved. Set aside.
2. Measure 1/2 cup of water. Pour into plastic bag. Measure 1/2 cup of white glue and pour into bag. Seal the bag and mix the glue and water thoroughly by kneading the bag.
3. Add a couple drops of food coloring to the glue/water mixture in the bag.
4. Pour the Borax solution into the bag with the glue solution.
5. Seal the bag and knead the mixture.
6. Dig in and have fun exploring the mucus. This mucus is not sticky, so you can take it out of the bag to explore it. Remember to wash your hands when you are finished.

It can be difficult to know exactly how much Borax to add to your mixture. If you add too little, the mucus will be sticky. If you add too much, the mucus will be too wet. Once the mixture looks like it is not a liquid anymore, touch it. If it feels sticky, try adding a little more of the Borax solution. If the mixture feels too wet and slippery, knead it in your hands for a few minutes until the Borax solution is absorbed.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

WHAT IS ASTHMA?
Student Handout #2

Teacher Key

Build a Soda Bottle Lung

Each day, you take at least 23,000 breaths. Your respiratory system inhales and exhales over 8 million times per year. What is going on with each breath you take? What happens within the respiratory system during an asthma episode?

Follow these directions to build a soda bottle lung—a working model of a respiratory system. Your model will show you what happens to the lungs during an asthma episode. After you have built your model, answer the questions on the back of this page.

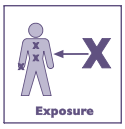
Materials (per group):

- 1 two-liter plastic soda bottle
- Construction paper (pink or gray)
- 4 Cotton balls
- 2 Straws
- 2 Round balloons (9”)
- Plastic shopping bag
- Thin gauge wire
- Transparent tape
- 3 Rubber bands
- Scissors

Directions:

1. Use the scissors to carefully cut the bottom off of the soda bottle. The bottle represents the **thoracic cavity**.
2. Put the end of one straw into a balloon and tightly wrap a rubber band around the neck of the balloon, attaching it to the straw. Repeat with the other straw and balloon. The balloons represent the **lungs**.
3. Take one of the balloons and loosely wrap the wire around the balloon, spiraling around it to form a cage. This represents the muscle bands that constrict around the **bronchial tubes** during an asthma episode. Leave the other balloon as it is, to represent a normal lung.
4. Insert the two straws through the open bottom of the bottle and bring the top of the straws up through the neck of the bottle. The straws represent the bronchial tubes.
5. Tightly stuff the neck of the bottle with cotton balls around the straws.
6. Roll a piece of construction paper into a tube just big enough to fit over the tops of the straws. Tape closed. Place over the tops of the straws. The paper represents the **trachea**.
7. Cut the plastic shopping bag to make a piece big enough to cover the open bottom of the soda bottle. Stretch a rubber band around the base of the bottle to hold the bag in place. The bag represents the **diaphragm**.
8. Tape a loop of paper onto the center of the plastic bag to make a handle.
9. To make the model work, grasp the plastic bag by the handle. Try pulling it down or pushing it up. Watch as the lungs (balloons) expand and contract. Compare the **lung capacity** of the two different lungs.

Respiratory System Model



Thoracic Cavity: The chest cavity where the lungs and heart are located.

Lungs: A paired organ within the respiratory system of humans and many other air-breathing organisms.

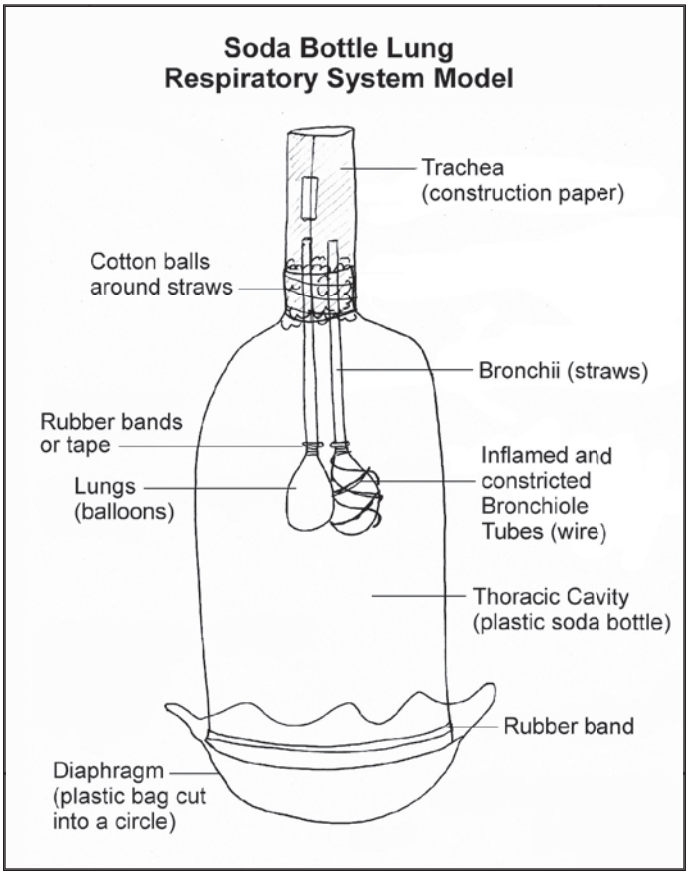
Bronchial Tubes: The trachea branches into two tubes that enter into the right and left lung. These bronchial tubes branch into smaller and smaller tubes, called bronchioles, like the branches on a tree. At the end of each bronchi, small sacs called alveoli allow for oxygen to be exchanged with the blood.

Trachea: The main tube in the respiratory system where air passes from the nose and mouth to and from the lungs.

Diaphragm: A partition of muscle and connective tissue that separates the chest from the abdominal cavity.

Lung Capacity: The amount of air an individual inhales during a normal breath. People with asthma often have reduced lung capacities.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).



Questions

Check Your Understanding

What happens during an asthma episode?

1. What happens to the normal lung when you move the diaphragm up and down? ***When the diaphragm is pushed up into a dome shape (relaxed state), the lungs empty of air. When the diaphragm is pulled down into a flattened shape (contracted state), the lungs expand and fill with air.***

2. What happens to the lung that represents an asthma episode? ***The muscle bands around the bronchial tubes are tight and do not allow the lung to fully expand, therefore reducing lung capacity. Also, the swollen, tight tubes make it difficult to empty the lungs of air.***

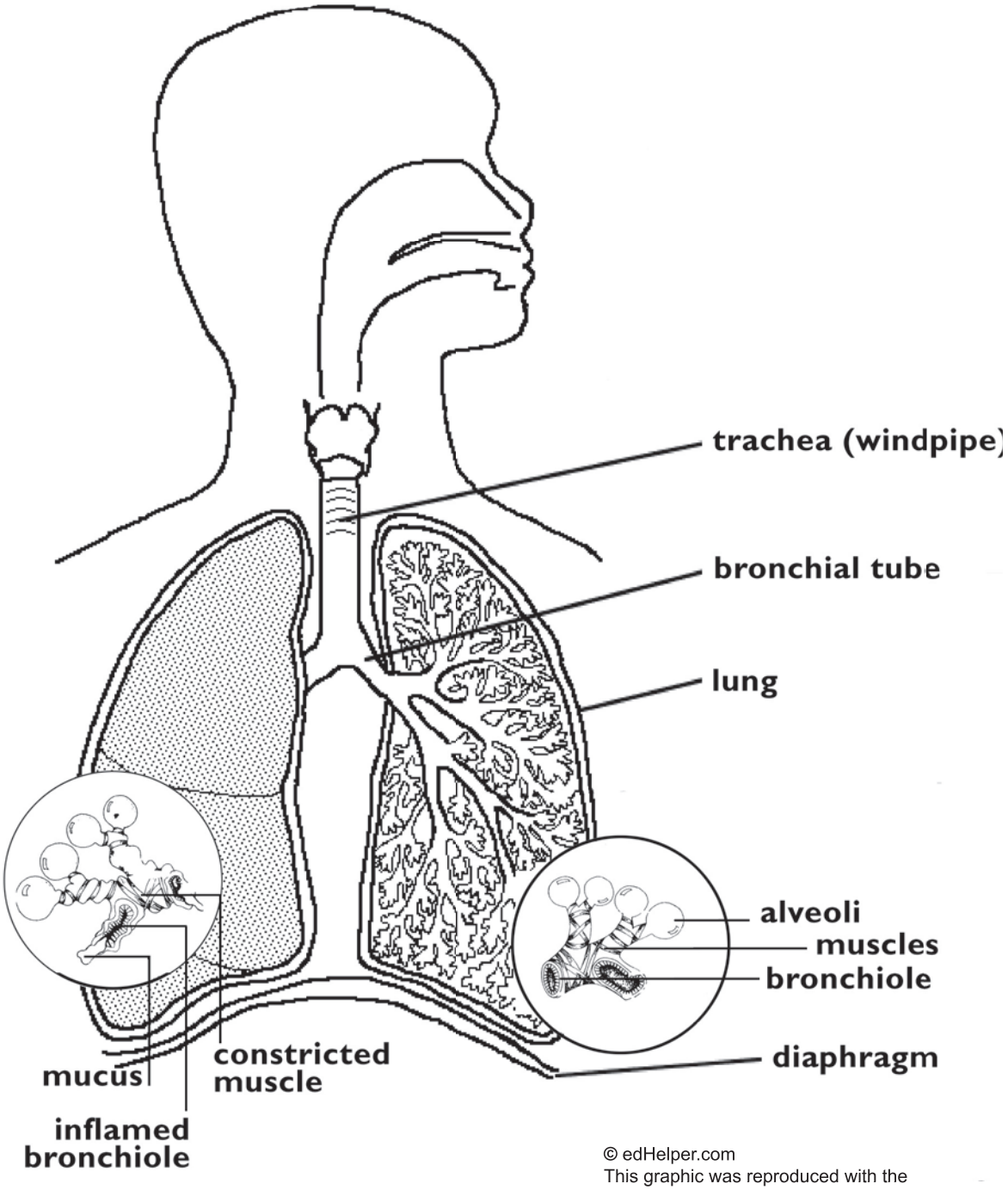
3. What three things happen in the respiratory system during an asthma episode? ***The bronchioles constrict, inflame and flood with mucus.***

4. What would happen if the lungs were full of mucus? ***If the lungs were filled with mucus, it would be even more difficult to move air in and out of the lungs. Combined with the swollen airways and the tight muscle bands, mucus would make it very difficult to breathe.***

WHAT IS ASTHMA?
Student Handout #3

Teacher Key

The Respiratory System and ASTHMA



Teacher Key

Write a sentence describing the function of each part of the respiratory system.

Alveoli:
Small sacs at the end of each branchi that allow for oxygen to be exchanged with the blood.

Bronchial Tube:
The trachea branches into two tubes that bring air in and out of the right and left lung.

Bronchiole:
The bronchial tubes branch into smaller tubes, each with an alveoli at its end.

Diaphragm:
A partition of muscle and tissue that separates the chest from the abdominal cavity, and contracts and relaxes to cause breathing.

Lung: A set of organs responsible for breathing.

Muscle:
Bands of muscles wrap around the brochioles.

Trachea:
The main tube where air passes from the nose and mouth to and from the lungs.

Write a sentence describing what effect each of the following parts of an asthma episode has on breathing:

Constricted Muscle:
The bands around the bronchioles tightly constrict, making it difficult to move air in or out.

Inflamed Bronchiole:
The bronchioles swell, making it difficult to move air in or out.

Mucus:
Thick mucus floods the bronchioles, causing coughing and making it difficult to breathe.

Lesson Two: HEALTHY BUILDINGS

Lesson Overview

Asthma and Indoor Air Pollution

This lesson examines the links between asthma and indoor air pollution. Most of the major indoor air pollutants are also known asthma triggers. Students first create a map of a room in their home or at school. Students plot both potential asthma triggers (such as mold and chalk dust) and air quality helpers (such as air filters) on the map. Then, students conduct an experiment where they swipe different surfaces around school and grow mold cultures on bread or potato slices. An optional extension activity involves creating air pollution collectors to collect and examine particulate matter from the air.

Suggested Grade Levels: 6 & 7
Curriculum Connections: Indoor air pollution, environmental science, asthma triggers, mold, mapping, conducting investigations.

EALRs Addressed

This lesson addresses the following Washington State Essential Academic Learning Requirements (EALRs). The benchmarks listed are for grade 8 in science.

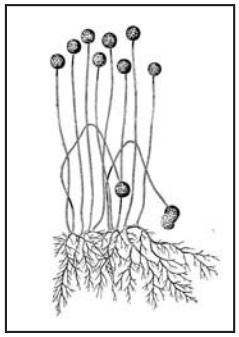
In this lesson, the student is asked to:

- Explain how human societies' use of natural resources affects quality of life and the health of ecosystems. (Science 1.3 Environmental and Resource Issues).
- Design, conduct, and evaluate scientific investigations, using appropriate equipment, mathematics, and safety procedures. (Science 2.1 Designing and Conducting Investigations).

This activity explores indoor air pollution, including the familiar culprit, mold. Before beginning **Activity #2: Monitoring Mold** with your students, you may want to introduce them to the lifecycle of molds and fungi, and how their spores are dispersed into the air and onto a variety of surfaces.

Teacher Background

Students will be familiar with the fuzzy black mold that grows on bread. Bread molds, such as Rhizopus, form a structure called a zygospore that can remain dormant for months. When conditions are favorable, the zygospore produces a stalk with a spore-producing tip. The spores are picked up by the wind and settle on different surfaces.



Rhizopus

Another familiar mold is one that turns grapes and oranges fuzzy. Ascomycetes form saclike reproductive cells. The spores are produced inside these sacs. When the spores reach maturity, the sacs burst open, spreading the spores into the air and onto different surfaces. In some ascomycetes, the spores can be tossed up to 30 cm (12 in.) away from the sac.

Ascomycetes

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

You can illustrate this spore-dispersal method by filling a balloon with confetti (representing spores) and then popping it. How far does the confetti travel?

For a more in-depth understanding of asthma and indoor air pollution, consult the following resources that were used to prepare this lesson:

- **U.S. Environmental Protection Agency Indoor Air Quality Website**
  http://www.epa.gov/iaq/
- **Centers for Disease Control Q & A on Mold**
  http://www.cdc.gov/nceh/airpollution/mold/stachy.htm

Teacher Preparation

Materials:

Activity #1—for each student:

- Graph paper; ruler; colored pencils or pens (optional).

Activity #2—for each student:

- Slices of raw potato or slices of fresh white bread (should not have preservatives); plastic re-sealable baggies; permanent marker; and alcohol wipes.

- Make enough copies of the **Student Handouts #1 and #2** for each student or group to have a set. Master copies of the handouts are included at the back of this book.

- If you are the first teacher in your team to use this FACT FILE, make copies of the student handout entitled, **Student Introduction: Environmental Health and Asthma**. Ensure that students have read the handout and mastered the content and vocabulary.

Procedure

- Have the students read **Student Handouts #1 and #2** before beginning the following activities.

- **Activity #1: Mapping asthma triggers**

  Students use graph paper to make a map of a room in their house or a particular classroom. Students draw (roughly to scale) the main parts of the room, including major furniture, windows, doors, etc. Students then plot on their map potential asthma triggers, such as cigarette smoke, mold, wood burning stove/fireplace, air conditioning and heater vents, perfume or other aerosols, feather pillows, down comforters, furry pets, mold, chalk board, dust, cockroaches, etc. Students also map indoor air quality helpers, such as an air purifier, a vacuum cleaner with a HEPA filter, or dust mite covers on mattresses and pillows.

- Students then write a description of five things that could be done to the room to help improve its indoor air quality.

- A variation of this activity can also be done through virtual homes filled with asthma triggers, which is part of the asthma game Breaking the Code™. You can order free copies of the CD-Rom from the Starbright Foundation at http://www.starbright.org.

  Note: Does not work on Mac computers.

- **Activity #2: Monitoring mold**

  This activity uses bread or potato slices to grow mold cultures. The bread and potato slices are high in starch and serve as a growing medium for the mold spores. Mold will grow more quickly on the potato slices. However, when the potato slices are swiped across surfaces, they will leave juices that will need to be cleaned up. If you

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

choose to use bread slices, it is important to purchase fresh bakery bread that does not have preservatives.

- Students can work in small groups during this activity. This activity can be set up as a quick activity, or a more involved experiment that draws on the scientific method. You can give your students as much instruction as you like, or allow them to design the experimental methods and data collection procedures on their own. You may want students to first consider the following experiment elements before beginning the activity; these elements can also be included in a lab report written at the conclusion of the experiment:
    - Question
    - Hypothesis
    - Experimental Variables
    - Procedure
    - Observations and Data
    - Results and Conclusion
- Have students wash their hands. Give each student two slices of bread or potato, two plastic baggies and an alcohol wipe. Have each student choose a surface somewhere in the school building that they want to test for mold spores. Students should use a permanent marker to write their name, the date, and the sample location on the outside of the baggies. Label one baggie "control" and the other "variable."
- Each student should rub one bread or potato slice on the surface, then immediately seal the slice in the plastic baggie marked "variable."
- Then the student should use an alcohol wipe to clean a spot at the same area. Then, rub the second break or potato slice on the cleaned surface and seal in the baggie marked "control."
- Place the bags in a warm, dark area, such as a closet or cabinet.
- Have students observe their samples every few days. The potatoes will show mold growth very quickly. The bread may take a bit longer. IMPORTANT: Do not allow students to open their baggies. The samples should stay sealed within the plastic baggies.
- When mold growth appears to slow or stop, throw the sealed baggies in the garbage.
- Ask students to record their observations. Possible methods include drawing their samples, taking photographs, weighing their samples, using graph paper to measure mold growth on the surface area of the bread/potato and creating graphs.
- You may want to ask students to create lab reports of the experiment.

Student Assessment

Student work can be assessed in the following ways, for a total of 100%.

10%	Did students read **Student Handouts #1** and **#2** and correctly answer the **Check Your Understanding** questions?
40%	Did your students complete **Activity #1 Mapping Asthma Triggers**? • 5% Drawing map roughly to **scale**. • 5% Identifying main parts and items of a **room**. • 10% Plotting **asthma triggers**. • 10% Plotting **air quality helpers**. • 10% Describing five plausible things that could be done to the room to **improve the indoor air quality.**

50%	Did students complete **Activity #2 Monitoring Mold,** including the required elements? • 5% Cooperating and actively participating in **small groups**. • 15% Following directions to complete the **investigation**. • Recording their **observations**. • 20% Writing a complete **lab report** that includes question, hypothesis, • experimental variables, procedure, observations, data, results, conclusion. • 5% Following proper **lab protocol.**

Extension Activities

Air Pollution Collectors

- Students make air pollution collectors, leave them in a location for two weeks and then examine them for different particulates captures from the air. More ideas for this activity can be found at:

  http://www.hhmi.org/coolscience/airjunk/index.html

  You can also download lesson #6 in the Air Aware section of the **Clean Air Express** curriculum, available at :

  http://www.pscleanair.org/news/cleanairexpress.shtml

  You can also have students use **The Virtual Microscope** to identify the particles they find, available at :

  http://www.geocities.com/thesciencefiles/microscope/slideintro.html

Air Quality Trends

- Compare asthma rates to air quality trends. Students can use the AIRNOW Air Quality index at http://www.epa.gov/airnow/ to research air quality in their own community or for the entire country. Students can also learn more about air pollutants in their community by using the databases on the EPA's Where You Live website at: http://epa.gov/epahomewhereyoulive.htm

The Awful Eight: A Play

- Students can stage a performance of a play geared at examining the eight major air pollutants. Students can perform the play for other middle school students or put on a performance for an elementary school class. For a complete lesson plan and script, see the **Texas Natural Resource Conservation Commission** website at:

  http://www.tnrcc.state.tx.us/air/monops/lessons/awfuleightlesson.html

Indoor Air Pollution Experiment

- Students use houseplants to test the effects of volatile liquids on indoor air quality. Students set up an experiment placing small houseplants in glass chambers. Then, they add to the chambers volatile liquids commonly found in homes, such as paint thinner, glue, nail polish remover, cleaning solvents, ammonia and perfume. You can download a lesson plan for this activity from the **Puget Sound Clean Air Agency** website. Look for Lesson #12 under the "Air Aware" section.

  http://www.pscleanair.org/news/cleanairexpress.shtml

The Mold activity is adapted from the lesson plan "How Clean Is it?" posted on the Utah Education Network website.

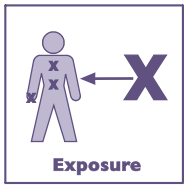
Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

HEALTHY BUILDINGS
Student Handout #1

Teacher Key

What is indoor air quality?

Did you know that every day, an adult's lungs process about 16,000 quarts of air? With every breath of air, your body is exposed to dust, pollen and spores. Sometimes, your body may inhale heavy metals, dangerous gases, irritating fibers and smoke through normal breathing. Our bodies are equipped to handle some of the pollution and allergens that comes along with breathing, such as by sneezing out dust particles. Yet, some particles are so small that they get lodged deep in the lungs where they can cause damage. These particles can have a big impact on the respiratory system of a person with asthma and may even trigger an asthma episode.



Americans spend about 90% of their time indoors, on average. The individuals who are most susceptible to indoor air pollution are the same people who spend the most time at home: children, pregnant women, elderly people and people with chronic diseases. The air inside a home, school or office building can have **pollutant** levels that are 2-5 times higher than outside. It is important for everyone to have healthy indoor environments with good air quality.

How are indoor air quality and asthma related?

A healthy indoor environment is important for everyone, but especially for people with asthma. There are many common household items, like cleaners and feather pillows, that can cause problems for people with asthma by triggering an asthma episode. Often, an individual may have an **allergy** to an item that triggers the asthma episode, but sometimes the episode is related to poor air quality, rather than an allergy. Many **asthma triggers** can usually be found in homes, schools and offices. Every individual with asthma is affected differently by asthma triggers based on their individual susceptibility. One person may have **exercise-induced asthma** and only have a problem during physical activity. Another person may be allergic to furry pets and feather pillows; just being in the same room with these triggers may cause an asthma episode. Each individual with asthma needs to learn to recognize their own triggers so they can avoid the them, as well as carefully monitor their asthma when exposed to a trigger.

If you have a friend or relative with asthma, it is a good idea to learn about their asthma triggers so you can help them avoid these items.

Pollutant:
Something that causes contamination of air, water or soil.

Allergy:
A hypersensitivity that causes a range of symptoms, including sneezing, watery eyes, and rashes. People can be allergic to foods, pollen, dust, animals and other items.

Asthma triggers:
A particular item that causes someone to have an asthma episode. A person may be allergic to the trigger, such as a furry pet. The trigger may be related to air pollution. Each individual with asthma has their own unique set of triggers.

Exercise-induced: asthma (EIA)
A type of asthma that is triggered by physical exercise.

What is mold?

Have you ever opened up a bag of bread only to discover fuzzy mold? Mold has all kinds of good uses, such as creating cheeses like blue cheese and Roquefort. The useful antibiotic penicillin is created from a special type of mold. Yet, some types of mold can cause trouble, such as when it grows in a damp basement or covers the wall in a bathroom. Some types of mold can cause health problems, especially for people with allergies and asthma.

Mold and mushrooms are both types of fungi. Green plants contain a chemical called chlorophyll that allows them to use the process of photosynthesis to create food from sunlight and water. Fungi do not have chlorophyll and cannot make their own food. Instead, a fungus absorbs nutrients from rotting materials. Some types of mold grow on food, such

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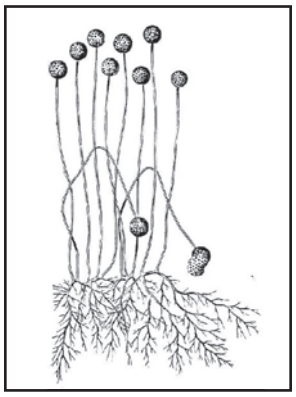
as bread, cheese and fruit. Some types of mold grow on decaying wood. One type of mold grows on moist materials in homes, such as damp plaster or wall board.



Bread mold

Mold grows by producing tiny spores that float around in the air. If a mold spore settles on the right kind of surface, it starts to grow. For people with allergies and asthma, breathing mold spores may cause their symptoms to worsen.

One type of mold has received a lot of attention lately. Black mold, or *Stachybotrys*, has been called "toxic mold." It was first believed that the mold caused serious illness, including death in infants. However, later scientific studies found no link between the presence of the mold and these conditions. People with serious allergies or asthma may be more sensitive to molds. They may experience symptoms such as itchy eyes, stuffed up nose or wheezing.

Mold can grow on moist surfaces in homes, such as ceilings, floors or wall board. It often starts with a leaking pipe. Sometimes, black mold grows in the area in between walls. Today's buildings are designed to be so energy efficient that many of them are air-tight, meaning that moisture that collects between walls during construction has no way to get out.

What should you do if you see mold growing in your house? Make sure to tell your parents about the mold, as they will first need to find the source of any moisture, such as a leaky pipe, and try to fix it. Then the mold can be cleaned up with a solution of bleach and water.

Student Assessment:
Did students correctly answer the questions?

Check Your Understanding

1. Through what route of exposure are you exposed to indoor air pollutants?
Inhalation or breathing.

2. What groups of people are most susceptible to indoor air pollution?
People who spend a lot of time indoors: children, pregnant women, the elderly, and people with chronic diseases.

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HEALTHY BUILDINGS
Student Handout #2

Teacher Key

Common Asthma Triggers around the Home

Place a checkmark by the asthma triggers and air quality helpers that you think are present in your own home or school.

In the Bedroom

- ☐ Dust in bedding, rugs, curtains or stuffed animals
- ☐ Dust mites (microscopic critters that live in pillows, mattresses, blankets, rugs and carpet)
- ☐ Feather stuffing in pillows, comforters and cushions
- ☐ Furry and feathered pets should not be allowed in the bedroom of someone with asthma

In the Kitchen

- ☐ Nitrogen dioxide and carbon monoxide from gas cook stoves
- ☐ Cockroaches
- ☐ Strong cleaning chemicals
- ☐ Mold

In the Bathroom

- ☐ High humidity (moisture in the air for a long period of time)
- ☐ Mold
- ☐ Aerosol sprays (perfume, hair spray, air freshener, etc.)

In Other Rooms

- ☐ Air conditioning
- ☐ Dander (dead skin flakes), saliva and urine from furry animals
- ☐ Cold air
- ☐ Fumes (paint, solvents, etc.)
- ☐ Cigarette smoke
- ☐ Smoke and ash from a fireplace or wood burning stove
- ☐ Smoke from candles or incense
- ☐ Strong odors (perfume, air fresheners, potpourri, etc.)
- ☐ Tree and grass pollens blowing in from outside
- ☐ Insecticides or pesticides used indoors (flea bomb, roach spray, etc.)
- ☐ Wood smoke from fire places or wood stoves

At School

- ☐ Chalk dust from chalk boards
- ☐ Strong smelling art supplies (glues, paint, glazes, stains, etc.)
- ☐ Furry or feathered animals kept as classroom pets
- ☐ Strong cleaning products
- ☐ Tree and grass pollens blowing in open windows or doors
- ☐ Dust in carpet or curtains

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Air Quality Helpers

- ☐ Air purifier
- ☐ Vacuum cleaner with a HEPA filter (a special filter that can capture small particles such as dust and pet dander).
- ☐ Fans to vent moisture outside (such as the exhaust fan above a stove or a bathroom fan)
- ☐ Regularly maintained filters on heating and air conditioning systems
- ☐ Dehumidifier in damp areas (like a basement)
- ☐ Cigarette smoking not allowed inside
- ☐ Regular cleaning to control dust
- ☐ Dust mite covers on mattresses and pillows
- ☐ Use of natural cleaning products

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Lesson Three:
FIRE AND SMOKE

Lesson Overview

This lesson explores smoke as an outdoor air pollution problem that can trigger asthma episodes. Students explore several demonstrations that illustrate the link between particulate matter created by incomplete burning of fuel and how temperature inversions can worsen air pollution problems. Students also read about how wood smoke, agricultural field burning, and wildfires can worsen asthma symptoms. Extension activities are also included for additional classroom work or homework assignments.

Suggested Grade Levels: 7 & 8
Curriculum Connections: Outdoor air pollution, combustion, weather patterns, environmental science, asthma triggers, exploring models.

EALRs Addressed

This lesson addresses the following Washington State Essential Academic Learning Requirements (EALRs). The benchmarks listed are for grade 8 in science.

In this lesson, the student is asked to:

- Explain how human societies' use of natural resources affects quality of life and the health of ecosystems. (Science 1.3 Environmental and Resource Issues).
- Correlate models of the behavior of objects, events, or processes to the behavior of the actual things; test models by predicting and observing actual behaviors or processes. (Science 2.1 Modeling).

Teacher Background

For a more in-depth understanding of asthma, fire and smoke consult the following resources that were used to prepare this lesson:

- **Puget Sound Clean Air Agency's "Clean Air Express" Curriculum**
  http://www.pscleanair.org/news/cleanairexpress.html
- **Burning Issues—Wood Smoke Information**
  http://www.webcom.com/~bi/
- **Washington Department of Ecology Publications of the Health Effects of Wood Smoke**
  http://www.ecy.wa.gov/ (Search for "wood smoke health" for a variety of publications.)
- **Outdoor Burning Information**
  http://www.ecy.wa.gov/programs/air/outdoor_burning.htm
- **Washington Department of Ecology Agricultural Burning Information**
  http://www.ecy.wa.gov/programs/air/aginfo/agricultural_homepage.htm
- **Power Point Presentation on Agricultural Burning Study**
  "Pullman Ag Burning Health Effects Study"
  http://depts.washington.edu/pmcenter/res_reports.html
- **University of Washington's Fire, Smoke and Health Information**
  http://depts.washington.edu/wildfire/

Please be aware that **Activity #1** requires the use of matches, candles and Bunsen burners. Please be careful around open flames and take care not to set off the fire alarm. Keep a fire extinguisher nearby. This activity may be more appropriate as a teacher-led classroom demonstration.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Teacher Preparation

Materials:

Activity #1 — as a class demonstration:

- Candle; Bunsen burner; matches or lighter; two glass jars or heatproof plates

Activity #2 — as a class demonstration or in groups:

- Three identical glass containers, such as glass beakers or jars; water; salt; red, green and blue food coloring; pipette or eye dropper; cup or other container for mixing water; funnel; rubber tubing; stirring rod; hot plate, burner, or mug warmer.

- Make enough copies of the **Student Handout** for each student or group to have a set. Master copies of the handouts are included at the back of this book.

- If you are the first teacher in your team to use this FACT FILE, make copies of the student handout entitled, **Student Introduction: Environmental Health and Asthma**. Ensure that students have read the handout and mastered the content and vocabulary.

Procedure

- Have the students read **Student Handout #1** before beginning the following activities. The **Check Your Understanding** questions may be answered individually in writing or verbally in small groups.

- **Activity #1: Incomplete combustion**

  This activity might work best as a teacher-led demonstration to the class.

- Light the candle. Hold the glass jar or plate over the candle about 2 inches above the flame for about 30 seconds. If using a jar, hold the mouth of the jar over the flame at a 45 degree angle. Then, show the students how black soot has collected on the jar or plate. This soot is a result of incomplete burning of the candle wax. The soot is made up of tiny particles—or particulate matter—that combustion emits into the air. The flame also produces gases, which we cannot see.

- Now light a Bunsen burner. Repeat the above demonstration with the second jar or plate. Compare the jar or plate with one from the candle demonstration. Note that the Bunsen burner did not produce any soot, since the natural gas burns more completely and cleanly.

- Return to the candle. Hold the lit candle in one hand and a lit match in the other hand. Gently blow out the candle, then use the match to re-light the smoke chain (do not lit the wick). The smoke chain will light, causing the candle wick to re-light. Discuss how fuels that burn incompletely release harmful gases and particulate matter into the air.

- Discuss how wood smoke produces thick, dark smoke filled with harmful particulate matter, while natural gas burns more cleanly. However, the combustion of natural gas in stoves and fireplaces does cause an increase in nitrogen oxide, an indoor air pollutant. Other fuels, such as coal, oil and gasoline, also burn incompletely and produce smoke and soot.

- Refer to the circle graph in the **Student Handout #1** that shows air pollution sources in Washington State. Point out how much air pollution is attributed to indoor burning in wood stoves and fireplaces and to outdoor burning.

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- **Activity #2: Temperature inversion**

  This demonstration illustrates how a temperature inversion works. Inversions can cause major air pollution episodes when a layer of pollution is trapped between layers of cold and warm air. In this activity, water represents different temperatures of air. This activity can be done as a teacher-led demonstration to the class or can be done by students working in small groups. Explain that air has some fluid-like properties and will form “layers” by temperature.

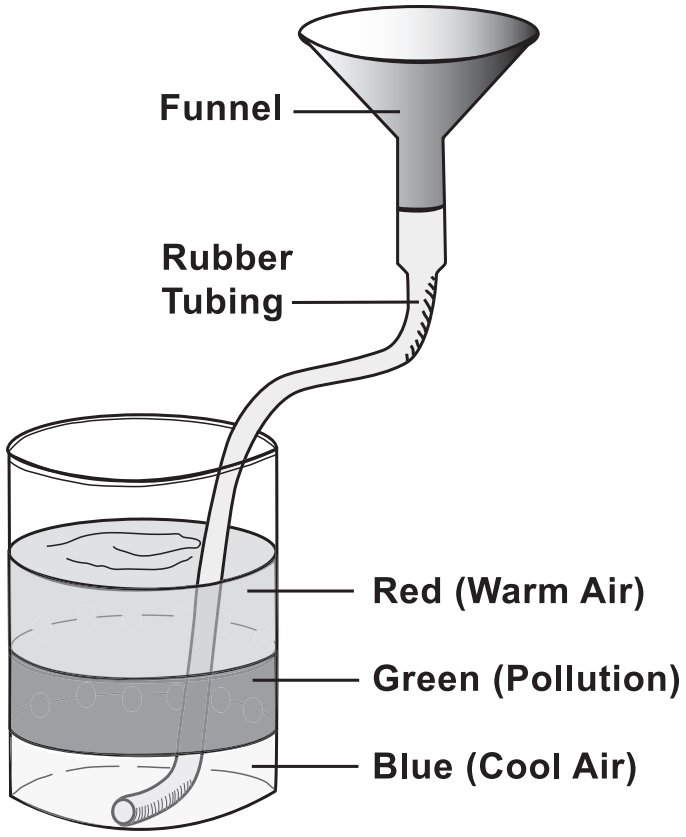
- Fill the three containers each a little less than half full with warm water. Put some red food coloring in the water in each container. Explain that the red water represents warm air and that it is less dense than cold air.

- Fill a cup or other mixing container with cold water and saturate it with salt (add salt until no more will dissolve). Dye this water blue. Explain that this represents cold air and that it is more dense than warm air.

- Fit the rubber tubing snugly over the end of the funnel. Pour the blue water slowly and carefully through the funnel into each container, making sure that the tubing is on the bottom of the container. This should result in two layers—blue on bottom and red on top.

- Fill a cup or other mixing container with lukewarm water. Add green food coloring and lightly salt the water. Explain that this represents air pollution.

- Show what happens when pollutants enter the air during an inversion. Use a pipette to slowly introduce the “pollution” to the other mix in each of the three containers. It will settle in a layer somewhere between the red and blue water.



- Explain that this is what happens when there is an inversion. The air is stagnant with little wind. This condition keeps the "cold" heavy air and "warm" light air from mixing, making it easier for pollution to become trapped above the cold layer of air. Instead of mixing in and blowing away, the cold air keeps the pollution trapped within our breathing space. Air pollution is generated daily by human activities such as indoor and outdoor burning, motor vehicles and industrial emissions. As the **Student Handout** explains, episodes of stagnant air and temperature inversions have been linked to increased cases of asthma episodes and other respiratory diseases. Set Container #1 aside.

- Demonstrate what happens when a windstorm comes into an area during an inversion. Use the stirring rod to stir up Container #2 so that the layers of mix.

- Demonstrate what happens when the ground begins to warm up. Place Container #3 on a mug warmer, burner or hot plate. Watch as the layer of cool, blue water warms up and begins to rise. You should see a mixing of the layers as the warm water rises and cool water sinks. (You can also see this kind of thermal mixing in a cup of hot coffee when cold cream is poured in). These density currents can also be likened to weather and ocean currents.

- Compare Container #1 with the stable inversion model to Containers #2 and #3 that show how the inversion has been dispersed.

Student Assessment:
Use these questions as discussion points.

Check your students' understanding by asking the following questions:

- How might agricultural burning, wood smoke and wildfires be related to temperature inversions?

- Why are temperature inversions more common in valleys and areas bordered by mountains?

- What can people do during an inversion to reduce air pollution?

- What kind of weather is needed to break up an inversion?

- Explain why the fluids form distinct layers?

- Compare observed liquid densities with gases. Would the gases behave the same? Why or why not?

- How does the temperature inversion model relate to weather patterns and ocean currents?

Activity #1 and #2 were adapted with permission from Puget Sound Clean Air Agency's "Clean Air Express" curriculum.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Student Assessment

Student work can be assessed in the following ways, for a total of 100%.

10%	Did students view the demonstrations **Activity #1: Incomplete Combustion** and **Activity #2:Temperature Inversion**?
70%	Did your students read **Student Handout #1** and complete the **Check Your Understanding Questions**?
20%	Did students participate in a **class discussion** about outdoor air pollution and human health?

Extension Activities

The extension activities provide for more in-depth assessment of student understanding.

Burning Fuel

- Students burn different types of combustible fuel materials and compare what kinds of materials are released into the air from each fuel type. A lesson plan for this activity can be downloaded from the Clean Air Express curriculum. Look for Lesson #2 in the "Supplemental Activities 6-8" section.
  http://www.pscleanair.org/news/cleanairexpress.shtml

Charting Weather Patterns

- Students collect different types of weather data over several weeks, examining links between air pollution and weather. A lesson plan for this activity can be downloaded from the Clean Air Express curriculum. Look for Lesson #3 in the "Supplemental Activities 6-8" section.
  http://www.pscleanair.org/news/cleanairexpress.shtml

Satellite Images

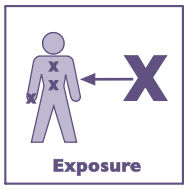
- You can access a NOAA website with recent satellite images of forest fires to show students the geographic impact of the smoke plume. NOAA Satellites and Information website.
  http://www.osei.noaa.gov/

FIRE AND SMOKE
Student Handout #1

Teacher Key

Smoke in Your Lungs

Every day, you breathe in tiny **particles** from smoke that can be harmful to your lungs. Just think about all the different sources of smoke that may surround you in your own home: wood smoke from fireplaces and wood stoves, cigarette smoke, smoke from burning candles and incense, and smoke from cooking foods, especially when frying or sautéing or when you accidentally burn your dinner. For people with asthma, the tiny particles in smoke can trigger asthma episodes and worsen their symptoms.



Particles: Tiny pieces of a substance that are suspended in the air, such as dust or ash.

These different sources of indoor smoke can make the air within your home unsafe, especially for people with asthma. In addition, sometimes bigger events can cause serious outdoor air **pollution** problems that can affect a large number of people, such as wood fires in the winter time, field burning and wildfires.

Pollution: The act of contaminating the air, water or soil with toxic substances.

Smoke is filled with tiny particles. These particles are less than 2.5 micrometers in diameter. A micrometer is one millionth of a meter, about the same as dividing one inch into 25,400 parts. These particles are so small that the diameter of a human hair is about 70 times bigger; a grain of salt is 100 times bigger. These particles are too small to be filtered by the nose and are inhaled deep into the lungs, where they can immediately cause inflammation or remain for months before causing trouble.

Killer Smog

Some of the worst cases of air pollution in history happened because of a weather pattern that trapped pollution close to the ground for days, creating a killer smog.

Temperature Inversion: An atmospheric condition in which a layer of warm air traps a layer of cold air close to the ground, causing the stagnant air to trap pollution near the ground.

A **temperature inversion** is caused when a layer of warm air traps a layer of cool, heavy air close to the ground. Oftentimes, this happens on cold, clear, calm nights when the ground cools rapidly. The cold ground cools the air closest to it, but the air higher up is slower to cool. The upper warm layer of air acts like a lid, trapping the cool air—and any air pollution—close to the ground.

Stagnant: Air that is motionless because there is no wind.

Air pollution, such as vehicle emissions or smoke from chimneys, can become trapped in the layer of cool air. If the air is **stagnant** for too long, it may allow high levels of pollution to accumulate and create **smog**. If pollutant levels become too high during a temperature inversion, people may be advised to stay indoors and avoid exercising. Sensitive people, such as infants, the elderly, or people with respiratory diseases like asthma may need to take extra precautions during a temperature inversion.

Smog: A term that was coined in London in 1911 to describe the thick smoke and fog that hangs in the air over industrialized areas. Now the term is incorrectly, but commonly used to describe low-lying air pollution often caused by motor vehicles.

Temperature inversions can occur in almost any region, but they are most common in valleys or areas like the Puget Sound region that are bordered by mountains. Temperature inversions are common in winter time, when stagnant air and temperature inversions trap pollution in our breathing space. A temperature inversion will break up from a windstorm or when the ground heats up and the warm air rises, therefore mixing up the layers of the inversion.

In 1948, there were no air quality laws to limit how much pollution factories could put into the air. The small factory town of Donora, Pennsylvania is known for an air pollution tragedy that

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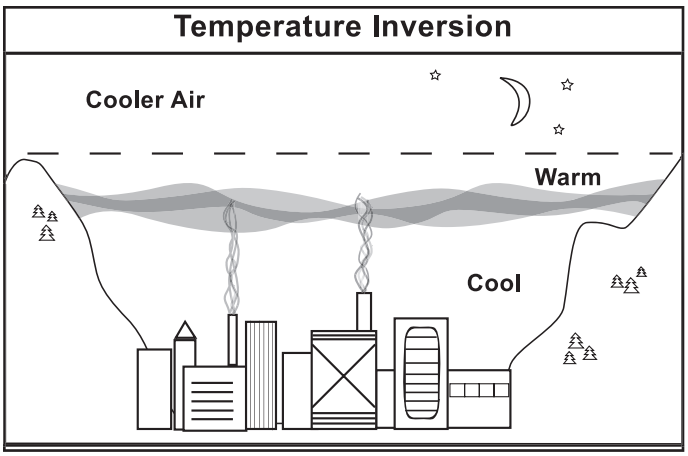
helped emphasize the need for today's air quality laws. In October of 1948, the town of Donora experienced an unusually long temperature inversion. The inversion combined with toxic pollutants including flouride gas from a zinc and steel factory, trapping the pollutants in the stagnant air hanging over the town. The air was heavy with yellow-white smog that became so thick that the town's residents could not see well enough to drive; even walking outside became difficult. People did not understand that the smog was dangerous for their health. The thick smog contributed to the deaths of 21 people in two days. One-third of the town's population—about 6,000 people—became ill.



A similar disaster occurred in London in 1952. A week-long temperature inversion combined with heavy pollution from coal factories, diesel buses and coal burning stoves to create killer smog. In four days, the smog contributed to the deaths of about 4,000 people. The total number of people who died is closer to 12,000 people. This was not the first time London had experienced killer smog. In 1909, stagnant air and coal burning contributed to the deaths of 1,000 people in one winter. Later, in 1962, 750 people died from causes related to smog. Both the Pennsylvania and the London disasters caused the citizens of Donora and London to demand that their governments develop laws to protect clean air and help prevent further disasters caused by killer smog.

Check Your Understanding

1. How does a temperature inversion make pollution worse?
An inversion traps air pollution in a layer of cold air that is held close to the ground by an overlying layer of warm air. The pollution is trapped in people's breathing space.

2. What caused the smog in Pennsylvania and London?
The combination of a temperature inversion and industrial and residential emissions (factories, coal burning stoves and diesel buses) caused the killer smog.

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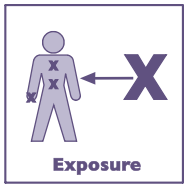
Wood Smoke



Most people enjoy the cozy smell of a crackling fire in the fireplace. Some people depend on wood-burning fireplaces and stoves for cooking and heating. Did you know that wood smoke is filled with substances that are potentially harmful to humans? Wood does not burn completely, so it may release harmful substances in its smoke. Wood smoke can irritate the eyes, cause headaches and trigger allergies and asthma episodes.

Wood smoke contains over 200 chemicals. The smoke includes a combination of substances that are dangerous for humans to inhale, including carbon monoxide, particulate matter including soot and ash, and some cancer-causing compounds. Also, other kinds of toxic substances in the air may attach to the particles in wood smoke, actually hitching a ride deep into your lungs where they can potentially cause serious health problems. Wood smoke can make many respiratory diseases worse, including asthma.

Half of the homes in Washington State have fireplaces. There are over a half million fireplaces and wood stoves in the Puget Sound area alone. In urban and suburban areas, wood smoke can become concentrated and cause a big outdoor pollution problem.

Pollution from wood-burning fireplaces and stoves makes up about 9% of all of the outdoor air pollution in Washington State each year. However, this pollution is concentrated in the winter months when the air is often stagnant and when temperature inversions occur. On a crisp winter day, about 80% of the air pollution in some neighborhoods is caused from smoke from fireplaces and wood stoves.

Tips for better burning:

- Outdoor burning of yard waste is banned in many urban growth areas, such as the Puget Sound region. In other areas, check to see if a burn ban is in effect.
- Burning garbage is illegal because materials like plastics can produce harmful smoke.
- If possible, use alternative heat sources, such as natural gas, electric furnaces or pellet stoves.
- If you must burn wood, choose compressed sawdust logs (Presto Logs), which burn more completely than stick wood does. If you must burn wood, only burn dry wood that has aged for at least six months.

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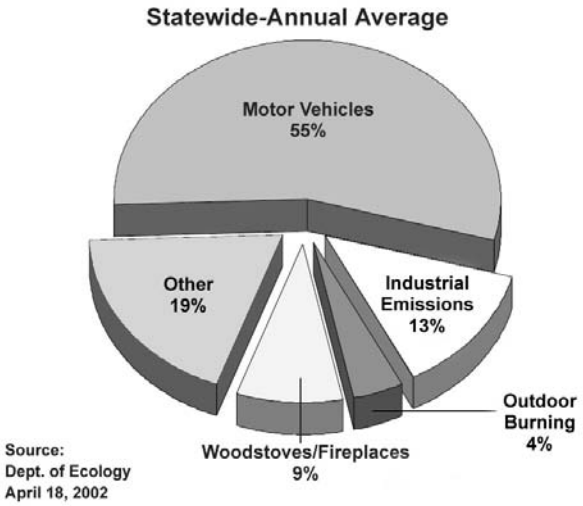
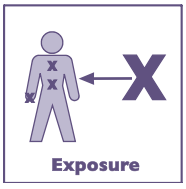
AIR POLLUTION SOURCES IN WASHINGTON



Check Your Understanding

1. Why are wood smoke particles dangerous?
Wood smoke contains over 20 chemicals, some of which are dangerous to human health. Wood smoke may trigger asthma episodes.

2. Temperature inversions most often occur on cold, winter days. What happens to wood smoke during a temperature inversion?
The temperature inversion traps the wood smoke close to the ground. The smoke cannot disperse and hangs around in your breathing space.



Agricultural Field Burning

Field burning is a traditional method of getting rid of unwanted plant parts left over after harvest and preparing the fields for a new crop. Cereal (wheat, barley, corn and oats) and grass seed farmers have historically used field burning to get rid of stubble and straw and to take care of pest infestations and disease. However, setting fire to acres and acres of fields causes huge clouds of smoke. This smoke can cause health problems for people who inhale it, especially for people with asthma. Smoke from field burning has sometimes drifted over major highways and caused car accidents. The car accidents brought attention to the issue of field burning and caused changes to laws throughout the Pacific Northwest concerning field burning.

Many states now allow only a small number of acres to be burned each year on days where the weather makes it the safest. Other states continue to allow field burning, but provide information to the public on when and where field burning will take place. Many farmers

depend on crop burning as an inexpensive, effective way of preparing a field for the next growing season.

Some farmers are exploring alternative ways to deal with unwanted plant parts instead of burning them. Stubble and straw can be raked, mowed, chopped and left to decompose in the soil. Leftover straw can be made into an interesting particleboard material that is used to build kitchen cabinets and countertops. Scientists are also researching the use of straw as a pulp to make paper.

Check Your Understanding

1. What are some pros and cons of field burning?

Pros: Field burning is a way to get rid of unwanted plant parts after harvest and to get rid of insect infestations and disease. It is inexpensive and effective.

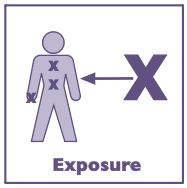
Cons: Field burning causes clouds of smoke, which can cause health problems. Also, the smoke has caused car accidents in the past.

Just Say No to Wildfire Smoke

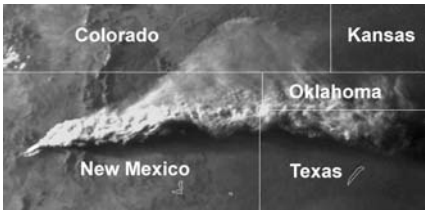
Wildfires can be sparked by lightening, started by an abandoned camp fire or purposefully lit as part of a **controlled burn** to remove dry brush, grass and diseased trees.

Controlled Burn: A fire that is purposefully set and carefully monitored in order to burn dry brush, grass or diseased trees.

Smoke from wildfires has the same health impacts as wood smoke from fireplaces and wood stoves. However, the amount of smoke from a wildfire is much worse, often blanketing entire communities in thick, choking smoke. All people can be harmed by inhaling this smoke, but people with respiratory diseases like asthma have to be extra careful around a wildfire. Sometimes, people who are sensitive to wood smoke must stay indoors or may even need to evacuate to someplace less smoky.



Smoke from wildfires can travel long distances, so a fire in a different area can still have a big impact. For example, the Cerro Grande wildfire in Los Alamos, New Mexico was started as a controlled burn by the National Park Service in May 2000. After just one day, the fire quickly got out of hand and ended up burning more than 47,000 acres. Over 25,000 people in New Mexico were forced to evacuate their homes during the fire. Smoke from this fire traveled across New Mexico, Colorado, Oklahoma and Texas.



Satellite image of Cerro Grande Fire in New Mexico

One California town has found a creative way to avoid doing controlled burns. The town of Mill Valley has employed 500 goats to gobble up dry brush and grass. The town hopes that their new four-legged employees will help reduce air pollution from the controlled burns they once used in the area.

Check Your Understanding

1. If smoke from a distant wildfire blanketed your community, what could you do to protect yourself from the smoke?

Answers will vary, but may include: avoid going outside; avoid exercising; keep windows closed; evacuate; etc.

Lesson One: ATHLETES WITH ASTHMA

Lesson Overview

Biography Boxes

In this lesson, students are encouraged to research the lives of professional athletes who have asthma. Each student then designs a cereal box featuring their chosen athlete, similar to Wheaties™ cereal boxes. Each biography box includes a cover illustration featuring the athlete, a description of asthma and a short biography of the athlete. Extension activities are also included for additional classroom work or homework assignments.

Suggested Grade Levels: 7 & 8
Curriculum Connections: Biographies, research, publishing.

EALRs Addressed

This lesson addresses the following Washington State Essential Academic Learning Requirements (EALRs). The benchmarks listed are for grade 7 in language arts.

In this lesson, the student is asked to:

- Write in a variety of forms. Write in a variety of forms and genres (narratives, journals, poems, essays, stories, research reports, etc.). (Writing 2.3).
- Publish. Select from a variety of publishing options. Produce a legible, neat final product. Use different technologies to produce a finished product. (Writing 3.5).
- Read to learn new information. Understand and use materials to investigate a topic (reference materials, encyclopedia, manuals, public documents, newspaper and magazine articles, trade publications, etc.). (Reading 3.1).

Teacher Background

This lesson strives to help students learn that while asthma is a chronic condition that needs to be taken seriously, with proper medical management, it does not need to impact a person's ability to participate in sports. In fact, many physicians encourage children with asthma to participate in sports in order to increase their overall fitness.

In the 1998 Winter Olympics in Nagano, Japan, 22.4% of the U.S. athletes had been diagnosed with asthma at some point in their lives and 17.3% were currently taking medications for asthma. Asthma is a common condition among Olympic athletes. However, these athletes and their coaches know that with proper medical management, asthma does not need to interfere with the athletes' performance.

In the 1996 Olympic Games in Atlanta, Georgia, at least one in six U.S. athletes had a history of asthma. A total of 16.7% of all the U.S. athletes had a history of asthma, while 10.4% of the athletes had active asthma and were currently taking medications to control their asthma. How did the athletes with asthma compare to their competition? Nearly 30% of the 1996 U.S. Olympians who had a history of asthma or took asthma medications won medals in their competition. They fared just as well as athletes without asthma, of which 28.7% earned medals. In comparison, 4 to 7% of the general population is reported to have asthma.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

For a more in-depth understanding of professional athletes and other famous people with asthma, consult the following resources that were used to prepare this lesson:

- **Wheaties™ Cereal Home Page.** You can access over 75 cereal boxes featuring professional athletes.
  http://www.wheaties.com/index.asp
- **Famous People with Asthma in History**
  http://www.nlm.nih.gov/hmd/breath/breathhome.html
  http://www.getasthmahelp.org/famous_people.asp
- **Tips to Remember: Exercise-Induced Asthma**
  http://www.aaaai.org/patients/publicedmat/tips/exerciseinducedasthma.stm
- **Sports and Asthma**
  http://getasthmahelp.com/kids_sports.asp
- **Winning the Gold with Asthma**
  http://www.savvyhealth.com/disp.asp?doc_id=159

Teacher Preparation

- **Materials:**
  Copies of **Student Handout #1 and #2**; cereal boxes; art supplies.
- Make enough copies of the **Student Handouts #1 and #2** for each student or group to have a set. Master copies of the handouts are included at the back of this book.
- If you are the first teacher in your team to use this FACT FILE, make copies of the student handout entitled, **Student Introduction: Environmental Health and Asthma**. Ensure that students have read the handout and mastered the content and vocabulary.

Procedure

- **Introduction**
  Ask students to think of their favorite sport or physical activity, such as soccer, gymnastics, football or swimming. Ask students to write the name of their favorite sport at the top of a piece of paper. Then, hold a 5 minute free-write time where students can respond to the following prompts. You may want to write the prompts on the board or use an overhead projector. You can also hold a discussion using these prompts as targets.
  - What fitness level is required to play this sport?
  - How are the athlete's lungs affected when they participate in this sport?
  - How do you think having asthma would affect an athlete's performance in this sport?
- **Biography Boxes**
  Hand out **Student Handout #1,** which provides background on athletes and asthma. Then distribute **Student Handout #2** with the list of athletes with asthma. Ask the students to each choose an athlete on the list for their biography

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

project. You may want to have students only choose someone on the list, or you can give them the option of choosing someone they know who is an athlete with asthma. In addition, there are many famous politicians, writers, and entertainers from history that have had asthma. You may want to give students the option of choosing someone outside of the sports world.

- Allow students the time and resources they need to conduct research on their chosen athlete. The Internet may be the best source of information on current athletes. You may want to discuss with your students ways to analyze Internet sites to decide if they make valid sources of information.

- Challenge each student to write a brief biographical sketch on their chosen athlete. The biography should be no more than one page in length. You may want to have students turn in a rough draft of their biographical sketches to you for comments before they go on to create their cereal boxes. Student's biographical sketches should include:
    - Athlete's name
    - Where they grew up
    - What event or sport the athlete participates in
    - What team they play for (if a team sport), their position and particular event (such as "linebacker" or "the 800 yard relay")
    - What medals or honors the athlete has been awarded
    - When and/or how the athlete was diagnosed with asthma
    - How the athlete views their asthma

- Students then create a cereal box featuring their athlete. You may want to bring in a WHEATIES™ cereal box to show students an example. Students can use a real cereal box for the base of their project, but they need to completely cover the box with their own design. The cereal boxes should include the following elements:
    - A fictitious brand name for the cereal
    - An image of the featured athlete on the front of the cereal box, either a photograph printed from the Internet or photocopied from a book or magazine, or a neatly drawn illustration. The athlete's name should be featured on the front of the box.
    - The back of the box includes the biographical sketch about the athlete
    - One side panel includes a definition of asthma
    - One side panel includes a list of resources that the student used to obtain information about their athlete
    - **Extra credit**:
      Design some sort of freebie to include in the cereal box, such as a trading card featuring the athlete.

- **Wrap-Up**
  Conclude the activity with a discussion focused on the question, "Why are there so many Olympic athletes with asthma?" Scientists have tracked the number of Olympic athletes with a history of asthma, but do not know why there is such a high percentage of athletes with asthma, as compared to the general population. One reason may be that children with asthma are often encouraged by their doctors to participate in a sport to help increase their overall fitness. Can your students think of some other possible reasons?

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Student Assessment

Student work can be assessed in the following ways, for a total of 100%.

10%	Did students participate in a five minute **free-write** responding to prompts about sports and asthma?
5%	Did students read **Student Handout #1**?
85%	Did students create a **cereal box** featuring their chosen athlete, including the required elements? • 40% **Biographical sketch** on the athlete, including all the required parts, located on the back of the box. • 5% Fictitious **brand name** for the cereal. • 5% An **image** of the featured athlete on the front of the box. • 5% A **definition of asthma** on one side panel. • 10% A list of research **sources** on one side panel, in correct bibliography format. • 10% Diversity and validity of **research** sources. • 10% **Neatness, color** and **creativity**.

Extension Activities

Letter Writing to Athletes

- Students can write letters to their chosen athlete asking them about their experiences with asthma. Many athletes have fan clubs or official websites where contact information may be listed. Athletes that are part of a professional team, such as the WNBA, NBA, NHL or NFL, USA Swimming, and US Soccer Federation will have team contact information on their team websites.

Asthma and Sports

- Challenge students to create an informational brochure on asthma and sports to give to the coaches and student athletes at your school. Topics might include exercise-induced asthma, recognizing asthma symptoms, asthma management plans, and school policies.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

ATHLETES WITH ASTHMA
Student Handout #1

Teacher Key

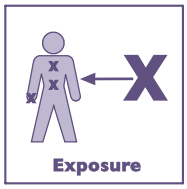
Many great athletes live with asthma. In fact, at the 1998 Winter Olympic Games, about 22% of the U.S. athletes had a history of asthma or took asthma medications. These athletes have to avoid things that make their asthma worse and take their medications regularly. However, these athletes do not let asthma stop them from competing—and winning!

One example is Tom Poti, a professional hockey player for the New York Rangers and a member of the U.S. Olympic Hockey Team. When he was very young, Tom could not run or play as hard as other kids. Now, Tom makes sure to properly treat his asthma. Tom has a message for kids with asthma who want to play sports. "Just go for it and try and work as hard as everybody else," he says. "Make sure no one is going to alter your dream by telling you can't do it because you have asthma."

Exercise Induced Asthma (EIA): A type of asthma that is triggered by physical exercise. People with EIA have a sensitivity to sudden changes in air temperature and humidity (moisture in the air).

Exercise-Induced Asthma

Many people, including some professional athletes, have **exercise-induced asthma (EIA).** EIA is a type of asthma that is triggered by physical exercise. Usually, after 5-20 minutes of physical activity, the person will feel difficulty breathing, tightness in the chest or will begin to wheeze or cough. People with EIA often take a special asthma medicine prior to beginning to exercise to keep their EIA in check. People with EIA may have a sensitivity to sudden changes in air temperature and humidity. For example, if a woman with EIA leaves her warm house on a cold, dry winter morning to go jogging, the cold air might trigger an asthma episode if she is not properly managing her asthma.



Exercising Tips for People with Asthma

People with asthma sometimes have to be careful when exercising. Here are some things they may need to do:

- **Avoid cigarette smoke**. Cigarette smoke triggers asthma episodes in many people who have asthma. When Tom Poti travels with his team, he needs to stay in non-smoking hotel rooms and eat in restaurants that do not allow smoking.
- **Avoid exercising in polluted air**. Air pollution from cars, trucks, buses and other sources can trigger an asthma episode. People with asthma or other lung problems should avoid exercising near busy roads or freeways, especially during rush hour or on warm days.
- **Avoid breathing cold, dry air**. People with asthma may need to wear a scarf or mask over their nose and mouth when they exercise in the winter to help warm the air before they breathe it.
- **Warm up and cool down during each workout.** People with asthma can have a reaction if they exercise too hard or too fast without a proper warm up. They need to let their lungs adjust gradually to a workout.

Source: Michael O'Reilly. 2002. Athletes vs. Asthma. *Secondwind Magazine.*

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

ATHLETES WITH ASTHMA
Student Handout #2

Teacher Key

The following list includes some professional athletes who have asthma. You may select an athlete from this list, or find your own favorite athlete that has asthma. The information below includes some website links that provide information about the individual athlete's experiences with asthma. See what other information you can find on the internet and from other sources.

BASKETBALL

Hakeem Olajuwon
Hakeem "the Dream" Olajuwon is a NBA star center for the Toronto Raptors and was selected as "One of the 50 Greatest Players in NBA History." He is from Lagos, Nigeria and was born in January, 1963.

http://espn.go.com/nba/news/2000/1027/840984.html
http://www.nba.com/players/

FOOTBALL

Chad Brown
Chad is a NFL linebacker for the Seattle Seahawks. He is also a spokesperson for the American Lung Association of Washington. He is from Altadena, California and was born in July, 1970.

http://www.alaw.org/support_alaw/media_center/1999_media_release/october_26.html
http://www.seahawks.com
http://www.nflplayers.com

Martin Chase
Martin is a NFL defense tackle for the Jacksonville Jaguars. He is from Lawton, Oklahoma and was born in December, 1974.

http://www.umdnj.edu/about/news_events/releases/04/r040526_asthmatic.htm
http://www.jaguars.com
http://www.nflplayers.com

Jerome Bettis
Jerome is a NFL running back for the Pittsburgh Stealers. He is from Detroit, Michigan and was born in February, 1972.

http://www.usatoday.com/news/health/spotlight/2001-09-04-bettis-asthma.htm
http://www.lungusa.org/site/apps/nl/content2.asp?c=duLUK900E&b=34893&ct=567025&notoc=2
http://www.steelers.com/
http://www.nflplayers.com

Amani Toomer
Amani is a NFL wide receiver for the New York Giants. He is from Berkeley, California and was born in September, 1974.

http://www.usatoday.com/news/health/spotlight/2001-10-22-toomer-asthma.htm
http://www.giants.com
http://www.nflplayers.com

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Jimmy Smith
Jimmy is a NFL wide receiver for the Jacksonville Jaguars. He is from Detroit, Michigan and was born in February, 1969.

http://www.usatoday.com/news/health/spotlight/2002-01-04-smith-asthma.htm
http://www.nflplayers.com

HOCKEY

Tom Poti
Tom is a NHL defense player for the New York Rangers and has played on the U.S. Olympic Hockey Team. He is from Worcester, Massachusetts and was born in March, 1977.

http://www.newyorkrangers.com/
http://www.nhlpa.com/Content/THE_PLAYERS/player_bio1.asp?ID=6197

KAYAKING

Karen Furneaux
Karen is the former World Champion in Women's Kayaking. She is from Waverly, Nova Scotia in Canada.

http://www.canoekayak.ca/eng_bio.cfm?ID=9
http://www.cleanairchampions.ca/onetonnechallenge/champions.asp?title=champions&championid=11

RUNNING/TRACK

Rep. Jim Ryun
Jim is a former Olympic silver medal runner who is now a U.S. Congressmen. He still holds the male High School Mile Record. He is from Wichita, Kansas and was born in 1948.

http://www.drgreene.com/21_1332.html
http://www.umm.edu/careguides/asthma/asthma_jim.html

Jackie Joyner-Kersee
Jackie is an Olympic gold medal track and field star. She has earned four World Titles. She is sometimes called the "greatest all-around female athlete in the world." She is from East Saint Louis, Illinois and was born in March, 1962.

http://www.heathtalk.com/aen/path/jackie1.html
http://www.nlm.nih.gov/hmd/breath/Faces_asthma/present_html/VIIB15.html
http://www.usatoday.com/news/health/spotlight/2002/01/31/spotlight-kersee.htm

SWIMMING

Amy Van Dyken
Amy is an Olympic gold medal swimmer. She won four gold medals in a single Olympic Games. She was on the cover of a Wheaties cereal box in 1996. She is from Englewood, Colorado and was born in February, 1973.

http://www.geocities.com/Colosseum/8361/amybio.htm
http://www.cnn.com/HEALTH/9910/27/chat.vandyken/
http://www.usswim.org/superstars/template.pl?opt=biosearch&name=337
http://www.ahealthyme.com/topic/asthmaqu

Tom Dolan
Tom is an Olympic gold medal swimmer and is a World Record Holder. He was featured on a Wheaties box in 1996. He is from Arlington, Virginia and was born in September, 1975.

http://www.savvyhealth.com/disp.asp?doc_id=159

Kurt Grote
Kurt is an Olympic gold medal swimmer. He once was quoted as saying, "I have asthma. I live with that fact every day, but I do not let my asthma control my life. I control my asthma." Kurt is studying to become a pediatrician so that he can help other kids with asthma. Kurt is from San Diego, California and was born in August, 1973.

http://www.aaaai.org/patients/just4kids/grote/letter.stm
http://www.sfgate.com/sports/olympics96/profiles/grote.html

Misty Hyman
Misty is a senior at Stanford. She plans to swim at the 2004 Olympics in Greece. She is from Phoenix, Arizona and was born in March, 1979.

http://www.ahealthyme.com/topic/asthmaqa

TRIATHLETE

Joanna Zeiger
Joanna is a world class triathlete (swimming, cycling and running) who has participated in Ironman competitions. She is from San Diego, California and was born in May, 1970.

http://www.aaaai.org/patients/just4kids/exercise_induced/default.stm
http://www.joanna-zeiger.com

Lesson Two: READING ABOUT ASTHMA

Lesson Overview

Students choose from a list of young adult literature that features a main character with asthma. Students then write a book report that includes reflecting on how the character's asthma impacted his or her life and how the character dealt with the asthma. Extension activities are also included for additional classroom work or homework assignments.

Suggested Grade Levels: 6 - 8
Curriculum Connections: Book reports, writing about literature, media studies.

EALRs Addressed

This lesson addresses the following Washington State Essential Academic Learning Requirements (EALRs). The benchmarks listed are for grade 7 in language arts.

In this lesson, the student is asked to:

- Read for literary experience in a variety of forms. Read, discuss, and use literature to understand a variety of perspectives of self, others, and world issues. (Reading 3.3).
- Develop interests and share reading experiences. Express reasons for recommending books to others; share reading experiences with others. Share knowledge gained through reading with others. (Reading 4.3).
- Write in a variety of forms. (Writing 2.3).

Teacher Background

For a more in-depth understanding of diseases and disabilities in popular literature, consult the following resources that were used to prepare this lesson:

- **A Guide to Children's Literature and Disability**
  http://www.kidsource.com/NICHCY/literature.html

Teacher Preparation

- **Materials:**
  Teacher Resource #1; books from suggested list available at school or community library for students to check out.
- If students will be choosing which books they would like to read, make a transparency of **Teacher Resource #1** to share with your students. If you will be reading the same book as a class, you can use this resource yourself to help choose the book.
- If you are the first teacher in your team to use this FACT FILE, make copies of the student handout entitled, **Student Introduction: Environmental Health and Asthma**. Ensure that students have read the handout and mastered the content and vocabulary.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

- Review the **Teacher Resource #1,** which includes a list of suggested book titles. Each of these books includes a main character who has asthma. The different books deal with asthma on differing levels. Each book title is accompanied with a suggested reading level and a brief description of the book.

- You may want to consult your school's librarian to find out which of the books are available at your school or community library. In addition, your librarian might know of other appropriate books.

Procedure

- Ask each student to choose a book from the list of book titles. Students will then read their books and write a book report. The book report should follow the format for reports that you have established in your class, but also include a section that reflects on the character's experience with asthma.

- You may choose to have students address specific elements in their book reports. Some suggested elements are listed below:
    - Title of book
    - Author of book
    - Plot summary (in one brief paragraph)
    - Description of setting
    - Description of main characters
    - Description of writing style (point of view, dialog, word choice, etc.)
    - Recommendation (would you recommend this book? Who else might enjoy it?)

- Each of the suggested books includes a main character with asthma. Ask your students to pay careful attention to how asthma is portrayed in the book as they are reading it. Following are some questions that can help guide students' reading and that can be addressed in their book reports:
    - Who is the character who has asthma? Describe him or her.
    - How is the character's asthma described in the book?
    - What are the character's asthma triggers?
    - How does the character treat/medicate their asthma?
    - How is the character impacted by their asthma, positively and negatively?
    - Do other characters treat the character differently because of their asthma?
    - Does the book provide any information or education about asthma to its readers? If so, what did you learn?
    - How does the book make you feel about asthma? Did your reading inform your thinking about asthma?

- Challenge your students to present their book reports in a creative way, such as: a speech, an interview, a scene from a play, a diary entry, a newspaper article, a poem, a collage, a comic strip, a video or a website.

- Once the book reports are completed, hold a discussion (as a whole class or in small groups) about how asthma was portrayed in the different books read by the class. What impact did reading about asthma have on the students? What did they learn about asthma? How can books be used to teach about diseases and disabilities?

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Student Assessment

Student work can be assessed in the following ways, for a total of 100%.

25%	Did students completely and critically **read a book** from the suggested list?
50%	Did write a book report, including all of the required elements? • 5% **Title** and **author** of book. • 5% **Plot summary** (in one paragraph). • 5% Description of **setting** and **main characters**. • 5% Description of **writing style**. • 20% **Information on the character that has asthma**, asthma triggers, treatment, positive and negavie impacts, education, etc. • 5% **Recommendation**. • 5% **Proper writing conventions**.
15%	Did students present their book report in a creative way?
10%	Did students actively participate in a **class discussion** about how asthma is portrayed in popular literature?

Extension Activities

Reading Together

- Instead of having students each read a different book, assign the same book to all students or read aloud one of the books on the list to the class. Choosing one book to focus on may allow for a more in-depth class discussion about the book and how asthma is portrayed in it.

Online Reviews

- Have your students write brief online book reviews to be posted on a website. Your school librarian may be able to suggest appropriate websites that your students can submit book reviews to be published online.

Asthma Awareness

- Make posters to post around school to teach other students about asthma.

Living with Asthma

- Have your students watch the animated film, *Jimmy Neutron*, and evaluate how the character Carl Wheezer is depicted. Then, have students read a letter written from a spokesperson of the Allergy and Asthma Network of Mothers of Asthmatics to the producers at Nickelodeon. The spokesperson believes that the movie put forth stereotypes and misinformation about asthma. Students are encouraged to rewrite a scene in the movie that depicts Carl's asthma differently. For a complete lesson plan, see Baywindow's "Living with Asthma" lesson plan at:

  http://www.kqed.org/w/baywindow/asthma/livingwithasthma.html

Asthma at the Movies

Students write reviews or rewrite scenes from movies that include a character living with asthma. Some movies that include characters with asthma include:

- *Jimmy Neutron: Boy Genius*
  Character Carl Wheezer has asthma.
  Paramount Pictures, 2001. Rated G.
- *The Goonies*
  The child character Mikey Walsh has asthma.
  Warner Studios. 1985. Rated PG.
- *Hardball*
  Character Jefferson has asthma.
  Paramount Pictures, 2003. Rated PG-13

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

- *As Good as it Gets*
  Character Carol Connelly's son has severe asthma.
  Columbia/Trstar Studios, 1997. Rated PG-13.
- *Signs*
  The child character Morgan has asthma.
  Touchstone Pictures, 2002. Rated PG-13.
- *Song of Bernadette*
  The character Bernadette has asthma as a child.
  20th Century Fox,1943. Rated NR.
- *Hitch*
  The character Albert has asthma.
  Columbia Tristar, 2005. Rated PG-13.

Reading About Asthma
Teacher Resource #1

Teacher Key

☆ A star in the margin indicates books that are highly recommended due to their focus on asthma, quality of story, and links to other classroom subject matter. These books would be a good choice for reading aloud to the class or assigning the entire class to read.

As defined by Titlewave.com: Reading level is based on difficulty of words, grammar and sentence structure. Any grade above eight is considered Young Adult. Interest level is based on subject/content.

Reading Level: Less Difficult

☆ ***Facing West, A Story of the Oregon Trail*** by Kathleen Kudlinski
(Once Upon America Series)
Reading Level: 3rd grade and up
Interest Level: Grades 3-6
58 pages ISBN: 0140369147 Puffin, 1996

An 11-year-old boy in 1845 sets out for Oregon, and wonders whether he will have more trouble with the dangers of the trip or his asthma. This book sets the scene of daily life along the Oregon Trail.

Young Teddy Roosevelt by Cheryl Harness
Reading Level: 4th grade and up
Interest Level: Grades 3-6
48 pages ISBN: 0792270940 National Geographic, 1998

This illustrated biography tells the story of Teddy Roosevelt's life, including overcoming childhood asthma to become President.

Amelia Lends a Hand by Marissa Moss
(American Girl Series)
Reading Level: 4th grade and up
Interest Level: Grades 3-6
32 pages ISBN: 1584855398 Pleasant Company, 2002

Amelia spends her summer becoming friends with a deaf boy who has moved in next door. She also suffers from an asthma attack and deals with her grouchy older sister. Amelia tells her story through an illustrated journal format.

On the Sidelines by Emily Costello
(Soccer Stars Series #2)
Reading Level: 5th grade and up
Interest Level: Grades 3-6
150 pages ISBN: 0553486454 Skylark, 1998

Fiona is a middle school student who loves soccer more than anything else, so trouble brews when her allergies and asthma start interfering with her game. Fiona

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

is embarrassed about her asthma and leaves her medication at home, which only makes the problem much worse. When her parents pull her off of the team, her friends band together to get Fiona back on the field.

☆ ***Weaver's Daughter*** by Kimberly Brubaker Bradley
Reading Level: 5th grade and up
Interest Level: Grades 3-6
166 pages ISBN: 0440417171 Yearling Books, 2002

A young pioneer girl suffers from severe asthma in her new home in the Southwest Territory in 1791. She weaves in order to pay for doctor's services and makes friends with a wealthy family. This is a great coming-of-age story with a focus on the hardships of asthma before the disease was understood.

☆ ***The Pistachio Prescription*** by Paula Danzinger
Reading Level: 5th grade and up
Interest Level: Grades 5-8
154 pages ISBN: 0698116909 Putnam, 1999

A thirteen-year-old girl has a hard life—arguing parents, asthma, unsympathetic siblings, a new boyfriend and an upcoming school election for class president. She gobbles red pistachios and confides in her friend to deal with all of her troubles.

Welcome to the BSC, Abby by Ann Martin
#90 in The Babysitter's Club Series
Reading Level: 6th grade and up
Interest Level: Grades 5-8
192 pages ISBN: 0590228749 Apple, 1995

Eighth grader Abby is the newest member of The Babysitter's Club. An asthma attack causes Abby to be rushed to the hospital while babysitting. When the other members of the Club start doubting her babysitting abilities, she feels the need to prove herself. Along the way, she helps her twin sister and mother adapt to their new town while participating in the town's carnival.

Reading Level: More Difficult

☆ ***Appointment with a Stranger*** by Jean Thesman
YA 166 pages
ASIN: 0395492157 Houghton, 1989. A Sequoyiah Award Winner

A teenage girl is sent from Seattle to live in a rural town to help improve her health. She is embarrassed about her asthma and has a difficult time trusting in friendships. She falls in love with a mysterious stranger with a secret past while the class clown falls for her.

Breathing Room by Barbara Elmore
YA 126 pages
ISBN: 0880921099 Royal Fireworks Press, 1994

Alberta copes with her asthma while dealing with her relationship with her mother. She finds a new friend and joins the cross-country team.

☆ ***Jackie Joyner-Kersee: Champion Athlete*** by Geri Harrington
("Great Achievers: Lives of the Physically Challenged" Series)
YA 111 pages
ISBN: 0791020851 Chelsea House Publishers, 1995

The book tells the life story of Jackie, who has asthma, and her journey to become a world-class athlete. Jackie grew up in a low income neighborhood, but rises beyond her difficulties while following her dreams to become an athlete. An inspirational story.

☆ ***Thin Air*** **by** David Getz
YA 120 pages
ASIN: 0805013792 Harper Collins Juvenile Books, 1992
A sixth grade boy with severe asthma learns to cope with an overprotective family and his own asthma, while trying to stay out of a special needs class. He gets in plenty of trouble and makes friends with an unlikely stranger.

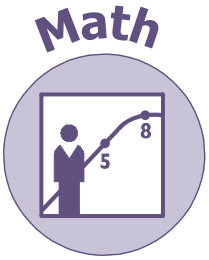
Lord of the Flies by William Gerald Golding
Adult book for Young Adults 208 pages
ISBN: 0399501487 Perigee, 1959

A classic novel about a group of plane-wrecked English schoolboys stranded on a deserted island. Two of the older boys wrestle for order and leadership. Their plight deteriorates as their civilization erodes and wildness takes over, climaxing with a group of boys hunting their former leader. One of the main characters, Piggy, has asthma. While his asthma is not a major focus of the story, it does contribute to his character. This is a difficult book for the middle school level. If it is already being assigned in class, a discussion can occur about the portrayal of Piggy's asthma.

Peace Like A River by Leif Engers
Adult book for Young Adults 320 pages
ISBN: 0802139256 Grove Press, 2002

Eleven-year-old Rueben Lands, who has severe asthma, and his family live in a small Minnesota town in the early 1960s. Rueben's life changes when his brother kills two intruders and later escapes from jail. The Lands family and the police both set out to try to find his brother first. For mature readers due to length, reading difficulty, mature content and violence.

*** Books that are highly recommended due to their focus on asthma, quality of story, and links to other classroom subject matter. These books would be a good choice for reading aloud to the class or assigning the entire class to read.*



Lesson One:
ASTHMA DIARIES

Lesson Overview

This lesson uses an asthma diary as a source of information on peak flow meters, a device used to monitor asthma. Students take the information from the diary and create a line graph to display the information. They also interpret the information to answer questions about the individual's health. Extension activities are also included for additional classroom work or homework assignments.

Suggested Grade Levels: 6 & 7
Curriculum Connections: Percentages, line graphs, interpreting graphs.

EALRs Addressed

This lesson addresses the following Washington State Essential Academic Learning Requirements (EALRs). The benchmarks listed are for grade 8 in mathematics.

In this lesson, the student is asked to:

- Demonstrate understanding of integers, fractions, decimals, percents, place value of decimals, and properties of the rational number system using pictures and symbols. (Mathematics 1.1 Number and Numeration).
- Understand and make inferences based on analysis of experimental results, statistical data, and simple graphical representations. (Mathematics 1.4 Prediction and Inference).
- Clearly and effectively express or present ideas and situations using both everyday and mathematical language such as models, tables, charts, graphs, written reflection, or algebraic notation. (Mathematics 4.3 Represent and Share Information).

Teacher Background

For a more in-depth understanding of asthma diaries and peak flow meters, consult the following resources that were used to prepare this lesson:

- **American Lung Association**
  http://www.lungusa.org
- Silverstein, Alvin, Virginia and Laura. **Diseases and People: Asthma**. Enslow Publishers, Inc., 1997.

Teacher Preparation

- **Materials:**
  Copies of **Student Handouts #1 and #2**; graph paper; colored pens or pencils.
- If you are the first teacher in your team to use this FACT FILE, make copies of the student handout entitled, **Student Introduction: Environmental Health and Asthma**. Ensure that students have read the handout and mastered the content and vocabulary.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Procedure

- Have the students read **Student Handout #1** before beginning the activities on **Student Handout #2.** The **Teacher Key** includes examples of how students might answer the questions and provides correct answers.

Student Assessment

Student work can be assessed in the following ways, for a total of 100%.

10%	Did students read **Student Handout #1** and complete the **Check Your Understanding Questions**?
10%	Did students read **Student Handout #2** and correctly calculate the percentages?
75%	Did students complete the **Line Graph Activity** on **Student Handout #2** that includes the required elements? • 50% **Data** is correctly represented. • 5% Information on the dates and times is on the **x-axis** and information on the peak flow rates is on the **y-axis**. • 5% Uses **symbols** for readings before and after taking medication. • 5% Includes a **key** to the symbols. • 5% Axes are **labeled** and graph is **titled**. • 5% **Neatness**.
5%	Did students complete the **Check Your Understanding** questions following the Line Graph Activity on **Student Handout #2**?

Extension Activities

Guest Speaker

- Ask your school nurse, a public health nurse from your local health department, or a representative from your local chapter of the American Lung Association to visit your class to talk about peak flow meters. Alternatively, if there is a student in your class who has asthma, he or she may be comfortable making a presentation about their peak flow meters to the class. The speaker may be able to bring peak flow meters that students can use to determine their own peak flow rates.

Peak Flow Meters

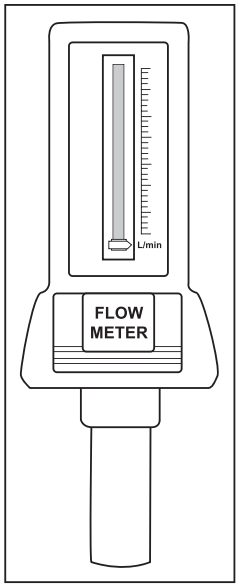
- If you have access to peak flow meters, have each student measure their peak flow rates. If students are sharing meters, make sure to use an alcohol wipe to cleanse the meters between each use. Students can use the class data to find range and measures of central tendency.

ASTHMA DIARIES
Student Handout #1

Teacher Key

What is an asthma diary?
Have you ever kept a diary where you document your feelings and secrets? Some people with asthma keep a different kind of diary to help monitor their asthma. An **asthma diary** is a written record that charts how a person with asthma is feeling. It may also include information about any exposures to personal **asthma triggers, peak flow rates**, and what kind of medicines he or she took. An asthma diary can help an individual's doctor determine the patient's asthma triggers, adjust medication and better understand how to manage his or her asthma.

What is a peak flow meter?
A **peak flow meter** is a simple, hand-held device that measures a person's ability to push air out of their lungs. Peak flow meters are used by people with asthma to monitor their breathing. It can help an individual and his or her doctor determine if the asthma is getting worse over time, or if there is a particular time of the day when the asthma is worse. A peak flow meter is also a tool that a person with asthma can use to determine when to take their medicine, and in the case of a serious asthma episode, if they need to go to the doctor or emergency room. A peak flow meter may show that a person is having problems even before he or she feels any changes in their own breathing. It helps measure how a person's lungs are doing, almost like receiving a daily weather report.



A peak flow meter is usually shaped like a tube. It has a mouthpiece on one end, and a sliding marker that moves along a numbered scale along the length of the tube. The peak flow meter measures a person's peak flow rate using the measurement of liters per minute (L/min). The scale usually runs from 0 to 800 L/min.

Peak flow meter readings are especially important for young children who cannot always communicate how they are feeling. A peak flow meter allows a parent or a doctor to get an accurate reading on the child.

Everyone has differences in lung capacity. Some people just naturally have larger lung capacities than other people. Respiratory infections, like having a cold, will reduce lung capacity. Every person has variability in their own lung capacity.

How do you use a peak flow meter?
Using a peak flow meter is somewhat like trying to blow out a candle in a fast, hard breath. Try taking a deep breath and then emptying your lungs in a fast burst. A peak flow meter is used to measure the force of that burst of air. When a person blows into the meter, the air pushes a marker along a scale. The number is recorded and the test is repeated three times. The highest of the three readings is the number used as the peak flow reading.

Peak flow meter readings are usually taken in the morning and evening, at the same time each day. Some people also take a reading both before and after taking their

Asthma diary:
A written record of a person's peak flow rates, daily activities and observations about asthma triggers. An asthma diary helps a person with asthma, and their doctor, keep the asthma under control.

Asthma trigger:
Something that provokes an asthma episode. Oftentimes, triggers may be something that the person is allergic to, such as a feather pillow, a furry pet or dust mites.

Peak flow rate:
A measurement of the amount of air and the speed which a person can push out of their lungs. An individual's peak flow rate depends on their size and age. The rate is measured on a scale of 0 to 800 L/min. A lower than normal rate signals that the person's airways are having trouble.

Peak flow meter:
A simple, hand-held device that measures a person's ability to push air out of their lungs. A peak flow meter is a tool that a person with asthma uses to monitor his or her asthma.

Individual Susceptibility

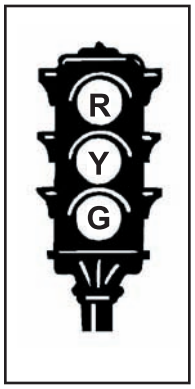
Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

daily asthma medications. This information may help their doctor determine how well the medication is controlling their asthma and whether or not they need to increase or decrease their dose or how often they take their medicine.

What does the reading mean?
A peak flow reading tells a person how healthy their lungs are, or how constricted their lungs are, in the case of an asthma episode.

A peak flow meter is used to help a person determine their personal best peak flow rate. Using this number, the person's doctor can help them establish the three zones of their peak flow rates. These zones are just like the colors on a traffic light: red, yellow and green. The zones are based on a percentage of the individual's best peak flow rate and helps them to determine how well their asthma is under control, and if they need to take medication or go see their doctor. An individual's doctor may help develop an asthma action plan, so that the person knows what exactly they need to do if they have a reading within the yellow or red zones.

Peak flow zones:
These zones (red, yellow and green) help a person with asthma decide if they need to take any action to control their asthma. For example, a rate within the red zone signals a medical emergency.



Peak Flow Zones

Red Zone: (0-50% of best peak flow rate): This reading signals a medical alert. You need to take your rescue medication and call your doctor. You may need to seek emergency medical care.

Yellow Zone: (50-80% of best peak flow rate): This reading signals caution. You may require extra treatment, such as using your inhaler and trying to relax.

Green Zone: (80-100% of best peak flow rate): This reading signals that everything is fine. Your asthma is under control.

Check Your Understanding

1. What does a Red Zone reading on a peak flow meter mean?
A Red Zone reading signals a medical emergency. The person needs to take their rescue medication and call their doctor. If the medication does not work quickly, they may need to go to the emergency room.

2. Why do peak flow meter readings for a person vary from day to day? Why do readings differ between people?
Answers may include: Peak flow meter readings vary for a person because lung capacity can be affected by respiratory infections or asthma. Readings differ between people because of their differences in size, age, and experiences with asthma or other respiratory diseases.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

ASTHMA DIARIES
Student Handout #2

Teacher Key

Examine the sample asthma diary. This is an example diary charting one week in the life of Sarah Wetstone, an 11-year old girl with moderate asthma. She has recorded information on her daily peak flow rates, along with information on how she is feeling and comments on possible **asthma triggers**. Sarah has recorded her peak flow readings both before and after taking her daily control asthma medications. These medications help Sarah control her asthma and help prevent asthma episodes from occurring. The medications work by keeping her airways from becoming swollen and tight. Sometimes Sarah also needs to use an inhaler when she feels an asthma episode beginning. The quick-acting medicine in her inhaler relaxes the muscles in her lungs so that she can breathe easier right away.

Asthma trigger: Something that provokes an asthma episode. Oftentimes, triggers may be something that the person is allergic to, such as a feather pillow, a furry pet or dust mites.

Name: Sarah Wetstone

ASTHMA DIARY
PEAK FLOW

		12/8		12/9		12/10		12/11		12/12		12/13		12/14	
PEAK FLOW RATES	Take a.m. and p.m. readings at the same time every day	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
	Before medicine	140	150	120	130	160	150	150	160	160	170	140	170	140	170
	After medicine	180	200	150	160	170	170	170	160	170	180	180	170	180	190
SIGNS	Wheeze	0		1		0		0		0		0		0	
	Cough	1		1		1		1		0		1		0	
	Activity	0		0		1		0		0		0		0	
	Sleep	0		1		1		0		0		2		0	
TRIGGER COMMENTS		Feel good today		Cleaned bedroom, stirred up dust		Have a slight cold		Feeling better		Pretty active today		Cough from cold air		Very tired in a.m.	

My personal best peak flow is: 200
My green zone (80-100%of personal best) is:_____
My yellow zone (50-80% of personal best) is:_____
My red zone (below 50% of personal best) is:_____

SIGNS

WHEEZE
None: 0
Slight, during exhale only:1
During entire exhale: 2
During both inhale and exhale: 3

COUGH
None: 0
Less than one per minute: 1
One to four per minute: 2
More than four per minute: 3

ACTIVITY
Fully active: 0
Can run short distances: 1
Can only walk: 2
Missed school or stayed inside: 3

SLEEP
Fine: 0
Slight wheeze/cough: 1
Awake several times: 2
Awake most of the time: 3

Percentages

1. Determine Sarah's three peak flow zones. As you can see at the bottom of the diary page, her personal best peak flow rate is 200. Calculate the ranges of the peak flow rates within each of the three zones. Record your answers at the bottom of the diary page in the blank spaces.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Answers:

My personal best peak flow rate is: ***200***
My green zone (80-100% of personal best) is: ***160-200***
My yellow zone (50-80% of personal best) is: ***100-160***
My red zone (0-50% of personal best) is: ***0-100***

Line Graph Activity

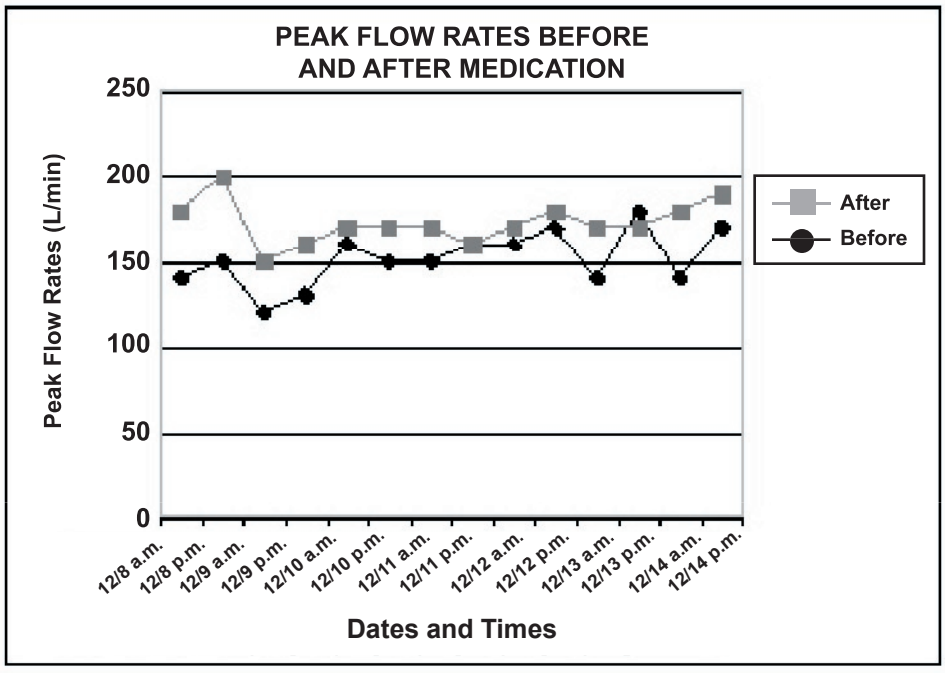
Student Assessment:

Did students create a neat and complete line graph?

Create a line graph that charts Sarah's peak flow meter rates through the week.

- Place the dates and times (a.m. and p.m.) along the x-axis.
- Place the peak flow rates along the y-axis.
- Use a ● for readings before she took her daily medicine and a ■ for readings after she took her daily medicine.
- Make sure to label the axes, give your graph a title and to include a key to your symbols.

Example graph:



Check Your Understanding

1. What effect does Sarah's medication usually have on her peak flow rates?
   Usually, the medicine raises her peak flow rates.

2. On average, are Sarah's peak flow rates higher in the morning or the evening?
   Sarah's peak flow rates are usually higher in the evening.

3. On what day did Sarah have her highest peak flow rate? How was she feeling on this day?
   On 12/8 Sarah had a peak flow rate of 200, which is her personal best rate. She was "feeling good" that day, but did have a slight cough.

4. On what day did Sarah have her lowest peak flow rate? What happened that day that may have affected her peak flow rate?
   On 12/9 Sarah had her lowest peak flow rate of 120. She had cleaned up her room that day and stirred up a lot of dust. She noted that she had a slight wheeze and cough, and didn't sleep all that well. She also came down with a cold the following day, so perhaps she was starting to get sick, which could have made her asthma worse.

Student Assessment:

Did students complete the Check Your Understanding questions?

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Lesson Two: THE COST OF CHILDHOOD ASTHMA

Lesson Overview

In this lesson, students examine data from a research study on the costs of childhood asthma. Students interpret information from a data chart, including calculating percentages. Students also investigate how statistics can be used to express different points of view. Extension activities are also included for additional classroom work or homework assignments.

Suggested Grade Levels: 7 & 8
Curriculum Connections: Percentages, statistics, economics, populations.

EALRs Addressed

This lesson addresses the following Washington State Essential Academic Learning Requirements (EALRs). The benchmarks listed are for grade 8 in mathematics.

In this lesson, the student is asked to:

- Demonstrate understanding of integers, fractions, decimals, percents, place value of decimals, and properties of the rational number system using pictures and symbols. (Mathematics 1.1 Number and Numeration).
- Identify how statistics can be used to support different points of view. (Mathematics 1.4 Statistics).
- Understand and make inferences based on analysis of experimental results, statistical data and simple graphical representations. (Mathematics 1.4 Prediction and Inference).
- Relate mathematical concepts and procedures to real-life situations. Recognize the widespread use of mathematics in daily life and the extensive use of mathematics outside the classroom. (Mathematics 5.3).

Teacher Background

For a more in-depth understanding of pediatric asthma and economics, consult the following resources that were used to prepare this lesson:

- Landrigan, Philip et. al. *Environmental Health Perspectives*. “Environmental Pollutants and Disease in American Children: Estimates of Morbidity, Mortality, and Costs for Lead Poisoning, Asthma, Cancer and Developmental Disabilities.” v.110, no. 7. July 2002.

  Available from the EHP Online website at:

  http://ehpnet1.niehs.nih.gov/docs/2002/110p721-728landrigan/abstract.html

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Teacher Preparation

- **Materials:**
  Copies of **Student Handouts #1 and #2**.

- If you are the first teacher in your team to use this FACT FILE, make copies of the student handout entitled, **Student Introduction: Environmental Health and Asthma**. Ensure that students have read the handout and mastered the content and vocabulary.

Procedure

- Have the students read **Student Handout #1** before beginning the activities on **Student Handout #2**. The **Teacher Key** provides examples of how students might solve the problems, along with the correct answers.

- You may want to hold a discussion with your students about the limitations of the research study. While the researchers attempted to discover the costs of childhood asthma in the U.S., there are some things that were just too difficult, if not impossible, to assign a monetary value. Just because there is no direct monetary value for this impact, does not mean that it has no value or cost.

  Asthma can have a big impact on the productivity, stress level and overall well being of a household. Sometimes these emotional, economic and physical impacts are called the "shadow price of unpaid services." Discuss with your students the limitations of the research study and the impacts that were not included in the study. Do the students have any ideas on how to attach a monetary value to some of these impacts? Or are some of these personal impacts separate from an economic cost?

  Following are some potential discussion points:

  - The cost of health insurance for a child with asthma.
  - Time and energy spent on housekeeping (some children with asthma need homes that are free of dust and other asthma triggers).
  - The loss of education when a child stays home from school due to an asthma episode.

Student Assessment

Student work can be assessed in the following ways, for a total of 100%.

10%	Did students read **Student Handout #1**?
80%	Did student read **Student Handout #2** and correctly answer the questions?
10%	Did students actively participate in a **class discussion** about the research study?

The Cost of Clean Air:

- Scientists understand that when air pollution is reduced, less people suffer from asthma and other respiratory diseases. Scientists have estimated that for every reduction in air pollution production in the U.S., there is a reduction in asthma and other respiratory diseases across all age groups. So, if we clean up the air, there is less impact to society from the cost of asthma.

  The **Clean Air Act** is U.S. law that was passed in 1970 and amended in 1990 that set new standards for air pollution. In particular, the law regulated the amount of various air pollutants that can be emitted by industries, utilities, motor vehicles, wood stoves, and other products.

  For the first twenty years after the Clean Air Act was made into a law, air pollution was greatly reduced in the U.S. Scientists have estimated that the implementation of the Clean Air Act caused a reduction in instances of asthma, saving $3.5 billion between 1970 and 1990.

  Students can hold a discussion about how statistics are commonly used by lobbyists and lawmakers to support legislation.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

THE COST OF CHILDHOOD ASTHMA
Student Handout #1

Teacher Key

Directions

In this activity, you will be evaluating data from a research study that links together childhood asthma and exposure to air pollution. First, you will read a summary of the research study. Then you will perform some calculations and answer some questions related to the study.

What is this study all about?

The research study examined the cost, in dollars, of childhood asthma. One way to evaluate the impact of a disease on society is to look at how much money is spent diagnosing, treating and medicating the disease. Over 7.7 million children in the U.S. have asthma. Having an illness can cost a lot of money in doctor bills and prescription medicines. When looking at the cost of a disease or illness, researchers examine both the obvious costs and the hidden costs. For example, think about coming down with the flu. The obvious costs related to that illness might include going to the doctor and buying medicine. Hidden costs may include things like having to stay home from school or work. When an adult stays home from work, he or she is not able to accomplish work tasks and may not get paid for that day. When a child stays home from school, he or she misses out on important learning, which may impact his or her future job opportunities.

This research study attempted to look at all of the costs associated with children in the U.S. that have asthma. The study examined five-year-old children living in the United States. The researchers chose this age group to study because about 80% of children with asthma develop the symptoms of the disease before they turn five years old. Many children with asthma end up “outgrowing” the disease, while some people have asthma through adulthood.

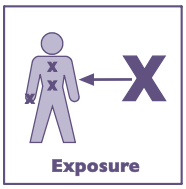
Most young children with asthma are not able to manage their asthma by themselves. Sometimes it can be difficult for a young child to communicate how they are feeling or to recognize when they need to take their medicine. Young children must rely on their parents to help them manage their asthma. On the other hand, teenagers and young adults are often able to manage their asthma by themselves. As children grow older, become more mature and better educated about their asthma, they are better able to manage it. Teens are able to use peak flow meters and asthma diaries to manage their asthma.

When asthma is under control, a person has asthma episodes less often and these episodes are less severe. Proper asthma management reduces medical costs and time missed from work or school.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

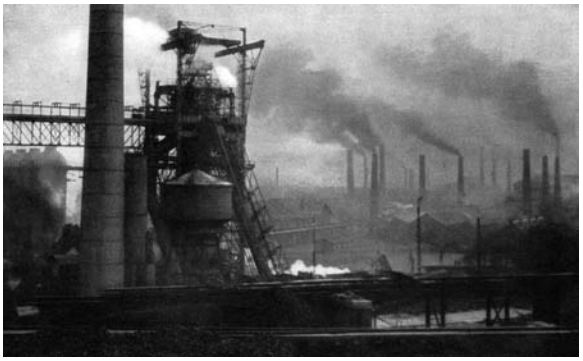
Why is it important to calculate the costs of a disease?

It is important for researchers to understand the economic cost of a disease and its impact on society. If researchers have accurate information about the costs of a disease, it will help them to make decisions about how to prevent more people from getting asthma and how to treat people who already have asthma. Researchers can also use this information to compare information from year to year, or to compare data from different countries. By studying the cost of asthma, researchers have learned that more money is spent on emergency or rescue medications than daily medicines that can help prevent an asthma episode in the first place. This tells doctors and researchers that more work needs to be done to improve the therapy for preventing asthma episodes. The information also tells the researchers that educating people on how to manage their asthma may help keep them from needing emergency medical care.



How are asthma and air pollution connected?

Asthma is caused by a complex combination of genetics and environmental factors. Depending on the individual, an asthma episode can be triggered by a viral infection, an allergy, an irritant or exercise. Air pollution can irritate the respiratory system and trigger an asthma episode.



This study examined the link between childhood asthma and outdoor air pollution. This study did not look at asthma triggers like household dust, feather pillows or cleaning products; it only looked at a child's exposure to environmental pollutants, such as exhaust from automobiles, fumes from a factory's smokestack, or smoke from a wood stove. The researchers estimated that about 30% of asthma episodes are triggered or made worse by exposure to air pollution. The researchers used this figure to adjust the total cost of asthma in order to relate it to environmental pollutants (see formula below).

(Total cost of asthma) x (.30) = Cost related to environmental pollutants

Air pollution often makes a person's asthma worse and can trigger an asthma episode. Therefore, knowing the cost of childhood asthma in the U.S. can also help lawmakers make decisions about future air pollution laws and regulations.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

THE COST OF CHILDHOOD ASTHMA
Student Handout #2

Teacher Key

Interpreting Tables

Costs of Childhood Asthma

Examine the data table below. Then, answer the following questions about the data. Definitions of unfamiliar words are listed on the next page.

Estimated Costs of Children's Asthma in the United States, 1997

Study included five-year old children in the United States

	Medical and Indirect Costs	U.S. Dollars
Medical Costs	**Hospital Care**	
	Inpatient	$634 million
	Emergency Room	$323 million
	Outpatient	$154 million
	Physician's Services	
	Inpatient	$54 million
	Outpatient	$625 million
	Medications	$2810 million
	SUBTOTAL MEDICAL COSTS	**$4600 million**
Indirect Costs		
	Indirect Costs	
	School Days Lost	$1780 million
	Premature Deaths	$193 million
	SUBTOTAL INDIRECT COSTS	**$2000 million**
Total		
	TOTAL COSTS OF CHILDREN'S ASTHMA (per year)	**$6600 million**

From Landrigan, et. al. Environmental Health Perspectives. v.110, no. 7, July 2002.

1. Who is the focus of this study?
   Five year old children in the U.S. that had asthma.
2. In 1997, what was the source of the most medical costs?
   What was the source of the most indirect costs?
   Medications were the source of the most medical costs.
   School days lost was the source of the most indirect costs.
3. What percentage of the total cost of asthma was from medical costs?
   Total cost of asthma: $6600 million
   Subtotal medical costs: $4600 million
   (4600 million / 6600 million) * 100 = 69.697%
   Answer: 70% of the total cost of asthma was from medical costs.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

4. What percentage of the total cost of asthma was from indirect costs?
   Total cost of asthma: $6600 million
   Subtotal indirect costs: $2000 million
   (2000 million / 6600 million) * 100 = 30.303%
   Answer: 30% of the total cost of asthma was from indirect costs.
5. The researchers estimated that 30% of asthma episodes were triggered or made worse from exposure to air pollution. What is the yearly cost of childhood asthma related to exposure to air pollution?
   Total cost of childhood asthma: $6600 million
   Percentage associated with air pollution: 30%
   $6600 million * .30 = $1980 million
   Answer: Childhood asthma related to air pollution costs is estimated to be $1980 million per year.

Vocabulary Words

Mortality rate: A measurement of death rates among a population.

Morbidity rate: A measurement of disease rates among a population.

Pediatric asthma: A form of asthma that occurs in young children. This study examines five-year old children in the U.S. with asthma.

Inpatient: Medical care associated with being admitted to a hospital for an overnight stay.

Outpatient: Medical services performed in a doctor's office, clinic or hospital that do not require an overnight stay.

Emergency room: Emergency medical care received at a hospital or urgent care clinic, including ambulance services.

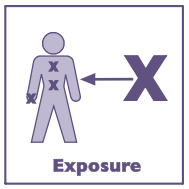
Physician's services: A doctor's services at an office, clinic or hospital.

Medications: Prescription medications used to treat asthma, including emergency or rescue medicines and daily medicines used to prevent asthma episodes.

School days lost: Asthma is the leading cause of days lost from school due to a chronic disease. Over 10.1 million school days annually are missed due to asthma. This figure includes the cost of parents who missed work to take care of their ill child.

Premature deaths: Someone who dies before the age predicted based on their current age and their gender. This figure includes an estimate of what that child may have earned during their lifetime in a job.

The Cost of Childhood Diseases



Now that you have examined the costs associated with asthma among young children, you may be wondering what this number really means. How does this compare to other childhood diseases linked to environmental exposure to pollutants (including pollution in air, water and food)? Examine the data below and answer the following questions.

Estimated costs of childhood diseases of environmental origin, U.S., 1997

Disease	Best estimate
Lead poisoning	$43400 million
Asthma	$2000 million
Cancer	$300 million
Behavioral disorders	$9200 million
Total	**$54900 million**

1. Rank the childhood diseases by their estimated cost, from most costly to least costly.
   Lead poisoning
   Behavioral disorders
   Asthma
   Cancer

2. The total annual cost of these four childhood diseases linked to environmental exposures of pollutants is $54900 million.

   a. What is this number in billions?
   $54.9 billion

   b. The total annual cost of the four diseases is approximately 2.8% of the total annual cost of all illnesses in the United States. What is the total annual cost of all illnesses in the United States (in billions)?
   $54.9 billion / .028 = $1960.7 billion
   Answer: The total annual cost of all illnesses in the U.S. is $1960.7 billion.

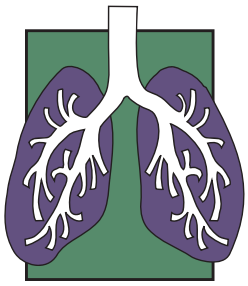
   c. What is this number in trillions?
   $1.96 trillion

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Asthma in your Health & Fitness Curriculum

Teacher Key

Why is asthma an important topic for the Health and Fitness curriculum?



The most important environmental health topics to share with students are those that have a direct impact on them and the things that they have control over in their lives. By being aware of an environmental health issue in their own community, students can become empowered with that knowledge to reduce their personal risks and lessen their opportunities to come in contact with the hazard.

In a classroom of 30 children, about three are likely to have asthma. As one of the most common chronic childhood illnesses, it is likely that many of your students have asthma. Exercise-induced asthma is common among children, making this topic especially relevant to fitness teachers and athletic coaches. The prevalence of this disease makes it an important topic for the Health & Fitness curriculum. Integrating asthma into your curriculum is not only pertinent to children with asthma; educating all of your students about asthma will help them to understand the disease, and to be sensitive and helpful toward their classmates with asthma.

The topic of asthma has links to content already covered in the Health & Fitness curriculum. In addition, the topic of asthma offers many opportunities for exploring the issue from multiple angles and connecting the content to other disciplines.

The *Environmental Health Fact File: ASTHMA* provides lesson plans, activities and resources to introduce the concept of asthma to your students. By using these resources, asthma can be taught in the context of:

- Diseases and disorders
- Growth and development
- Indoor and outdoor air pollution
- Environmental health
- Tobacco
- Physical fitness
- Community health
- Social and emotional health

What is Environmental Health?

Your health depends on the environment around you. Environmental health is how the environment affects human health. Every day, you come in contact with things in your environment that can help you or hurt you. An interaction between genetics and things in the environment can cause someone to develop asthma.

What is asthma?

Asthma is a condition that causes the airways of your lungs to become inflamed and obstructed, making it hard to breathe. The airways also flood with thick mucus. Asthma can make you wheeze, cough, and have difficulty breathing. When this happens, it is called an asthma episode or attack. If not properly treated, it can be fatal. Each year, approximately 500,000 Americans are hospitalized because of asthma, and 5,000 Americans die from the disease.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

How do people get asthma? You cannot catch asthma from someone like a cold. It is not contagious. Asthma is usually caused by a combination of genetics and environment. You may have asthma because it was passed to you through your genes. Sometimes an allergy may cause an asthma episode. Another way the environment may contribute to your asthma is by irritating your respiratory system.

Some people get the symptoms of asthma when they are very young, less than a year old, and others do not have the signs and symptoms of asthma for many years. With proper education and medication, people can control their asthma and live active, healthy lives.

What environmental factors trigger asthma episodes?

Something in the environment that causes an asthma episode is called a trigger. An awareness of common asthma triggers can help people with asthma monitor their exposure to their triggers.

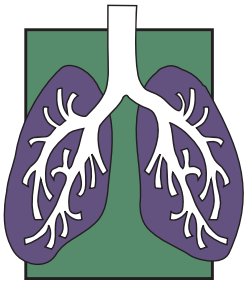
Four common triggers include:

- Exercise
- Viral infections (cold or flu)
- Allergies (pollen, furry or feathered pets, cockroaches, dust mites, or mold)
- Irritants (cold air, tobacco smoke, household chemicals, perfumes, air pollution, dust, or car exhaust)

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Asthma Activities for the Health & Fitness Teacher

Overview



This section provides lesson plans, activity ideas and resources for the Health & Fitness teacher. The topic of "environmental health and asthma" has natural connections to the Health & Fitness curriculum. Many of the lesson plans in this *Environmental Health Fact File*, while focused on science, math, language arts, and social studies content, are also relevant to the Health & Fitness curriculum. Through the lens of Health & Fitness, EALRs in reading, writing, math, science, and social studies can also be addressed.

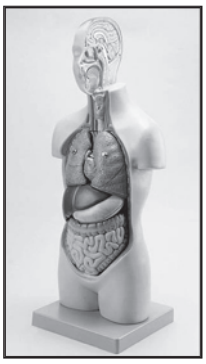
The "What is Environmental Health?" Student Reading introduces key environmental health concepts and vocabulary.

The lesson plans and activity ideas in this section focus mainly on the following Washington State Essential Academic Learning Requirements for Health & Fitness:

- Recognize patterns of growth and development (2.1).
- Understand the concept of control and prevention of disease (2.2).
- Acquire skills to live safely and reduce health risks (2.3).
- Understand how environmental factors affect one's health (air, water, noise, chemicals) (3.1).
- Gather and analyze health information (3.2).
- Use social skills to promote health and safety in a variety of settings (3.3).

Diseases & Disorders; Growth & Development

What is Environmental Health and Asthma?



Environmental Health Fact File: ASTHMA

This reading provides students with the background knowledge they need aabut environmental health and asthma before proceeding with other activities or lessons. (EH Fact File: ASTHMA Student Introduction).

Suggested Grade Levels: 6-8
Topics: Asthma, environmental health
Subject Links: Health, science, reading, writing

What is Asthma?

Environmental Health Fact File: ASTHMA

This lesson helps students understand asthma as a chronic disease of the respiratory system. Students participate in a simple simulation of what it is like to have reduced lung capacity from asthma. Then, students mix up a batch of mucus similar to the fluids that fill the bronchioles in the lungs during an asthma episode. Students also work in small groups to build a working model of the respiratory system—a soda bottle lung—using easy to find materials. (EH Fact File: ASTHMA Science Lesson One)

Suggested Grade Levels: 6-8
Topics: Asthma, respiratory system, human biology, exploring models
Subject Links: Health, science, biology

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Asthma Anatomy Hike

The Consortium on Children's Asthma Camps

In this "blind walk" activity, students experience simulated parts of the respiratory system to gain an understanding of breathing anatomy and asthma episodes. Available in Chapter One: Anatomy Activities of *Asthma Adventures: Asthma Camp Activities*. Available at: http://www.asthmacamps.org

Suggested Grade Levels: 6-8
Topics: Asthma, respiratory system, human biology
Subject Links: Health, science, biology

Living Murals

Environmental Health Fact File: ASTHMA

Create a life-size human body mural by tracing a student's outline on butcher paper. Then, challenge students to draw and label the parts of the respiratory system. They can also label the route of oxygen as it travels through the respiratory system to the bloodstream. As students study other body systems, they can add these onto the human body murals as well. (EH Fact File: ASTHMA Science Lesson One extension activity).

Suggested Grade Levels: 6-8
Topics: Asthma, respiratory system, human biology
Subject Links: Health, science, biology

Air Pollution and Environmental Health

Healthy Buildings: Asthma and Indoor Air Pollution

Environmental Health Fact File: ASTHMA

This lesson examines the links between asthma and indoor air pollution. Students first create a map of a room in their home or at school. Students plot both potential asthma triggers and air quality helpers on the map. Then, students conduct an experiment where they swipe surfaces around school and grow mold on bread or potato slices. (EH Fact File: ASTHMA Science Lesson Two).

Suggested Grade Levels: 6-7
Topics: Asthma triggers, indoor air quality, mold, mapping, conducting investigations
Subject Links: Health, science, environmental science

Fire and Smoke

Environmental Health Fact File: ASTHMA

This lesson explores smoke as an outdoor air pollution problem that can trigger asthma episodes. Students explore several demonstrations that illustrate the link between particulate matter created by incomplete burning of fuel and how temperature inversions can worsen air pollution problems. Students also read about the link between wood smoke, agricultural field burning, wildland fires and asthma. (EH Fact File: ASTHMA Science Lesson Three).

Suggested Grade Levels: 7-8
Topics: Asthma triggers, outdoor air pollution,
Subject Links: Health, science, environmental science

The Awful Eight: A Play

Texas Natural Resource Conservation Commission

Students can stage a performance of a play geared at examining the eight major air

pollutants. Students can perform the play for other middle school students or put on a performance for an elementary class. For a complete lesson plan and script, go to:
http://www.tnrcc.state.tx.us/air/monops/lessons/awfuleightlesson.html

Suggested Grade Levels: 6-8
Topics: Air pollution
Subject Links: Health, science, drama

Indoor Air Pollution Experiment

Puget Sound Clean Air Agency

Students use houseplants to test the effects of volatile liquids on indoor air quality. Students set up an experiment placing small houseplants in glass chambers. Then, they add to the chambers volatile liquids commonly found in homes, such as paint thinners, glue, nail polish remover, cleaning solvents, ammonia and perfume. The lesson plan for this activity is available by looking for Lesson #12 under the "Air Aware" section.
http://www.pscleanair.org/news/cleanairexpress.shtml

Suggested Grade Levels: 6-8
Topics: Asthma triggers, indoor air pollution
Subject Links: Health, science, environmental science

Air Pollution Collectors

Howard Hughes Medical Institute

Students make air pollution collectors, leave them in a location for two weeks, and then examine them for different particulates captured from the air. More ideas for this activity can be found at:
http://www.hhmi.org/coolscience/airjunk/index.html

Suggested Grade Levels: 6-8
Topics: Asthma triggers, air pollution
Subject Links: Health, science, environmental science

Air Quality Trends

Environmental Protection Agency

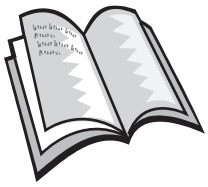
Compare asthma rates to air quality trends. Students can use the AIRNOW Air Quality Index at http://www.epa.gov/airnow/ to research air quality in their own community or for the entire country. Students can also learn more about air pollutants in their community by using the databases on the EPA's Where You Live website at:
http://www.epa.gov/epahome/whereyoulive.htm

Suggested Grade Levels: 6-8
Topics: Asthma triggers, air pollution
Subject Links: Health, science, environmental science

Physical Fitness and Asthma

Asthma Diaries

Environmental Health Fact File: ASTHMA

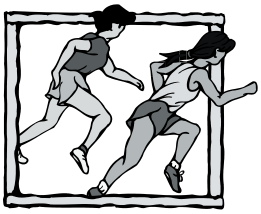


This math lesson uses an asthma diary as a source of information on peak flow meters, a handheld device used to monitor lung capacity. Students take information from the diary and create a line graph to display the information. You can extend this lesson by providing students with peak flow meters or lung volume bags to take their own readings, record data, and create graphs to represent the information. Peak flow/lung volume

measurements could be taken to show personal variation at different times of day, or before/after exercise. Comparisons among class members can be made of height, age, and physical activity.

Lung volume bag sets with disposable mouthpieces are available from Ward's Natural Science, Delta Education and other scientific supply companies. Peak Flow meters are available from medical supply companies. (EH Fact File: ASTHMA Math Lesson One).

Suggested Grade Levels: 6-7
Topics: Asthma, lung volume, line graphs, interpreting data
Subject Links: Health, math, reading



Athletes with Asthma

Environmental Health Fact File: ASTHMA

In this lesson, students are encouraged to research the lives of professional athletes who have asthma. Students then design cereal boxes similar to WHEATIES™ cereal boxes that feature athletes. Each biography box includes a cover illustration featuring the athlete, a description of asthma, and a short biography of the athlete. (EH Fact File: ASTHMA Language Arts Lesson One).

Suggested Grade Levels: 7-8
Topics: Asthma, biographies, research, publishing
Subject Links: Health, writing, reading

Asthma and Sports

Environmental Health Fact File: ASTHMA

Challenge students to create an informational brochure on asthma and sports to give to the coaches and student athletes at your school. Topics might include exercise-induced asthma, recognizing asthma symptoms, asthma management plans, and school policies. (EH Fact File: ASTHMA Language Arts Lesson One extension activity).

Suggested Grade Levels: 7-8
Topics: Asthma, reading, research, publishing
Subject Links: Health, writing, reading

Letter Writing to Athletes

Environmental Health Fact File: ASTHMA

Students can write letters to a professional athlete asking them about their experiences with asthma. Many athletes have fan clubs or official websites where contact information may be listed. Athletes that are part of a professional team, such as the WNBA, NBA, NHL, NFL, USA Swimming, and US Soccer Federation, will have contact information on their team websites. (EH Fact File: ASTHMA Language Arts Lesson One extension activity).

Suggested Grade Levels: 6-8
Topics: Asthma, letter writing
Subject Links: Health, writing, reading

Community Health and Asthma

The Cost of Childhood Asthma

Environmental Health Fact File: ASTHMA

In this lesson, students examine data from a research study on the costs of childhood asthma. Students interpret information from a data chart and investigate how statistics can be used to express different points of view. (EH Fact File: ASTHMA Math Lesson Two).

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Suggested Grade Levels: 7-8
Topics: Asthma, statistics, economics, populations
Subject Links: Math, economics

The Geography of Asthma

Environmental Health Fact File: ASTHMA

Students read a short description of a study of asthma rates in the United States. They then complete a mapping exercise based on the data set from the study. Students also analyze the strengths and weaknesses of the survey design. (EH Fact File: ASTHMA Social Studies Lesson One).

Suggested Grade Levels: 7-8
Topics: Asthma, population studies, American geography, mapping, interpreting statistics
Subject Links: Health, geography, math

Asthma Awareness

Environmental Health Fact File: ASTHMA

Students are challenged to prepare an asthma awareness advertisement or commercial for use in Washington. The ad or commercial should include a description of what asthma is, how it is treated, and what you can do to help people with asthma. The campaign should be visually appealing and make people want to learn more. For an example of media campaigns used by the American Lung Association, go to their website: http://www.lungusa.org (EH Fact File: ASTHMA Social Studies Lesson Two extension activity).

Suggested Grade Levels: 6-8
Topics: Asthma, media studies
Subject Links: Health, writing, media studies

Asthma Bill of Rights

Environmental Health Fact File: ASTHMA

People with asthma need to carry their lifesaving asthma medications with them, but some school policies and state laws do not allow students to carry and self-administer these medications. A variety of resources are available to involve students in researching this topic. Students could be challenged to write a position paper, a letter to the editor, or to participate in a debate on this topic.

The Allergy & Asthma Network/Mothers of Asthmatics website contains information on **State Statutes Protecting Student Rights to Carry and Use Prescribed Asthma and Anaphylaxis Medication.** The website lists states that protect student rights to possess asthma medications, states that have pending legislation, and states that do not have statutes. State of Washington House Bill 1904 and Senate Bill 5841, an Act related to the prevention, diagnosis, and treatment of asthma, passed the legislature and became effective in July 2005.
http://www.breatherville.org/cityhall/ch_childrights.htm

The American Lung Association has created a **Kids with Asthma Bill of Rights**, to be presented to the President of the United States. The document includes: “The right to attend an asthma-friendly school, where there’s a school nurse, they can use their medicine when they need it, and all the adults know enough about asthma to help them if they get in trouble.”
http://www.lungusa.org/site/pp.asp?c=dvLUK9O0E&b=186670
(EH Fact File: ASTHMA Social Studies Lesson Two extension activity)

Suggested Grade Levels: 6-8
Topics: Asthma, medication, health care policy
Subject Links: Health, civics, constitutional issues, policy

Social/Emotional Aspects of Asthma

Reading about Asthma

Environmental Health Fact File: ASTHMA

Students choose from a list of young adult literature that features a main character with asthma. Students then write a book report that includes reflecting on how the character's asthma impacted his or her life and how the character dealt with their asthma. (EH Fact File: ASTHMA Language Arts Lesson Two).

Suggested Grade Levels: 6-8
Topics: Asthma, book reports, writing about literature, media studies
Subject Links: Health, reading, writing

Asthma at the Movies

Environmental Health Fact File: ASTHMA

Students write reviews or rewrite scenes from movies that include a character living with asthma. Some movies that include characters with asthma include:

- *Jimmy Neutron: Boy Genius*
  Character Carl Wheezer has asthma.
  Paramount Pictures, 2001. Rated G
- *The Goonies*
  The child character Mikey Walsh has asthma.
  Warner Studios, 1985. Rated PG.
- *Hardball*
  Character Jefferson has asthma.
  Paramount Pictures, 2003. Rated PG-13.
- *As Good as it Gets*
  Character Carol Connelly's son has severe asthma.
  Columbia/Tristar Studios, 1997. Rated PG-13.
- *Signs*
  The child character Morgan has asthma.
  Touchstone Pictures, 2002. Rated PG-13.
- *Song of Bernadette*
  The character Bernadette has asthma as a child.
  20th Century Fox, 1943. Rated NR.
- *Hitch*
  The character Albert has asthma.
  Columbia Tristar, 2005. Rated PG-13.

Students can watch the animated film *Jimmy Neutron* and evaluate how the character Carl Wheezer is depicted. Then, have students read a letter written from a spokesperson from the Allergy and Asthma Network of Mothers of Asthmatics to the producers of Nickelodeon. Students are encouraged to rewrite a scene in the movie that shows Carl's asthma differently. For a complete lesson plan, see Baywindow's "Living with Asthma" lesson plan at:
http://www.kqed.org/w/baywindow/asthma/livingwithasthma.html
(EH Fact File: ASTHMA Language Arts Lesson Two extension activity).

Suggested Grade Levels: 6-8
Topics: Asthma, media studies
Subject Links: Health, writing, communication, media studies

ASTHMA Resources for Health and Fitness Teachers

Asthma Statistics and Facts

- 4.9 million or 9.2% of school-age children in the U.S. have "current asthma." This makes asthma one of the most common chronic childhood illnesses.
  (Epidemiology and Statistics Unit. Trends in Asthma Morbidity and Mortality. NYC: ALA, April 2004).

- In a classroom of 30 children, about 3 are likely to have asthma.
  (Unpublished Analysis of Asthma Data from 2002 National Health Interview Survey, NCHS, CDC, 2004).

- Asthma is the leading cause of school absences. Asthma accounts for 14 million lost days of school missed annually
  (Mannino et al. Surveillance for Asthma—US, 1980-1999. *MMWR*, March 29, 2002; 51 (No. SS-1): 1-13).

- Asthma is the third ranking cause of hospitalization among children under 15 years old.
  (Hall MJ & DeFrances CJ. 2001. National Hospital Discharge Survey. Advance data from vital and health statistics, Table 3; no 332. Hyattsville, MD: NCHS, 2003).

- The estimated cost of treating asthma in children and youth under 18 years old is $3.2 billion per year.
  (Weiss KB, Sullivan SD, Lytle CS. Trends in the cost of illness for asthma in the United States, 1985-1994. *Journal of Allergy Clinical Immunology,* 2000;106:493-499).

- Low-income populations, ethnic minority community members, and children in inner-cities experience more emergency room visits, hospitalizations, and deaths due to asthma than the general population.
  (Lieu et al. Racial/ethnic variation in asthma status and management practices among children in managed Medicaid. *Pediatrics*, 2002; 109:857-866).

Asthma in Schools Resources

CDC's Tobacco Information and Prevention Source: Educational Materials
http://www.cdc.gov/tobacco/edumat.htm

EPA's Smoke-Free Home Pledge Kit
http://www.epa.gov/smokefree/

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

CDC's Asthma Control Programs Related to Children and Adolescents
http://www.cdc.gov/asthma/children.htm

CDC's Public Health Law Program
This CDC site provides selected asthma-related legislation addressing the right to self administer asthma medication and carry inhalers in schools.
http://www.phppo.cdc.gov/od/phlp/Asthma_school.asp

EPA's Healthy School Environment Resources
A gateway to on-line resources to help facility managers, school administrators, architects, design engineers, school nurses, parents, teachers and staff address environmental health issues in school.
http://cfpub.epa.gov/schools/index.cfm

EPA's Clean School Bus USA
The goal of Clean School Bus USA is to reduce both children's exposure to diesel exhaust and the amount of air pollution created by diesel school buses. Diesel exhaust can be an asthma trigger.
http://www.epa.gov/cleanschoolbus/

Asthma and Allergy Foundation of America
Offers many educational resources for parents, students, and health care professionals.
http://www.aafa.org

Asthma Awareness: Curriculum for the Elementary Classroom
From the National Heart Lung Blood Institute.
http://www.nhlbi.nih.gov/health/prof/lung/asthma/school/index.htm

Asthma Adventures: Asthma Camp Activities
Lesson plans for fun asthma-related activities.
http://www.asthmacamps.org

Resources for P.E. Teachers and Coaches

Asthma & Physical Activity in the School
This easy-to-read booklet is a perfect companion for teachers and coaches who want to help students with asthma participate in sports and physical activities. Available as a free download or you can order print copies.
http://www.nhlbi.nih.gov/health/public/lung/asthma/phy_asth.htm

Tips to Remember: Exercise-Induced Asthma
http://www.aaaai.org/patients/publicedmat/tips/exerciseinducedasthma.stm

Sports and Asthma
http://getasthmahelp.com/kids_sports.asp

Winning the Gold with Asthma
http://www.savvyhealth.com/disp.asp?doc_id=159

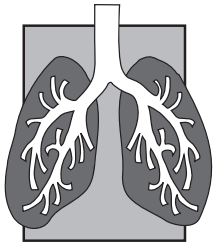
Asthma Camps
http://www.asthmacamps.org/asthmacamps/

Asthma Management Planning Materials

Managing Asthma: A Guide for Schools
This guide is intended to assist schools that are planning and/or maintaining an asthma management program. This guide provides follow-up steps for schools that

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

currently identify students with asthma through health forms or emergency cards or plan to do so. It is designed to offer practical information to school staff members of every position.
http://www.nhlbi.nih.gov/health/prof/lung/asthma/asth_sch.htm



American Lung Association's Asthma-Friendly Schools Initiative
Information to help your community form a comprehensive asthma management program in your schools.
http://www.lungusa.org/site/pp.asp?c=dvLUK9O0E&b=22590

EPA's Indoor Air Quality Tools for Schools Program
This web-based resource contains recommendations and tools to help communities and design professionals integrate good indoor air quality practices into the design, construction, renovation, and operation and maintenance of K-12 school facilities.
http://www.epa.gov/iaq/schools/

School/Childcare Information on Asthma Management
National Heart Lung Blood Institute
http://www.nhlbi.nih.gov/health/public/lung/index.htm#schools

Strategies for Addressing Asthma Within a Coordinated School Health Program
Atlanta, Georgia: Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, 2002.
http://www.cdc.gov/HealthyYouth/asthma/index.htm

Asthma Presentation Materials

CDC's Asthma Speaker's Kit for Health Care Professionals
This slideshow on asthma management includes information on epidemiology, risk factors, prevention, clinical management of asthma, and managing asthma.
http://www.cdc.gov/asthma/speakit/default.htm

National Asthma Education and Prevention Program Slide Shows
The National Heart Lung Blood Institute offers these free, downloadable slide sets for public use. The **School Asthma Education Slide Set** presents background information about the growing problem of asthma in the U.S., what asthma is, what school staff should know about helping students to manage their asthma, including triggers and warning signs of asthma episodes (attacks).
http://hin.nhlbi.nih.gov/naepp_slds/menu.htm

Peak Flow Meters Resources

Peak Flow Meters Information
http://www.lungusa.org/site/pp.asp?c=dvLUK9O0E&b=22586

Peak Flow Chart
http://www.lungusa.org/site/pp.asp?c=dvLUK9O0E&b=33661

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Human Respiratory System Flash Presentation
http://www.lungusa.org/site/pp.asp?c=dvLUK9O0E&b=40743

Asthma Daily Diary
http://www.nickjr.com/parenting/health_fitness/asthma/asthma_diary.jhtml

Resources for School Nurses

The School Nurse Asthma Management Program (SNAMP)
The National Association of School Nurses (NASN) is participating in a cooperative agreement with the Centers for Disease Control Division of Adolescent and School Health (CDC-DASH) to develop a continuing education program to teach school nurses to more effectively manage asthma in students at school and during school-related activities.
http://www.nasn.org/education/snamp.htm

Managing Asthma Triggers Workshop
The workshop goal is to increase awareness of potential asthma triggers within the school environment and to encourage optimal management of the school environment to reduce asthma episodes.
http://www.nasn.org/education/asthmatriggers.htm

Allergy and Asthma Tool Kit for School Nurses
Free information from the American Academy of Allergy, Asthma & Immunology. Includes information, PowerPoint presentations, and handouts.
http://www.aaaai.org/members/allied_health/tool_kit/

Starbright School Asthma Program
The STARBRIGHT School Asthma Program includes the STARBRIGHT Asthma CD-ROM Game: Quest for the Code in English and Spanish, the Implementation Guide for School Use, brochures to give out to families to order their own copies of the CD-ROM, and a web site for school nurses that includes asthma related resources and information. Brochures for families are also available in Spanish.
http://www.starbright.org/

Asthma Action Cards
http://www.aafa.org/display.cfm?id=4&sub=81&cont=392

Internet Resources for Students

Fit 4 Life: Meeting the Challenge
This CDC site is aimed at educating children with asthma about the importance of physical activity and gives tips on asthma-friendly activities.
http://www.bam.gov/fit4life/dont.htm

Kids with Asthma Bill of Rights
The American Lung Association offers many resources for kids with asthma.
http://www.lungusa.org/site/pp.asp?c=dvLUK9O0E&b=186670

Breatherville, USA
As you stroll through the streets of Breatherville and step inside any of its buildings, you'll find answers to your questions, concerns, and fears. You'll learn to minimize asthma and allergy symptoms and prevent flare-ups…and have a little fun along the way, too!
http://www.aanma.org/breatherville.htm

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

ASTHMA Resources for the Librarian

The following resources are intended to provide additional information and in-depth research opportunities for teachers and students studying environmental health and asthma. Visit the IEHMSP website for more teacher and student resources at: http://depts.washington.edu/iehmsp/

General Background Resources on Asthma

Internet Resources for Teachers, Coaches and Parents

How Asthma-Friendly Is Your School?
National Heart, Lung, and Blood Institute
http://www.nhlbi.nih.gov/health/public/lung/asthma/friendhi.htm

Asthma & Physical Activity in the School
National Heart, Lung, and Blood Institute
http://www.nhlbi.nih.gov/health/public/lung/asthma/phy_asth.htm

Student Asthma Action Cards
Asthma and Allergy Foundation of America
http://www.aafa.org/display.cfm?id=4&sub=81&cont=392

Indoor Air Quality: Tools for Schools
United State Environmental Protection Agency
http://www.epa.gov/iaq/schools/tools4s2.html

Smoke-free Home Pledge Kit
U.S. EPA Indoor Environments Division. Kit includes magnet, decal, certificate and brochures. 1-866-SMOKE-FREE or
http://www.epa.gov/smokefree

Asthma's Impacts on Children and Adolescents
National Center for Environmental Health
http://www.cdc.gov/asthma.htm

The Climb for Clean Air
The American Lung Association of Washington sponsors this annual fundraising climb of Mt. Rainier. Watch the video at their website or order it to show to your class.
http://www.alaw.org/support_alaw/climb_for_clean_air/

Asthma Adventures: Asthma Camp Activities
Lesson plans for fun asthma-related activities.
http://www.asthmacamps.org

EPA's Indoor Air Quality Information
http://www.epa.gov/iaq/

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

EPA's Asthma Information
http://www.epa.gov/asthma/index.html

Allergy and Asthma Network/Mother's of Asthmatics, Inc.
http://www.aanma.org

American Lung Association
http://www.lungusa.org

American Lung Association of Washington
http://www.alaw.org

Asthma and Allergy Foundation of America
http://www.aafa.org

American Academy of Allergy, Asthma and Immunology
http://www.aaaai.org

Kidshealth.org Managing Asthma
http://www.kidshealth.org/parent/medical/lungs/asthma_mgmt.html

Asthma Moms
http://asthmamoms.com

Health Finder
Office of Disease Prevention and Health Promotion, U.S. Department of Health and Human Services. Health information on a wide variety of topics, including asthma.
http://www.healthfinder.gov/

Air Pollution and Respiratory Health Information
National Center for Environmental Health, Center for Disease Control and Prevention.
http://www.cdc.gov/nceh/airpollution/default.htm

Asthma and Physical Activity in the School
National Heart, Blood and Lung Institute. Information for teachers and coaches.
http://www.nhlbi.nih.gov/health/public/lung/asthma/phy_asth.htm

Asthma Awareness: Curriculum for the Elementary Classroom
National Health, Blood and Lung Institute. Lessons for grades 4-6.
http://www.nhlbi.nih.gov/health/prof/lung/asthma/school/index.htm

Teacher's Guide to Indoor Air Pollutants
Environmental Health Center, National Safety Council. Curriculum on indoor air quality.
http://www.nsc.org/public/ehc/iaq/teachgde.pdf

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Internet Resources for Students

Quest for the Code
This new CD-ROM game is filled with colorful graphics to teach students about asthma. Includes information on asthma triggers, medication, peak flow meters and more. Designed for kids ages 7-15. Includes the voices of eleven top celebrities. Free to educators and families with asthma. Parent guide available. Game comes in both English and Spanish.
http://www.starbright.org/projects/asthma/

American Lung Association's Asthma Busters
An online club for kids ages 7-14 who have asthma.
http://www.asthmabusters.org

National Institute of Environmental Health Sciences Kids Page
The "Story Time" link includes four storybooks written by students in grades 4-6 about environmental health topics, including asthma.
http://www.niehs.nih.gov/kids/asthma.htm

Kid's Asthma Section
American Academy of Allergy, Asthma and Immunology. Includes games, stories and movies in English and Spanish.
http://www.aaaai.org/patients/just4kids/default.stm

Kids Health Asthma Information
http://www.kidshealth.org/teen/diseases_conditions/respiratory/asthma.html

Other Resources

The following resources are intended to provide additional information specific to the two **Social Studies** lessons on asthma and environmental health.

Children's Hospital Video Lending Library. Videos and books about asthma are available free of charge to school nurses. Two items can be borrowed for up to two weeks free of charge. Contact Marianne Gonterman at (800) 293-2462, option #2, or (206) 527-5706, option #2 or email mgonte@chmc.org.

Open Airways for Schools Curriculum
American Lung Association. A school-based asthma health education program. Call 1-800-LUNG-USA or contact your local chapter of the American Lung Association for training schedules.

Let's Talk about Asthma: A Guide for Teens
American Lung Association, 1993. Booklet available by calling the ALA at 1-800-586-4872.

Teens Talk to Teens about Asthma
Asthma and Allergy Foundation of America, 1995. Brochure available through AAFA by calling 1-800-7-ASTHMA.

Breathe Easy: Young People's Guide To Asthma
Jonathan Weiss; Magination Press, 1994
(ISBN: 0945354622) Ages 10+

Coping With Asthma by Carolyn Simpson; Rosen Publishing Group, 1995 (ISBN: 0823920690) Ages 12+

Asthma by Wendy B. Murphy; Millbrook Press, 1998 (ISBN: 0761303642) Young Adult

Asthma (Diseases And People) by Alvin Silverstein; Enslow Publishers, Inc., 1997
(ISBN: 0894907123) Young Adult

Resources for Social Studies Lessons

The following resources are intended to provide additional information specific to the two Social Studies lessons on asthma and environmental health.

1 LESSON ONE: Arsenic, Crocodile Dung and Chicken Soup – The History of Asthma Treatments

Medicines and Drugs: The Road to Modern Medicine
http://www.schoolscience.co.uk/content/4/biology/abpi/history/index.html

"History of Asthma" by Roger Ellul-Micallef. From ***Asthma***, edited by P.J. Barnes, et. Al. Lippincott-Raven Publishers, 1997.

Catherine, Called Birdy by Karen Cushman; HarperTrophy, 1995.
(ISBN: 0064405842) Young Adult

Weaver's Daughter by Kimberly Brubaker Bradley
Yearling Books, 2002
(ISBN: 0440417171) Young Adult

2 LESSON TWO: The Geography of Asthma

Self-Reported Asthma Prevalence Among Adults—United States, 2000." Centers for Disease Control and Prevention, 2001.
http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5032a3.htm

Scorecard.org
Find maps and data sources on air quality in your region and the entire country.
http://www.scorecard.org

Resources for Science Lessons

The following resources are intended to provide additional information specific to the three **Science** lessons on asthma and environmental health.

1 LESSON ONE: What is Asthma?

Brain Pop Website
Check out the animated videos explaining "Asthma" and the "Respiratory System" in the Health section.
http://www.brainpop.com

Asthma Tutorial
Children's Medical Center of the University of Virginia
http://www.healthsystem.virginia.edu/intnet/pediatrics/patients/Tutorials/Asthma/home.cfm

NASA Explores Lung Capacity and Air Pressure
http://www.NASAexplores.com

2 LESSON TWO: Healthy Buildings – Asthma and Indoor Air Pollution

U.S. Environmental Protection Agency Indoor Air Quality
http://www.epa.gov/iaq/

The Virtual Microscope
http://www.geocities.com/thesciencefiles/microscope/slideintro.html

The Awful Eight: A Play about Air Pollution
http://www.tnrcc.state.tx.us/air/monops/lessons/awfuleightlesson.html

Puget Sound Clean Air Agency's "Clean Air Express" Curriculum
http://www.pscleanair.org/news/cleanairexpress.html

Howard Hughes Medical Institute's "Air Junk" lesson plan
http://www.hhmi.org/coolscience/airjunk/index.html

Burning Issues—Woodsmoke and Your Health
http://www.webcom.com/~bi

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

3 LESSON THREE: Fire and Smoke

University of Washington's Fire, Smoke and Health Website
http://depts.washington.edu/wildfire/

NOAA Satellite Images of Forest Fires
http://www.osei.noaa.gov

New Mexico Environment Department's Wildland Fires Information
http://www.nmenv.state.nm.us/aqb/Wildfire-PM.html

Washington Department of Ecology Agricultural Burning Information
http://www.ecy.wa.gov/programs/air/aginfo/agricultural_homepage.htm

Power Point Presentation on Agricultural Burning Study
http://depts.washington.edu/pmcenter/res_reports.html

EPA's AIRNOW Air Quality Information
http://www.epa.gov/airnow

Resources for
Language Arts Lessons

The following resources are intended to provide additional information specific to the two **LANGUAGE ARTS** lessons on asthma and environmental health.

1 LESSON ONE: Athletes with Asthma – Biography Boxes

WHEATIES™ Cereal
You can access over 75 cereal boxes featuring professional athletes.
http://www.wheaties.com/index.asp

Breath of Life
An exhibit about the faces of asthma through history.
http://www.nlm.nih.gov/hmd/breath/breathhome.html

Tips to Remember: Exercise-Induced Asthma
http://www.aaaai.org/patients/publicedmat/tips/exerciseinducedasthma.stm

Sports and Asthma
http://getasthmahelp.com/kids_sports.asp

Winning the Gold with Asthma
http://www.savvyhealth.com/disp.asp?doc_id=159

2 LESSON TWO: Reading About Asthma

***Jimmy Neutron* Lesson Plan**
Media Studies lesson plan critiquing the portrayal of Carl Wheezer, a character with asthma, in the animated movie ***Jimmy Neutron***.
http://www.kqed.org/w/baywindow/asthma/livingwithasthma.html

Facing West, A Story of the Oregon Trail by Kathleen Kudlinski
(Once Upon America Series)
Grade 3+ 58 pages
ISBN: 0140369147 Puffin, 1996

Young Teddy Roosevelt by Cheryl Harness
Grade 4+ 48 pages
ISBN: 0792270940 National Geographic, 1998

Amelia Lends a Hand by Marissa Moss
(American Girl Series)
Grade 4+ 32 pages
ISBN: 1584855398 Pleasant Company, 2002

On the Sidelines by Emily Costello
(Soccer Stars Series #2)
Grade 5+ 150 pages
ISBN: 0553486454 Skylark, 1998

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Weaver's Daughter by Kimberly Brubaker Bradley
Grade 5+ 166 pages
ISBN: 0440417171 Yearling Books, 2002

The Pistachio Prescription by Paula Danzinger
Grade 5+ 154 pages
ISBN: 0698116909 Putnam, 1999

Welcome to the BSC, Abby by Ann Martin
#90 in The Babysitter's Club Series
Grade 6+ 192 pages
ISBN: 0590228749 Apple, 1995

Appointment with a Stranger by Jean Thesman
YA 166 pages
ASIN: 0395492157 Houghton, 1989. A Sequoyiah Award Winner

Breathing Room by Barbara Elmore
YA 126 pages
ISBN: 0880921080 Royal Fireworks Press, 1994.

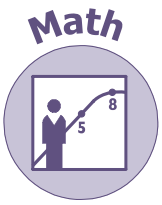
Jackie Joyner-Kersee: Champion Athlete by Geri Harrington
(Great Achievers: Lives of the Physically Challenged Series)
YA 111 pages
ISBN: 0791020 Chelsea House Publishers, 1995

Thin Air by David Getz
YA 120 pages
ASIN: 0805013792 Harper Collins Juvenile Books, 1992

Lord of the Flies by William Gerald Golding
Adult book 208 pages
ISBN: 0399501487 Perigee, 1959

Peace Like A River by Leif Engers
Adult book 320 pages
ISBN: 0802139256 Grove Press, 2002

Resources for Math Lessons



The following resources are intended to provide additional information specific to the two **MATH** lessons on asthma and environmental health.

1 LESSON ONE: Asthma Diaries

Brain Pop Website
Check out the animated videos explaining "Peak Flow Meters" in the Health section.
http://www.brainpop.com

Peak Flow Meter Information
http://www.lungusa.org/site/pp.asp?c=dvLUK9O0E&b=22586

Peak Flow Chart
http://www.lungusa.org/site/pp.asp?c=dvLUK9O0E&b=33661

Human Respiratory System Flash Presentation
http://www.lungusa.org/site/pp.asp?c=dvLK9O0E&b=40743

Asthma Daily Diary
http://nickjr.com/parenting/health_fitness/asthma/asthma_diary.html

2 LESSON TWO: The Cost of Childhood Asthma

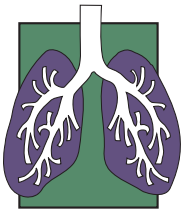
Landrigan, Philip et. al. *Environmental Health Perspectives*. "Environmental Pollutants and Disease in American Children: Estimates of Morbidity, Mortality and Costs for Lead Poisoning, Asthma, Cancer and Developmental Disabilities." v.110, no. 7. July 2002.

http://ehpnet1.niehs.nih.gov/docs/2002/110p721-728landrigan/abstract.html

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Master Copies of Student Handouts

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).



Student Introduction: ENVIRONMENTAL HEALTH AND ASTHMA

Student Handout

Name _____

Date _____

What is Environmental Health?

Your health depends on the environment around you. **Environmental health** is the study of how the environment affects human health. It differs from the study of how humans affect the environment, because it focuses on people's health. An environmental scientist might study how water pollution is hurting fish. An environmental health scientist would study what happens to the health of people when they catch and eat those fish. Environmental health is not just about the health of the environment – it always comes back to you and whether the environment you are part of is helping you stay healthy, or making you sick.

Environmental Health: How the environment affects human health.

Hazard: Something that can harm the health of humans or the environment.

Chemical: Any substance that is made from elements combined into molecules.

Every day, you come in contact with things in your environment that can help you or hurt you. Some of these things are important for keeping you healthy, such as oxygen or medications. However, some of these things may be harmful to your health, such as tobacco smoke or snake venom. Things in the environment that are harmful are called **hazards** and include things like **chemicals,** disease-causing bacteria, loud noises and even stress. Hazards can be natural or human-made.

People working in the fields of environmental health do many different jobs. They work to identify environmental hazards, and prevent people from being harmed by them. Some are scientists working in laboratories. Some work for the government writing regulations and studying pollution. Some work for corporations to help make sure that workplaces are safe and that the environment is kept as clean as possible. Most of these jobs require a solid understanding of science and math, knowledge about history and the law, and good communication skills.

Toxicology: The study of the harmful effects of chemicals on living things.

To understand the field of environmental health, you need to understand seven core concepts: **Toxicity, Exposure, Dose/Response, Individual Susceptibility, Risks & Benefits, Environmental Justice, and Community Resources & Action**.

Toxicity: A measure of how dangerous a chemical is.

Toxicity

Most people working in environmental health-related jobs have taken classes in the science of **toxicology**. Toxicology is the study of how environmental hazards, such as natural and human-made chemicals, can enter our bodies and make us sick.

When scientists study different chemicals in the environment to see if they might be dangerous to humans, they are trying to understand the **toxicity** of those chemicals. Toxicity is a measure of how dangerous a chemical is. The greater a chemical's toxicity, the less it takes to make a person sick or even kill them. The Environmental Protection Agency, for example, uses the following scale to rate the toxicity of products commonly used in the home.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Toxicity Rating	Word and symbols that appear on product's label	Approximate amount need to kill an average size adult
1 – Highly Toxic	DANGER POISON 	A few drops to one teaspoon
2 – Moderately Toxic	WARNING 	One teaspoon to one ounce
3 – Slightly Toxic	CAUTION	More than one ounce
4 – Not Toxic	none	

A bottle of bleach, for example, will have the word DANGER on the label, because it is highly toxic if ingested (toxicity rating = 1). Borax powdered cleaner, however, is rated as slightly toxic (toxicity rating = 3) and will have the word CAUTION on the label. This is just one example of a system used to measure the toxicity of hazards.

Source of Exposure:
A hazard's point of origin, such as cars, industry, or a volcanic eruption.

Environmental Pathways:
How a hazard travels from its source to humans. These include air, water, food, and soil.

Exposure:
The total amount of a chemical that comes into direct contact with the body.

Inhalation:
Breathing. When chemicals enter the body through this route of exposure, they can get stuck in the lungs and/or be taken up into the bloodstream.

Ingestion:
Swallowing (usually by eating or drinking). When chemicals enter the body through this route of exposure, they can easily be taken up into the bloodstream.

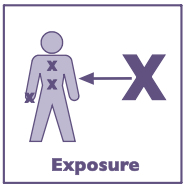
Dermal Absorption:
Absorbing a chemical through any part of the skin, including the eyes. When chemicals come in contact with the skin, they can sometimes enter the bloodstream through this route of exposure. However, for many chemicals the skin provides good protection of your body.

Routes of Exposure:
The ways in which a chemical can enter the human body. The three main routes of exposure are inhalation, ingestion, and dermal absorption.

Dose:
The total amount of a chemical that gets into a human or other living thing, relative to the individual's body weight.

Duration of Exposure:
The length of time you are in direct contact with a hazard.

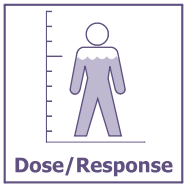
Frequency of Exposure:
How often you are in direct contact with a hazard.



Exposure

We all know what it means to be "exposed" to something like a cold or a flu. Everyday our bodies are exposed to all sorts of environmental hazards, such as bacteria, viruses, and the sun's ultra-violet (UV) rays. Some of these hazards exist naturally and some of them are the result of human activities. There are many possible **sources** of hazards, such as cars, industry, even volcanic eruptions. In order for us to be exposed, however, the hazard has to get from the source to us. To do this, it travels along an **environmental pathway.** Pathways include the air we breathe, the water we drink, the food we eat, and even the soil we work in, play in, and use to grow much of our food.

Environmental health scientists use the term **exposure** to describe the total amount of a hazard that comes in direct contact with your body. Once you have come into contact with a hazard, it can get into your body through different routes. You can breathe it in (**inhalation**). You can eat or drink it (**ingestion**). You can get it directly on your skin or in your eyes (**dermal absorption**). You can also get it directly into your body through an injection. Inhalation, ingestion, and dermal absorption are the three main **routes of exposure**. Things that help us stay healthy, like vitamins, nutrients, and medications, enter the body through these routes of exposure, but hazards can use these same routes to enter the body and make us sick.



Dose/Response

Imagine that someone has been exposed to a hazardous chemical through one of the three possible routes of exposure. They have now received a **dose** of that chemical. Dose is the amount of the hazard that actually enters your body. The amount someone gets into their body (their dose) depends on many factors, including how long you are exposed, how often you are exposed, and how big or small you are. For instance, if someone is exposed over a long period of time to a hazard, their dose will be larger. For example, 30 minutes spent under the bright summer sun would give you a much smaller dose of UV rays than 4 hours spent under the sun. This is called the **duration of exposure**. The **frequency of exposure** can also influence the dose. If someone works in a factory and is exposed to a chemical every day at work, their dose might be larger than someone who is only exposed once.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Dose can also depend on how big or small you are. When a doctor prescribes a medication for you, he or she calculates the amount of the medicine you should have based on your body size. The doctor can then give you the correct dose of the medicine for your body weight. While a teaspoon of medicine might be right for an adult, it may be far too large of a dose for an infant.

The dose you receive can influence how your body responds to a hazard. For most hazards, the larger the dose, the more extreme the **response** will be. The smaller the dose, the more mild the response will be. Drinking one can of a caffeinated soda might be fine. Drinking three cans in a row may make you jittery. Drinking five cans of soda might make you feel light-headed and sick.

Response:
The reaction to an exposure or dose of a hazard. A response can be anywhere from mild (e.g. headaches, a rash) to severe (e.g. brain damage, cancer).

Individual Susceptibility

Some people are more likely than others to get sick when they are exposed to environmental hazards. This might be because of their **genetics**, body size, age, gender or general health. This is called their **individual susceptibility**.

Genetics:
Information that is contained in the genes (DNA) of a person's cells. Genetic information is passed down from parents to their children.

Individual Susceptibility:
Differences in the ways that individuals react after exposure to the same amount of a hazardous chemical. Differences in susceptibility can be caused by differences in body size, age, genetics, gender and general health.

For example, some people are more likely than others to get sick when they are exposed to certain kinds of pesticides, just because of their genes. We all know that genes help determine things like hair color and eye color, but they also lead to some important (and invisible) differences in the way bodies work. It turns out that some people have a more extreme response to certain pesticides because of their genes. These people are said to be more "individually susceptible" to pesticide poisoning. Someone who lives or works on a farm where pesticides are sprayed might want to know how susceptible he or she is in order to avoid exposure and stay healthy.

Risks and Benefits

We live in an industrial society that depends on the use of both natural and human-made chemicals to function. The use of these chemicals results in **benefits** to society as well as **risks**. Pesticides, for example, make it easier to grow fruit. Unfortunately, in some cases, pesticides can make people sick. Most of us have heard that we can reduce the risk of getting sick without giving up the health benefits that fruit offers by washing or peeling the fruit before we eat it.

Benefit:
Something that results in increased well-being or good health.

Risk:
The likelihood that a harmful consequence will occur as a result of exposure to a hazard.

Scientific researchers and government officials measure the risks and benefits that we face when we manufacture or use certain products. They work to explain what they have learned to the public and create safety standards that help people protect themselves from unnecessary risk. Their goal is simple – to help us enjoy the greatest benefits from the products that we manufacture, while exposing ourselves to the least possible risk. By understanding the risks and benefits that we face each day, we can make decisions that reduce our risk and keep us as safe and healthy as possible.

Environmental Justice

Everyone has the right to live in an environment that does not make them sick, regardless of their race, culture, or income. This is called **environmental justice** (EJ).

Environmental Justice:
The fair treatment of people regarding the development of environmental laws, regulations and policies.

Unfortunately, some neighborhoods or communities are exposed to more environmental hazards than others, and may suffer higher rates of health problems. These communities often have less economic or political power in society when decisions are made. For example, toxic waste dumps, polluting factories, and busy highways are often built in

lower-income neighborhoods or communities of color. Communities recognize this as an environmental health issue and work to seek environmental justice.

Community Resources and Action

Community Resources and Action:
An individual's ability to access resources and act on new information in order to create positive change in their own community.

Where can you go in your own community to collect information about an environmental health issue? You can learn more about specific issues, understand environmental laws or seek environmental justice by using community resources. Community resources include places like the library and city hall. You could search the Internet for local, state, or federal agencies that can give you information about your issue. You can also talk to environmental health scientists at local universities or health departments, and ask your teachers and family members what they know about the issue.

Once you have gathered your resources and studied the issue carefully, it is time to take action! First, ask yourself what you as an individual can do to help solve the problem. If you are concerned about air pollution, for example, you might decide to walk to school instead of getting a ride in a car. Next, ask yourself how you can share what you have learned with others so that they can help too. Maybe you could write a letter to the editor of your local newspaper or speak to your community council or school board. Maybe you could create a flyer to hand out in your neighborhood. There are many great ways to get the word out and make positive changes in the world – use your imagination and be creative!

Check Your Understanding

1. Name one product that can be found in your home that might be considered to be highly or moderately toxic.

2. List the three routes of exposure. For each one, give an example of an environmental hazard to which you could be exposed through that route.

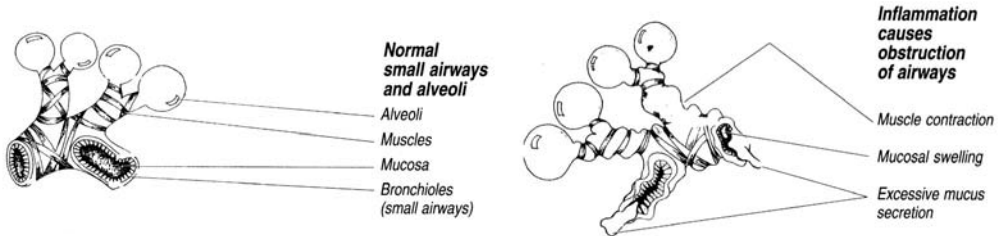
3. Explain how the concept of "exposure" is different from the concept of "dose."

4. Pick four vocabulary words from the margin on the previous pages and use each one in a complete sentence.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

What is asthma?

Asthma is a condition that causes the airways of your lungs to become inflamed and obstructed making it hard to breathe. The airways also flood with thick mucus. Asthma can make you wheeze, cough, and have difficulty breathing. When this happens, it is called an asthma **episode** or **attack**. If not properly treated, it can be fatal. Each year, approximately 500,000 Americans are hospitalized because of asthma, and 5,000 Americans die from the disease.



How do people get asthma? You cannot catch asthma from someone like a cold. It is not **contagious**. Asthma is usually caused by a combination of genetics and environment.

You may have asthma because it was passed to you through your genes. You cannot inherit asthma itself, but you can inherit a tendency to develop asthma. Then, if you come in contact with certain things in the environment, you may develop asthma.

Sometimes an **allergy** may cause an asthma episode. Allergies to pollen, furry or feathered pets, dust mites, mold or foods like peanuts may cause an asthma episode.

Another way the environment may contribute to your asthma is by irritating your **respiratory system**. These **irritants** may cause you to get asthma, or if you already have asthma, they may cause an asthma episode to occur. These irritants include dust, car exhaust, strong perfumes, household chemicals, tobacco smoke, and cold air.

There are two types of medications that people with asthma may use to control their asthma. Many people take daily long-term control medications that help prevent an asthma episode from occurring. This type of medication is taken daily and helps keep airways from becoming swollen or tight. When an asthma episode is occurring, many people use quick-acting or rescue medicine to stop the episode from becoming worse. The quick-acting medicine relaxes the muscles in the lungs to help the person breathe easier. Asthma medications may be taken as pills, or through the use of inhalers, spacers or nebulizers (tools used to deliver the medicine deep into the lungs). You or someone you know may use an inhaler. If an asthma episode is severe and does not get better after taking rescue medicine, a trip to the emergency room for more powerful drugs might be necessary.

Some people get the symptoms of asthma when they are very young, less than a year old, and others do not have the signs and symptoms of asthma for many years. There is no cure for asthma, but it is treatable. With proper education and medication, people can control their asthma and live active, healthy lives.

Asthma:
A condition that causes the airways of the lungs to become inflamed, constricted and filled with mucus, making it hard to breathe.

Asthma Episode/Attack:
A flare-up of asthma symptoms that may include wheezing, coughing, shortness of breath, or difficulty breathing.

Contagious:
An infection or disease that can be passed from one person to another, such as a cold.

Allergy:
People who have allergies get sick due to the presence of a certain kind of antibody around things that do not make most people sick. Things that cause allergies are called **allergens**. Common allergens include pollen from plants, furry animals, and tiny dust mites.

Respiratory System:
The system of organs involved in breathing. This includes the nose, mouth, throat, bronchial tubes, and lungs.

Irritant:
A chemical that can aggravate the skin, eyes, or respiratory system.

Some important facts about asthma:

- Fifteen million people in the U.S. now have asthma — that is twice as many as were reported having asthma twenty years ago.
- One out of every fourteen Americans has asthma. That means that a friend or relative of yours probably has asthma. You might have asthma.
- 4.9 million or 9.2% of school-age children in the U.S. have asthma.

Source: Epidemiology and Statistics Unit. Trends in Asthma Morbidity and Mortality. NYC: ALA, April 2004.

Check Your Understanding

1. Your friend is having an asthma episode. What symptoms might he have?

2. When might someone use an asthma inhaler? Why?

What does asthma have to do with environmental health?

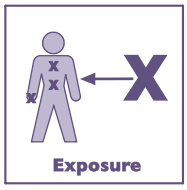
Even though genetics plays an important role in causing someone to develop asthma, it is not the only cause. Things in the environment can cause someone to get asthma, or lead to an asthma episode for someone who already has the disease. Environmental causes of asthma include dust mites and tobacco smoke.

Trigger:
A substance (e.g. pollen, pets, dust) or condition (e.g. having a cold) that causes an asthma episode.

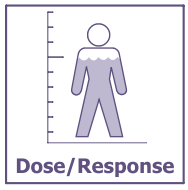
Something in the environment that causes an asthma episode is called a **trigger**.
Four common triggers include:

- Viral infections (cold or flu)
- Allergies (pollen, furry or feathered pets, dust mites or mold)
- Irritants (cold air, tobacco smoke, household chemicals, perfumes, dust, or car exhaust)
- Exercise

Let's answer a few basic environmental health questions about asthma.



- *What is the main **route of exposure** for most asthma triggers?*
  Asthma is a condition that affects the respiratory system, so you will not be surprised to learn that people with asthma are usually exposed to triggers when they breathe them in. This means that the main route of exposure for substances that trigger asthma is inhalation.



- *What does **dose** have to do with asthma?* People who have asthma learn to limit the dose they get of the things that trigger their symptoms. For instance, people whose asthma is triggered by being around cats learn to avoid cats. They also know that being around one cat for five minutes will not cause as bad a response as being around ten cats for fifty minutes. The bigger the dose and the longer the exposure, the worse they feel. Dose is also important for the medication used to control asthma. If the dose is too small, it may not control the asthma. If the dose is too large, the medicine itself can be dangerous.

- *What does **individual susceptibility** have to do with asthma?* Genetics are what makes each of us unique. No two people (except identical twins) have the exact same genetic code. Some individuals are more likely than others to develop asthma because of their genes. These people are more susceptible to allergies and react more strongly to the irritants that trigger asthma. Kids are more likely to develop asthma than adults are. This means that kids are more susceptible to asthma than adults.

- *What environments put people with asthma at **risk**?* Children whose parents smoke are more likely to develop asthma. Children who live in cities with air pollution problems are more likely to develop asthma. Air pollution can make people who have asthma feel even worse. Adults who are exposed to certain irritants (like chemical fumes or dust) at work are more likely to develop asthma. All of these things are called asthma "risk factors."

- *What does **environmental justice** have to do with asthma?* People of color and people from low income households may be exposed to higher than average levels of air pollution. This may be because they live in cities with outdoor air pollution problems or houses with indoor air pollution problems. These increased exposures to air pollution can make people of color and low income people have an increased risk for having asthma.

Student Assessment:
Have students answer these questions individually or in pairs.

Check Your Understanding

1. How are allergies related to asthma?

2. How can a person with asthma control their exposure to asthma triggers?

3. If your friend, who you know has asthma, begins to show signs of an asthma episode, what would you do?

4. Pick four vocabulary words from the margin on the previous pages and use each one in a complete sentence.

Social Studies

THE HISTORY OF ASTHMA TREATMENTS
Student Handout #1

Student Handout

Name _____

Date _____

Arsenic, Crocodile Dung and Chicken Soup: The History of Asthma Treatments around the World

Introduction

What do arsenic, crocodile dung, and chicken soup have in common? They have all been used at various times and in various places to treat **asthma**. Unfortunately, asthma is nothing new. People throughout history and around the world have suffered from this disease. Asthma symptoms, like wheezing, coughing, and difficulty breathing, can be quite dramatic and even scary. As a result, healers long ago recognized the importance of treating this disease. Asthma is described in some of the oldest medical books ever written.

Asthma: A disease of the lungs that usually results in difficulty breathing and can be life-threatening.

In the past, doctors came up with all sorts of things to try and make those suffering from asthma feel better, but only a few of these treatments actually worked. Many doctors actually hurt patients instead of helping them. Chinese doctors were the exception. Five thousand years ago, Chinese doctors successfully treated asthma sufferers using a powerful herb. Doctors still use chemicals extracted from that herb in medicines today.

The Ancient World

Prehistoric humans (before 3000 BC) left no written records, so we do not know very much about how they treated injury and disease, including asthma. From bones found at archeological sites, however, we know that they treated some illnesses by drilling holes in the skull of the sick person. This process is called **trepanation**. It is possible that severe asthma would have been treated this way, but without more evidence, medical historians cannot be sure.

Trepanation: Drilling a hole through the skull as a treatment for illness.

According to early written records, doctors in Ancient China used an herb that helped people with asthma and other ailments. It is called Ma Huang and it was in use as early as 3,000 BC. In the 1900s, scientists isolated the chemical component of Ma Huang that helped treat asthma. They called it **ephedrine**. This "new discovery," known for thousands of years in China, proved a popular and effective treatment for asthma for a long time and is still used in certain medications today. Most over-the-counter medications used to treat the symptoms of the common cold contain chemicals very similar to ephedrine.

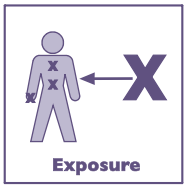
Ephedrine: A chemical derived from the herb Ma Huang that has been used successfully in the treatment of asthma.

In Ancient Egypt, records of daily life were recorded in **hieroglyphics** on paper made out of the leaves of the papyrus plant. Some of these records are medical texts. One particular text from around 1500 BC describes treatments for diseases of the **respiratory system**, which would have included asthma.

Hieroglyphics: An ancient Egyptian system of writing that used picture symbols.

Respiratory System: The system of organs involved in breathing, including the nose, mouth, throat, bronchial tubes, and lungs.

One treatment required the asthma sufferer to swallow a mixture of figs, grapes, beer, frankincense, and even camel or crocodile dung! The text also describes a treatment in which an extract made from a plant called henbane was heated on a brick. The asthma patient would then inhale the rising vapors.



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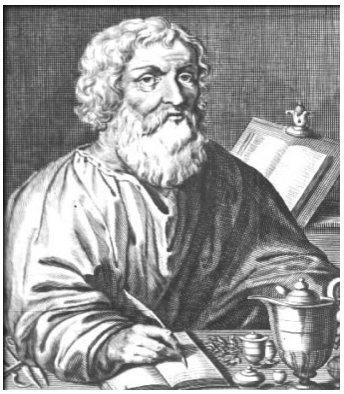


Hippocrates

The people of Ancient Greece were the first to use the word asthma to describe difficult or painful breathing. The word asthma actually means shortness of breath in Greek. Many Greeks believed that the gods were responsible for disease and that only the gods could cure a sick person. One Greek philosopher named Hippocrates, however, had a different idea. He lived from about 460 to 377 BC and is considered to be the father of Western medicine. He wrote that the body is made up of four "humors," substances like phlegm and bile that have to be kept in perfect balance for a person to stay healthy. He does not seem to have discovered any effective asthma remedies, but he was the first person to suspect that asthma might be an inherited disease. We now know that he was right – the **genes** we inherit from our parents definitely play an important role in making us susceptible to asthma.

Genes:
Genes are pieces of DNA that are found in every cell of the body. They are inherited from our parents and help determine our individual traits.

The doctors of Ancient Rome (509 BC to 476 AD) adopted many of the medical beliefs of the Ancient Greeks and further developed them. They also were the first culture to recognize the connection between dirt and disease. In order to help people stay healthy, they built sewers to deal with waste, bathhouses to help people stay clean, and aqueducts to supply cities with clean drinking water. Unfortunately, they did not make much progress in treating asthma. Medical texts from the period recommend treating asthma with a variety of things, including vinegar, millipedes, and ground up fox lungs.

Check Your Understanding - Ancient World

1. What is Ma Huang?

2. What two routes of exposure did the Egyptians use to get medicine into the patient's body?

3. What did Hippocrates correctly suppose was one of the causes of asthma?

Woodcut showing a woman being bled from the arm

The Middle Ages

After the Roman Empire fell in 476 AD, the period known as the Middle Ages began in Europe. During this period, much of the medical knowledge of the Greeks and Romans was lost or forgotten. People lived in poorer and dirtier conditions than before. They were less healthy and lived shorter lives. Asthma was treated with complicated potions containing exotic ingredients like animal bones, pearls, and goose dung.

Although the European part of the Roman Empire collapsed in 476 AD, the eastern half survived for a thousand years. It was called the Byzantine Empire (476 to 1453 AD) and much of the knowledge of Ancient Greece and Ancient Rome was preserved there. Paulus Aegineta was a Byzantine doctor who lived from about 625 to 690 AD. He wrote a medical encylopedia that included treatments for asthma. One recommendation was to "bleed" the patient. In this treatment, a doctor would cut open a vein in a patient's arm and let it bleed. The idea was that bleeding would take whatever was making the patient sick out of the their body. Instead, it just made patients weak, tired, and even sicker. **Bleeding** was used as a treatment as late as the 1800s, even though it hurt people rather than helped them. Byzantine doctors also recommended blistering a patient's skin with strong chemicals. The blisters were supposed to pull bad substances out of the patient's body.

Environmental Justice

Bleeding:
Intentional cutting of a vein as a medical treatment.

During the Middle Ages, Arab physicians had many supposed cures for asthma, including the use of arsenic as a treatment. Arsenic is a powerful poison and would have just made asthma sufferers feel worse. One Jewish doctor who was the court physician to an Egyptian king, however, had different ideas. Maimonides, who lived from 1135 to 1204 AD, acknowledged that he had no magic cure for the disease. Instead, he suggested the patient move to a dry climate, avoid polluted city environments and eat certain foods, including chicken soup! Maimonides was one of the first doctors to document that asthma may be related to the environment.

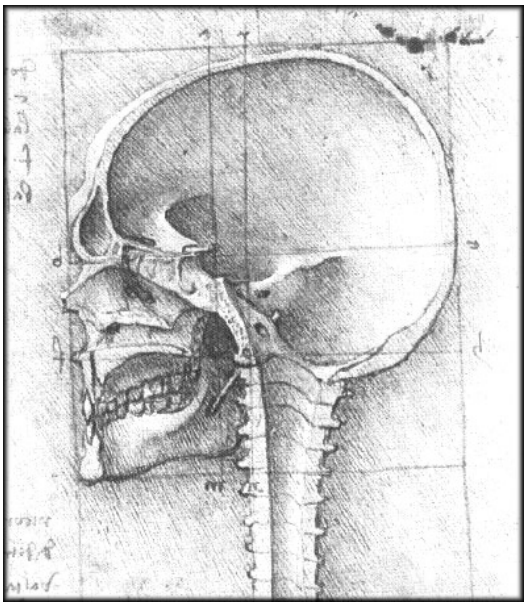
Check Your Understanding - Middle Ages

1. After the fall of the Roman Empire, what changes happened in Europe that affected human health?

2. Why did Byzantine doctors "bleed" patients?

3. Who recommended a change of climate and chicken soup as treatments for asthma?

The Renaissance

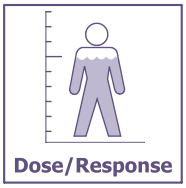


A drawing of the skull by Leondardo da Vinci

The period following the Middle Ages is called the Renaissance. It began in Italy about 1350 and lasted until about 1600. An important part of the Renaissance was the rediscovery of Greek and Roman knowledge about all sorts of things, including science and medicine. Scientists of the Renaissance also began to dissect human corpses for the first time. Great thinkers like Leonardo da Vinci (1452-1519) drew detailed pictures of human **anatomy**. This helped them better understand how human bodies worked.

Anatomy:
The structure of a plant or animal.

One Renaissance doctor with a very long name was so convinced that old ideas about medicine were wrong, that he publicly burned certain ancient medical books to make his point. Philippus Aureolus Theophrastus Bombastus von Hohenheim, better known as Paracelsus, lived from 1493 to 1541. He believed that medicine should be based on experiments, observation and reason. He was the first person to document that any substance could be poisonous if the dose were high enough. Even salt is deadly if you eat too much! Because of his writing on this topic, he is considered the founder of the study of poisons, or **toxicology**. Dose is still a very important concept to understand, whether treating a headache or asthma.



Toxicology:
The study of the harmful effects of chemicals on living things.

One asthma patient during the Renaissance was so famous, that his case got a lot of attention from the doctors of the period. The Archbishop John Hamilton, a very rich and important church leader in Scotland, was very sick with asthma. One doctor thought that the archbishop's problem was that he was too cold. He told the archbishop to avoid fresh air and sit next to a fire of peat or coal at all times. Peat and coal fires are very smoky and probably made the Archbishop's asthma much worse. Cold air can worsen asthma, so the doctor may have made a correct diagnosis but suggested a misguided treatment.

Another doctor, Gerolamo Cardano, was called in to help. Cardano lived from 1501 to 1576, and was Europe's most famous physician. Cardano decided that the Archbishop was sick because he was too hot. He told the Archbishop to go out into fresh air again and stay away from smoky fires. The doctor also told the Archbishop not to sleep on a feather mattress because it would make him too hot. The Archbishop got better. The fact that Cardano's approach worked was mostly accidental. The doctor did not understand about **allergies** or realize that the Archbishop might be allergic to feathers or hurt by breathing in coal smoke.

Allergies:
People who have allergies get sick around things that do not make most people sick. Things that cause allergies are called **allergens**. Common allergens include tobacco smoke, pollen from plants, furry animals, and tiny dust mites.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Check Your Understanding - Renaissance

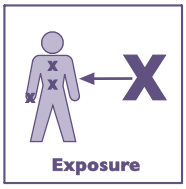
1. What did Renaissance scientists do that helped them better understand human anatomy?

2. Paracelsus is considered the founder of what field of scientific study?

3. How did Gerolamo Cardano help his asthma patient, John Hamilton, get better?

The Modern Era

During the 18th and 19th century, the Industrial Revolution and new ideas about government changed the world dramatically. Ideas about asthma also changed. An English doctor named John Floyer (1649-1734) had a very good reason to study asthma – he suffered from the disease himself. He studied the disease carefully and made an accurate list of the things that could cause asthma or make it worse. His list included heredity, exercise, air pollution, tobacco smoke, some occupations, and infections. However, even though Dr. Floyer understood the things that caused asthma, he did not know how to cure it. He told patients to put strong chemicals on their skin to make blisters. He also told them to take a lot of cold baths.



Spirometer

During this period, doctors began to better understand how the respiratory system worked. They also invented new tools to help diagnose asthma. The stethoscope, invented by a French doctor in 1816 named R.T.H. Laennec, made it possible to hear what the lungs sounded like during an asthma episode. In 1844, a British surgeon named John Hutchinson (1811-1861) invented a machine called a **spirometer**. This machine measures the maximum amount of air the lungs can inhale and exhale and is an important tool for identifying problems with lung function, such as asthma.

Spirometer:
An instrument for measuring the volume of air entering and leaving the lungs.

Although diagnosis was improving, however, treatments for asthma during the 1800s were still ineffective and even harmful. Doctors often told people with asthma to drink alcohol, smoke tobacco, or eat garlic. They also prescribed dangerous poisons like mercury. Bleeding was still popular too; either by applying live leeches to the skin or by cutting open a vein.

Fortunately, 20th century Western scientists made many new discoveries that helped find better treatments for asthma. In the 1930s, doctors proved that asthma and allergies were connected, leading to a better understanding of what triggers asthma episodes. Scientists also discovered many new and effective drugs to replace the old treatments. Chemicals were discovered that reduced asthma episodes by relaxing the

Bronchial tubes:
Part of the respiratory system - the windpipe divides into two main bronchial tubes, one for each lung.

Inhaler:
An inhaler is a device that gives your lungs a puff of medication in a measured dose. The medication is quickly absorbed into the bloodstream through the lungs.

muscles in the **bronchial tubes**, making it easier to breathe. These chemicals are called bronchodilators. The **inhaler** was also invented, making it easier for someone suffering from an asthma episode to get the medicine they need, when they need it.

As we begin the 21st century, there is bad news and good news. The number of people with asthma is greater than ever, and we now know that air pollution is a big part of the problem. We also know that low-income people and certain minorities are more likely to get asthma. That is the bad news. Fortunately, doctors and scientists have developed simple ways for people to avoid these triggers. New asthma medicines are now available, and people with asthma are living healthier lives.

Check Your Understanding - Modern Era

1. What six things were included on John Floyer's list of the causes of asthma?

2. Name two medical tools invented in the 1800s that helped scientists better understand how the respiratory system works.

3. How do the chemicals called bronchodilators help people with asthma feel better?

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Timeline Activity

Using what you now know about the history of asthma treatment, construct a timeline to help you understand the order in which the events mentioned in the reading took place.

Include the events listed below on your timeline. In the space below the timeline, describe briefly how each event or person relates to the history of asthma treatment. Be sure to include BC and AD on your timeline and the correct dates for each event or for each person's lifespan. Also, be sure to give your timeline a title.

- First use of Ma Huang
- Hippocrates
- Fall of the Roman Empire
- Maimonides
- Leondardo da Vinci
- Gerolamo Cardano
- John Floyer
- Invention of the stethoscope
- Invention of the spirometer

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Student Handout

THE GEOGRAPHY OF ASTHMA
Student Handout #1

Name _____

Date _____

In this lesson, you will read about a study that includes **statistics** about asthma across the U.S. You will then answer questions about the study to make sure you understand what you have read. Finally, you will complete a mapping exercise that will help you better understand the **data** presented in the reading.

Statistics: A collection of numerical information.

Data: Information organized for analysis or decision-making.

A Survey of Asthma Rates in the United States for the Year 2001

Asthma is a condition that causes the airways of your lungs to become inflamed, constricted and filled with sticky mucus, making it hard to breathe. Asthma can make you wheeze and cough. When this happens, it is called an asthma episode.

Unfortunately, more people in the U.S. have asthma than ever before. From 1980 to 1994, the number of people who said they had asthma increased 75%. People with asthma must work hard to control their disease by educating themselves and taking medication. Every time a student misses school, she misses out on the education that will help her succeed in life and give back to her community. We can all help society by learning more about asthma, too. If someone with asthma has to stay home from work, it means that person is not able to contribute to society by repairing a road, teaching a class, or running a business. When someone has to be hospitalized for asthma, the costs are high. In the year 2000 asthma caused 1.8 emergency room visits and 10.4 million doctor office visits in the U.S.

Since asthma is a problem that seems to be getting worse, people working in state government and health care need to know how much money to budget for asthma related expenses. To do this, they need an accurate estimate of how many people in their state have asthma. This helps ensure that hospitals will be prepared to treat people with asthma and also helps fund programs that teach people with asthma how to manage the disease and stay healthy.

Federal government agencies like the National Institute of Health (NIH) and the Centers for Disease Control and Prevention (CDC) also want to know how many people have asthma. In 2001, scientists used information gathered by the Centers for Disease Control and Prevention (CDC) to estimate how many people in each of the fifty states suffered from asthma. They based their estimates on information gathered from a survey conducted in the year 2001. The survey was a phone survey that randomly dialed phone numbers looking for adults (aged 18 and above) that were willing to answer a series of questions about their health. A few of those questions related to asthma. The table on the next page shows the percentage of people in each state that answered “yes” to the question: “Have you ever been told by a doctor that you have asthma?”

Phone surveys are a good way to get information from a large group of randomly selected people. This phone survey provided a good method to get some sense of the disease rate, but it is important to be aware of the survey’s shortcomings. The scientists did not check to make sure that those who answered “yes” really had asthma. They had to trust that those people taking the survey were telling the truth and that their

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

doctors had correctly diagnosed their condition. Also, the survey was limited in who it reached. The surveyors did not contact people in the military or adults who were institutionalized, such as people in mental health facilities, hospitals, nursing homes or prisons. In addition, since the survey was given over the phone, people who did not have telephones or did not speak English are not represented.

Why is it important to gather these kinds of data? State and federal officials use this information to budget for asthma treatment and prevention programs. Health care professionals also use the data to ensure that hospitals and clinics are prepared to treat the rising number of asthma sufferers around the nation. Finally, collecting this information every year allows experts to see patterns in asthma rates around the country. This helps answer questions like "Do more people have asthma this year than last year?" and "Are asthma rates higher in one part of the country than another?" This knowledge might one day lead to ways to lower asthma rates by identifying and controlling the things that cause asthma.

Data Chart

Percentage of adults by state that answered that they have been diagnosed with asthma, 2001

Alabama	9.7	Montana	11.8
Alaska	11.5	Nebraska	8.4
Arizona	12.4	Nevada	13.3
Arkansas	10.6	New Hampshire	12.5
California	12.4	New Jersey	9.4
Colorado	12.1	New Mexico	10.8
Connecticut	12.3	New York	11.1
Delaware	12.0	North Carolina	10.1
Florida	9.9	North Dakota	9.1
Georgia	11.0	Ohio	9.8
Hawaii	12.2	Oklahoma	10.1
Idaho	11.7	Oregon	13.0
Illinois	11.3	Pennsylvania	10.7
Indiana	11.3	Rhode Island	12.1
Iowa	9.7	South Carolina	10.8
Kansas	11.7	South Dakota	7.7
Kentucky	10.9	Tennessee	9.3
Louisiana	9.1	Texas	9.6
Maine	12.6	Utah	10.7
Maryland	11.1	Vermont	12.1
Massachusetts	13.1	Virginia	11.4
Michigan	12.4	Washington	12.0
Minnesota	10.1	West Virginia	12.5
Mississippi	9.2	Wisconsin	10.9
Missouri	12.0	Wyoming	11.6

From: "Self-Reported Asthma Prevalence and Control Among Adults, United States, 2001." MMWR, Centers for Disease Control & Prevention, 2003.

Check Your Understanding

1. What was the percent increase in the number of people with asthma in the U.S. between 1980 and 1994?

2. For every 1000 people with asthma in 1980, how many more would have the disease by 1994?

3. Give two examples of why asthma costs society so much money.

4. Who uses asthma estimates and what do they use them for?

5. Who participated in the random phone survey described in the reading?

6. Which state had the lowest estimated asthma rate for 2001?

7. What state had the highest estimated asthma rate?

Mapping Activity

Use the blank map of the United States on the following page to complete this activity.

- Label each state with its name.
- Select a color to represent each of the following percentage ranges:

  ☐ 7.0 to 8.9%

  ☐ 9.0% to 10.9%

  ☐ 11% to 12.9%

  ☐ 13% to 14.9%

- Create a key at the bottom of the map that shows what colors you have assigned to the percentage ranges above.
- Color in each state to indicate the approximate percentage of the population of that state that has been diagnosed with asthma.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Student Handout

Name

Date

Percentage of adults by state that answered that they have been diagnosed with asthma, 2001.

Percentage of adults by state that answered that they have been diagnosed with asthma, 2000

Alabama	9.1	Montana	11.4
Alaska	11.3	Nebraska	8.7
Arizona	11.1	Nevada	13.4
Arkansas	9.9	New Hampshire	12.0
California	11.5	New Jersey	8.7
Colorado	9.5	New Mexico	10.0
Connecticut	10.8	New York	10.7
Delaware	10.4	North Carolina	10.1
Florida	9.1	North Dakota	9.2
Georgia	9.6	Ohio	10.9
Hawaii	11.4	Oklahoma	9.2
Idaho	10.8	Oregon	12.1
Illinois	10.5	Pennsylvania	9.3
Indiana	11.2	Rhode Island	11.7
Iowa	8.5	South Carolina	10.4
Kansas	10.9	South Dakota	8.0
Kentucky	10.7	Tennessee	10.4
Louisiana	8.0	Texas	10.5
Maine	12.5	Utah	10.3
Maryland	10.6	Vermont	9.7
Massachusetts	11.9	Virginia	10.5
Michigan	10.3	Washington	11.9
Minnesota	9.5	West Virginia	11.8
Mississippi	9.9	Wisconsin	10.6
Missouri	10.6	Wyoming	11.8

From: “Self-Reported Asthma Prevalence Among Adults, United States, 2000.” MMWR, Centers for Disease Control & Prevention, 2001.

Name _____

Date _____

Percentage of adults by state that answered that they have been diagnosed with asthma, 2000.

WHAT IS ASTHMA?
Student Handout #1

Name _____

Date _____

Student Handout

Making Mucus

Have you ever stopped to think about your own amazing **mucus**? Your body makes mucus that coats your nose and sinuses, grabbing pollen and dust and keeping it from getting into your lungs. Thick mucus even coats your stomach, protecting it from your powerful digestive acids.

Mucus: A thick, slippery liquid secreted by the mucus membranes in the respiratory system. During an asthma episode, mucus floods the lungs and makes it difficult to breathe.

What is mucus? While it is mostly water, mucus also contains sugars, proteins and salts. Mixed together, these ingredients make a substance that is sticky, gooey and stringy. You are constantly recycling your own mucus. Did you know that the average person swallows about a quart of their own mucus a day?

Think about the last time you had a cold. As your body attempted to get rid of the virus making you sick, it produced lots of thick mucus, giving you a stuffy or runny nose. When you have a sinus infection, sometimes your mucus even turns yellow or green in response to the bacteria, letting you know that you need to go to the doctor. One of the reasons you need to drink a lot of fluids when you are sick is to help flush the excess mucus from your body.

Mucus can also cause trouble. During an asthma episode, the muscles around the bronchial tubes in the lungs contract and inflame. The bronchial tubes also flood with thick mucus, making it difficult to breathe. It is important to drink a lot of fluids after an asthma episode to help flush the mucus from the lungs.

Go ahead and mix up some fake mucus. As you examine the fake mucus, imagine what it would feel like if your lungs were filled with this thick substance.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Mucus Recipes

Fake Mucus Recipe #1

Materials:

- 1/2 cup water
- 3 envelopes of unflavored gelatin
- 1/2 cup of light corn syrup
- 1/2 cup measuring cup
- Fork
- Saucepan or microwave-safe bowl
- Bowl

Safety:

Make sure you follow lab safety rules when using a heat source (stove, microwave oven, etc.) to heat up the water.

Directions: (makes about 1 cup)

1. Heat water until it boils. Remove from heat. Carefully pour into a bowl.
2. Sprinkle in three packets of gelatin. Wait several minutes, then stir with a fork.
3. Add 1/2 cup of light corn syrup. Stir with a fork.
4. Use a fork to lift out long strands of mucus. Touch it with your fingers.
5. As the mucus cools and thickens, add water, a little at a time.

Real mucus is made up of water, sugars, proteins and salt. Your fake mucus has the same ingredients, they just come from different sources. The corn syrup provides sugar and the gelatin provides protein.

Fake Mucus Recipe #2

This recipe makes a substance that is opaque and thicker than actual mucus. To keep for longer periods, place mucus mixture in a re-sealable plastic bag and store it in the refrigerator.

Materials:

- 1 teaspoon powdered Borax
- 1/2 cup white glue, such as Elmer's Regular Glue
- Water
- Food coloring (optional)
- Re-sealable plastic bag
- 1/4 and 1/2 cup measuring cups
- Teaspoon

Safety:

This mucus should not be eaten! This mucus can stain fabric, so take care to keep it from carpets, furniture and clothing.

Directions: (makes about 1 cup)

1. Measure 1/4 cup of warm water in a measuring cup. Add 1 teaspoon of Borax. Stir until completely dissolved. Set aside.
2. Measure 1/2 cup of water. Pour into plastic bag. Measure 1/2 cup of white glue and pour into bag. Seal the bag and mix the glue and water thoroughly by kneading the bag.
3. Add a couple drops of food coloring to the glue/water mixture in the bag.
4. Pour the Borax solution into the bag with the glue solution.
5. Seal the bag and knead the mixture.
6. Dig in and have fun exploring the mucus. This mucus is not sticky, so you can take it out of the bag to explore it. Remember to wash your hands when you are finished.

It can be difficult to know exactly how much Borax to add to your mixture. If you add too little, the mucus will be sticky. If you add too much, the mucus will be too wet. Once the mixture looks like it is not a liquid anymore, touch it. If it feels sticky, try adding a little more of the Borax solution. If the mixture feels too wet and slippery, knead it in your hands for a few minutes until the Borax solution is absorbed.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

WHAT IS ASTHMA?
Student Handout #2

Name _____

Date _____

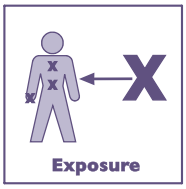
Student Handout

Respiratory System Model

Build a Soda Bottle Lung

Each day, you take at least 23,000 breaths. Your respiratory system inhales and exhales over 8 million times per year. What is going on with each breath you take? What happens within the respiratory system during an asthma episode?

Follow these directions to build a soda bottle lung—a working model of a respiratory system. Your model will show you what happens to the lungs during an asthma episode. After you have built your model, answer the questions on the back of this page.



Materials (per group):

- 1 two-liter plastic soda bottle
- Construction paper (pink or gray)
- 4 Cotton balls
- 2 Straws
- 2 Round balloons (9”)
- Plastic shopping bag
- Thin gauge wire
- Transparent tape
- 3 Rubber bands
- Scissors

Directions:

1. Use the scissors to carefully cut the bottom off of the soda bottle. The bottle represents the **thoracic cavity**.
2. Put the end of one straw into a balloon and tightly wrap a rubber band around the neck of the balloon, attaching it to the straw. Repeat with the other straw and balloon. The balloons represent the **lungs**.
3. Take one of the balloons and loosely wrap the wire around the balloon, spiraling around it to form a cage. This represents the muscle bands that constrict around the **bronchial tubes** during an asthma episode. Leave the other balloon as it is, to represent a normal lung.
4. Insert the two straws through the open bottom of the bottle and bring the top of the straws up through the neck of the bottle. The straws represent the bronchial tubes.
5. Tightly stuff the neck of the bottle with cotton balls around the straws.
6. Roll a piece of construction paper into a tube just big enough to fit over the tops of the straws. Tape closed. Place over the tops of the straws. The paper represents the **trachea**.
7. Cut the plastic shopping bag to make a piece big enough to cover the open bottom of the soda bottle. Stretch a rubber band around the base of the bottle to hold the bag in place. The bag represents the **diaphragm**.
8. Tape a loop of paper onto the center of the plastic bag to make a handle.
9. To make the model work, grasp the plastic bag by the handle. Try pulling it down or pushing it up. Watch as the lungs (balloons) expand and contract. Compare the **lung capacity** of the two different lungs.

Thoracic Cavity:
The chest cavity where the lungs and heart are located.

Lungs:
A paired organ within the respiratory system of humans and many other air-breathing organisms.

Bronchial Tubes:
The trachea branches into two tubes that enter into the right and left lung. These bronchial tubes branch into smaller and smaller tubes, called bronchioles, like the branches on a tree. At the end of each bronchi, small sacs called alveoli allow for oxygen to be exchanged with the blood.

Trachea:
The main tube in the respiratory system where air passes from the nose and mouth to and from the lungs.

Diaphragm:
A partition of muscle and connective tissue that separates the chest from the abdominal cavity.

Lung Capacity:
The amount of air an individual inhales during a normal breath. People with asthma often have reduced lung capacities.

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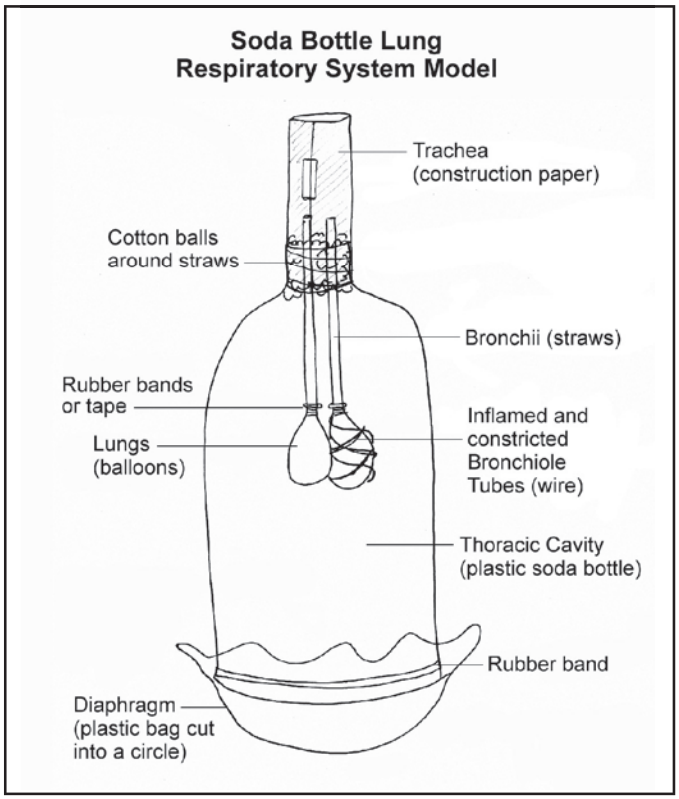


Questions

Check Your Understanding

What happens during an asthma episode?

1. What happens to the normal lung when you move the diaphragm up and down?

2. What happens to the lung that represents an asthma episode?

3. What three things happen in the respiratory system during an asthma episode?

4. What would happen if the lungs were full of mucus?

WHAT IS ASTHMA?
Student Handout #3

Student Handout

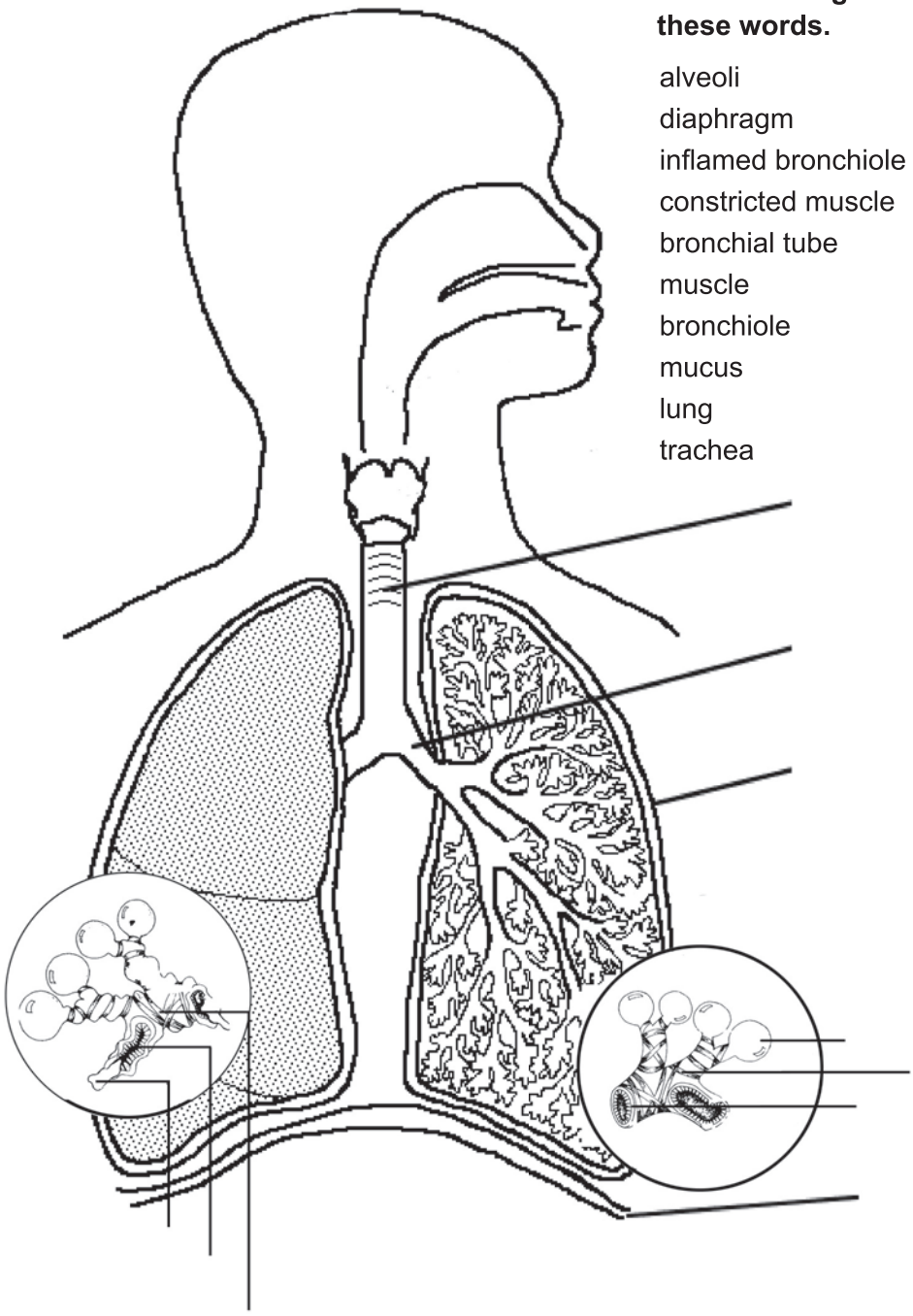
Name _____

Date _____

The Respiratory System and ASTHMA

Label the diagram below using these words.

alveoli
diaphragm
inflamed bronchiole
constricted muscle
bronchial tube
muscle
bronchiole
mucus
lung
trachea



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Write a sentence describing the function of each part of the respiratory system.

Alveoli:

Bronchial Tube:

Bronchiole:

Diaphragm:

Lung

Muscle:

Trachea:

Write a sentence describing what effect each of the following parts of an asthma episode has on breathing:

Constricted Muscle:

Inflamed Bronchiole:

Mucus:

HEALTHY BUILDINGS
Student Handout #1

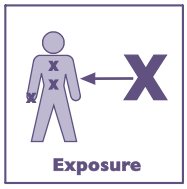
Name _____

Date _____

Student Handout

What is indoor air quality?

Did you know that every day, an adult's lungs process about 16,000 quarts of air? With every breath of air, your body is exposed to dust, pollen and spores. Sometimes, your body may inhale heavy metals, dangerous gases, irritating fibers and smoke through normal breathing. Our bodies are equipped to handle some of the pollution and allergens that comes along with breathing, such as by sneezing out dust particles. Yet, some particles are so small that they get lodged deep in the lungs where they can cause damage. These particles can have a big impact on the respiratory system of a person with asthma and may even trigger an asthma episode.



Americans spend about 90% of their time indoors, on average. The individuals who are most susceptible to indoor air pollution are the same people who spend the most time at home: children, pregnant women, elderly people and people with chronic diseases. The air inside a home, school or office building can have **pollutant** levels that are 2-5 times higher than outside. It is important for everyone to have healthy indoor environments with good air quality.

How are indoor air quality and asthma related?

A healthy indoor environment is important for everyone, but especially for people with asthma. There are many common household items, like cleaners and feather pillows, that can cause problems for people with asthma by triggering an asthma episode. Often, an individual may have an **allergy** to an item that triggers the asthma episode, but sometimes the episode is related to poor air quality, rather than an allergy. Many **asthma triggers** can usually be found in homes, schools and offices. Every individual with asthma is affected differently by asthma triggers based on their individual susceptibility. One person may have **exercise-induced asthma** and only have a problem during physical activity. Another person may be allergic to furry pets and feather pillows; just being in the same room with these triggers may cause an asthma episode. Each individual with asthma needs to learn to recognize their own triggers so they can avoid them, as well as carefully monitor their asthma when exposed to a trigger.

If you have a friend or relative with asthma, it is a good idea to learn about their asthma triggers so you can help them avoid these items.

Pollutant:
Something that causes contamination of air, water or soil.

Allergy:
A hypersensitivity that causes a range of symptoms, including sneezing, watery eyes, and rashes. People can be allergic to foods, pollen, dust, animals and other items.

Asthma triggers:
A particular item that causes someone to have an asthma episode. A person may be allergic to the trigger, such as a furry pet. The trigger may be related to air pollution. Each individual with asthma has their own unique set of triggers.

Exercise-induced: asthma (EIA)
A type of asthma that is triggered by physical exercise.

What is mold?

Have you ever opened up a bag of bread only to discover fuzzy mold? Mold has all kinds of good uses, such as creating cheeses like blue cheese and Roquefort. The useful antibiotic penicillin is created from a special type of mold. Yet, some types of mold can cause trouble, such as when it grows in a damp basement or covers the wall in a bathroom. Some types of mold can cause health problems, especially for people with allergies and asthma.

Mold and mushrooms are both types of fungi. Green plants contain a chemical called chlorophyll that allows them to use the process of photosynthesis to create food from sunlight and water. Fungi does not have chlorophyll and cannot make their own food. Instead, a fungus absorbs nutrients from rotting materials. Some types of mold grow on

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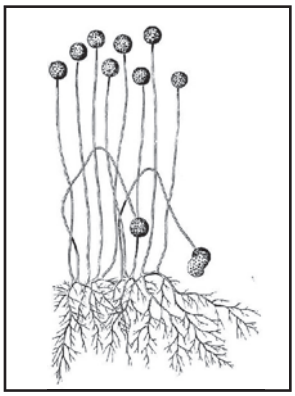

Bread mold

food, such as bread, cheese and fruit. Some types of mold grow on decaying wood. One type of mold grows on moist materials in homes, such as damp plaster or wall board.

Mold grows by producing tiny spores that float around in the air. If a mold spore settles on the right kind of surface, it starts to grow. For people with allergies and asthma, breathing mold spores may cause their symptoms to worsen.

One type of mold has received a lot of attention lately. Black mold, or *Stachybotrys*, has been called "toxic mold." It was first believed that the mold caused serious illness including death in infants. However, later scientific studies found no link between the presence of the mold and these conditions. People with allergies or asthma may be more sensitive to molds. They may experience symptoms such as itchy eyes, stuffed up nose or wheezing.

Mold can grow on moist surfaces in homes, such as ceilings, floors or wall board. It often starts with a leaking pipe. Sometimes, black mold grows in the area in between walls. Today's buildings are designed to be so energy efficient that many of them are air-tight, meaning that moisture that collects between walls during construction has no way to get out.

What should you do if you see mold growing in your house? Make sure to tell your parents about the mold, as they will first need to find the source of any moisture, such as a leaky pipe, and try to fix it. Then the mold can be cleaned up with a solution of bleach and water.

Check Your Understanding

1. Through what route of exposure are you exposed to indoor air pollutants?

2. What groups of people are most susceptible to indoor air pollution?

HEALTHY BUILDINGS
Student Handout #2

Student Handout

Name _____

Date _____

Common Asthma Triggers around the Home

Place a checkmark by the asthma triggers and air quality helpers that you think are present in your own home or school.

In the Bedroom

- ☐ Dust in bedding, rugs, curtains or stuffed animals
- ☐ Dust mites (microscopic critters that live in pillows, mattresses, blankets, rugs and carpet)
- ☐ Feather stuffing in pillows, comforters and cushions
- ☐ Furry and feathered pets should not be allowed in the bedroom of someone with asthma

In the Kitchen

- ☐ Nitrogen dioxide and carbon monoxide from gas cook stoves
- ☐ Cockroaches
- ☐ Strong cleaning chemicals
- ☐ Mold

In the Bathroom

- ☐ High humidity (moisture in the air for a long period of time)
- ☐ Mold
- ☐ Aerosol sprays (perfume, hair spray, air freshener, etc.)

In Other Rooms

- ☐ Air conditioning
- ☐ Dander (dead skin flakes), saliva and urine from furry animals
- ☐ Cold air
- ☐ Fumes (paint, solvents, etc.)
- ☐ Cigarette smoke
- ☐ Smoke and ash from a fireplace or wood burning stove
- ☐ Smoke from candles or incense
- ☐ Strong odors (perfume, air fresheners, potpourri, etc.)
- ☐ Tree and grass pollens blowing in from outside
- ☐ Insecticides or pesticides used indoors (flea bomb, roach spray, etc.)
- ☐ Wood smoke from fire places or wood stoves

At School

- ☐ Chalk dust from chalk boards
- ☐ Strong smelling art supplies (glues, paint, glazes, stains, etc.)
- ☐ Furry or feathered animals kept as classroom pets
- ☐ Strong cleaning products
- ☐ Tree and grass pollens blowing in open windows or doors
- ☐ Dust in carpet or curtains

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Air Quality Helpers

- ☐ Air purifier
- ☐ Vacuum cleaner with a HEPA filter (a special filter that can capture small particles such as dust and pet dander).
- ☐ Fans to vent moisture outside (such as the exhaust fan above a stove or a bathroom fan)
- ☐ Regularly maintained filters on heating and air conditioning systems
- ☐ Dehumidifier in damp areas (like a basement)
- ☐ Cigarette smoking not allowed inside
- ☐ Regular cleaning to control dust
- ☐ Dust mite covers on mattresses and pillows
- ☐ Use of natural cleaning products

FIRE AND SMOKE
Student Handout #1

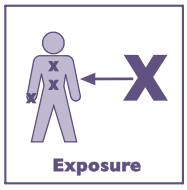
Name _____

Date _____

Student Handout

Smoke in Your Lungs

Every day, you breathe in tiny **particles** from smoke that can be harmful to your lungs. Just think about all the different sources of smoke that may surround you in your own home: wood smoke from fireplaces and wood stoves, cigarette smoke, smoke from burning candles and incense, and smoke from cooking foods, especially when frying or sautéing or when you accidentally burn your dinner. For people with asthma, the tiny particles in smoke can trigger asthma episodes and worsen their symptoms.



Particles: Tiny pieces of a substance that are suspended in the air, such as dust or ash.

These different sources of indoor smoke can make the air within your home unsafe, especially for people with asthma. In addition, sometimes bigger events can cause serious outdoor air **pollution** problems that can affect a large number of people, such as wood fires in the winter time, field burning and wildfires.

Pollution: The act of contaminating the air, water or soil with toxic substances.

Smoke is filled with tiny particles. These particles are less than 2.5 micrometers in diameter. A micrometer is one millionth of a meter, about the same as dividing one inch into 25,400 parts. These particles are so small that the diameter of a human hair is about 70 times bigger; a grain of salt is 100 times bigger. These particles are too small to be filtered by the nose and are inhaled deep into the lungs, where they can immediately cause inflammation or remain for months before causing trouble.

Killer Smog

Some of the worst cases of air pollution in history happened because of a weather pattern that trapped pollution close to the ground for days, creating a killer smog.

A **temperature inversion** is caused when a layer of warm air traps a layer of cool, heavy air close to the ground. Oftentimes, this happens on cold, clear, calm nights when the ground cools rapidly. The cold ground cools the air closest to it, but the air higher up is slower to cool. The upper warm layer of air acts like a lid, trapping the cool air—and any air pollution—close to the ground.

Temperature Inversion: An atmospheric condition in which a layer of warm air traps a layer of cold air close to the ground, causing the stagnant air to trap pollution near the ground.

Air pollution, such as vehicle emissions or smoke from chimneys, can become trapped in the layer of cool air. If the air is **stagnant** for too long, it may allow high levels of pollution to accumulate and create **smog**. If pollutant levels become too high during a temperature inversion, people may be advised to stay indoors and avoid exercising. Sensitive people, such as infants, the elderly, or people with respiratory diseases like asthma may need to take extra precautions during a temperature inversion.

Stagnant: Air that is motionless because there is no wind.

Smog: A term that was coined in London in 1911 to describe the thick smoke and fog that hangs in the air over industrialized areas. Now the term is incorrectly, but commonly used to describe low-lying air pollution often caused by motor vehicles.

Temperature inversions can occur in almost any region, but they are most common in valleys or areas like the Puget Sound region that are bordered by mountains. Temperature inversions are common in winter time, when stagnant air and temperature inversions trap pollution in our breathing space. A temperature inversion will break up from a windstorm or when the ground heats up and the warm air rises, therefore mixing up the layers of the inversion.

In 1948, there were no air quality laws to limit how much pollution factories could put into the air. The small factory town of Donora, Pennsylvania is known for an air pollution tragedy that helped emphasize the need for today's air quality laws. In October of

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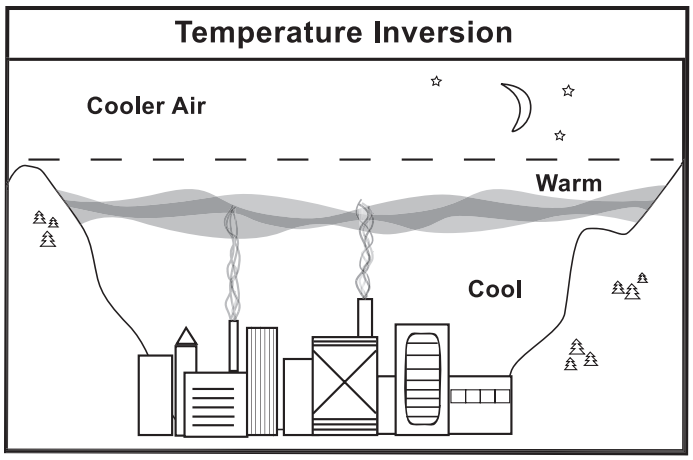


1948, the town of Donora experienced an unusually long temperature inversion. The inversion combined with toxic pollutants including flouride gas from a zinc and steel factory, trapping the pollutants in the stagnant air hanging over the town. The air was heavy with yellow-white smog that became so thick that the town's residents could not see well enough to drive; even walking outside became difficult. People did not understand that the smog was dangerous for their health. The thick smog contributed to the deaths of 21 people in two days. One-third of the town's population—about 6,000 people—became ill.

A similar disaster occurred in London in 1952. A week-long temperature inversion combined with heavy pollution from coal factories, diesel buses and coal burning stoves to create killer smog. In four days, the smog contributed to the deaths of about 4,000 people. The total number of people who died is closer to 12,000 people. This was not the first time London had experienced killer smog. In 1909, stagnant air and coal burning contributed to the deaths of 1,000 people in one winter. Later, in 1962, 750 people died from causes related to smog.

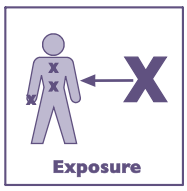
Both the Pennsylvania and the London disasters caused the citizens of Donora and London to demand that their governments develop laws to protect clean air and help prevent further disasters caused by killer smog.

Check Your Understanding

1. How does a temperature inversion make pollution worse?

2. What caused the smog in Pennsylvania and London?

Wood Smoke



Most people enjoy the cozy smell of a crackling fire in the fireplace. Some people depend on wood-burning fireplaces and stoves for cooking and heating. Did you know that wood smoke is filled with substances that are potentially harmful to humans? Wood does not burn completely, so it may release harmful substances in its smoke. Wood smoke can irritate the eyes, cause headaches and trigger allergies and asthma episodes.

Wood smoke contains over 200 chemicals. The smoke includes a combination of substances that are dangerous for humans to inhale, including carbon monoxide, particulate matter including soot and ash, and some cancer-causing compounds. Also, other kinds of toxic substances in the air may attach to the particles in wood smoke, actually hitching a ride deep into your lungs where they can potentially cause serious health problems. Wood smoke can make many respiratory diseases worse, including asthma.

Half of the homes in Washington State have fireplaces. There are over a half million fireplaces and wood stoves in the Puget Sound area alone. In urban and suburban areas, wood smoke can become concentrated and cause a big outdoor pollution problem.

Pollution from wood-burning fireplaces and stoves makes up about 9% of all of the outdoor air pollution in Washington State each year. However, this pollution is concentrated in the winter months when the air is often stagnant and when temperature inversions occur. On a crisp winter day, about 80% of the air pollution in some neighborhoods is caused from smoke from fireplaces and wood stoves.

Tips for better burning:

- Outdoor burning of yard waste is banned in many urban growth areas, such as the Puget Sound region. In other areas, check to see if a burn ban is in effect.
- Burning garbage is illegal because materials like plastics can produce harmful smoke.
- If possible, use alternative heat sources, such as natural gas, electric furnaces or pellet stoves.
- If you must burn wood, choose compressed sawdust logs (Presto Logs), which burn more completely than stick wood does. If you must burn wood, only burn dry wood that has aged for at least six months.

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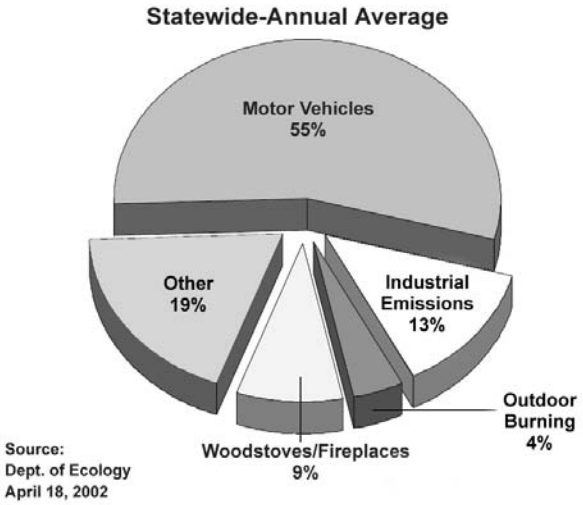
AIR POLLUTION IN WASHINGTON STATE

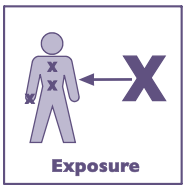


Check Your Understanding

1. Why are wood smoke particles dangerous?

2.Temperature inversions most often occur on cold, winter days. What happens to wood smoke during a temperature inversion?

Agricultural Field Burning



Field burning is a traditional method of getting rid of unwanted plant parts left over after harvest and preparing the fields for a new crop. Cereal (wheat, barley, corn and oats) and grass seed farmers have historically used field burning to get rid of stubble and straw and to take care of pest infestations and disease. However, setting fire to acres and acres of fields causes huge clouds of smoke. This smoke can cause health problems for people who inhale it, especially for people with asthma. Smoke from field burning has sometimes drifted over major highways and caused car accidents. The car accidents brought attention to the issue of field burning and caused changes to laws throughout the Pacific Northwest concerning field burning.

Many states now allow only a small number of acres to be burned each year on days where the weather makes it the safest. Other states continue to allow field burning,

but provide information to the public on when and where field burning will take place. Many farmers depend on crop burning as an inexpensive, effective way of preparing a field for the next growing season.

Some farmers are exploring alternative ways to deal with unwanted plant parts instead of burning them. Stubble and straw can be raked, mowed, chopped and left to decompose in the soil. Leftover straw can be made into an interesting particleboard material that is used to build kitchen cabinets and countertops. Scientists are also researching the use of straw as a pulp to make paper.

Check Your Understanding

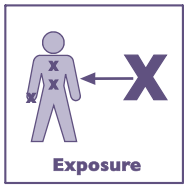
1. What are some pros and cons of field burning?

Just Say No to Wildfire Smoke

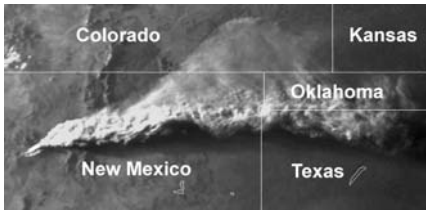
Wildfires can be sparked by lightening, started by an abandoned camp fire or purposefully lit as part of a **controlled burn** to remove dry brush, grass and diseased trees.

Controlled Burn: A fire that is purposefully set and carefully monitored in order to burn dry brush, grass or diseased trees.

Smoke from wildfires has the same health impacts as wood smoke from fireplaces and wood stoves. However, the amount of smoke from a wildfire is much worse, often blanketing entire communities in thick, choking smoke. All people can be harmed by inhaling this smoke, but people with respiratory diseases like asthma have to be extra careful around a wildfire. Sometimes, people who are sensitive to wood smoke must stay indoors or may even need to evacuate to someplace less smoky.



Smoke from wildfires can travel long distances, so a fire in a different area can still have a big impact. For example, the Cerro Grande wildfire in Los Alamos, New Mexico was started as a controlled burn by the National Park Service in May 2000. After just one day, the fire quickly got out of hand and ended up burning more than 47,000 acres. Over 25,000 people in New Mexico were forced to evacuate their homes during the fire. Smoke from this fire traveled across New Mexico, Colorado, Oklahoma and Texas.



Satellite image of Cerro Grande Fire in New Mexico

One California town has found a creative way to avoid doing controlled burns. The town of Mill Valley has employed 500 goats to gobble up dry brush and grass. The town hopes that their new four-legged employees will help reduce air pollution from the controlled burns they once used to light in the area.

Check Your Understanding

1. If smoke from a distant wildfire blanketed your community, what could you do to protect yourself from the smoke?

Language Arts

ATHLETES WITH ASTHMA
Student Handout #1

Student Handout

Name _____

Date _____

Many great athletes live with asthma. In fact, at the 1998 Winter Olympic Games, about 22% of the U.S. athletes had a history of asthma or took asthma medications. These athletes have to avoid things that make their asthma worse and take their medications regularly. However, these athletes do not let asthma stop them from competing—and winning!

One example is Tom Poti, a professional hockey player for the New York Rangers and a member of the U.S. Olympic Hockey Team. When he was very young, Tom could not run or play as hard as other kids. Now, Tom makes sure to properly treat his asthma. Tom has a message for kids with asthma who want to play sports. "Just go for it and try and work as hard as everybody else," he says. "Make sure no one is going to alter your dream by telling you can't do it because you have asthma."

Exercise-Induced Asthma

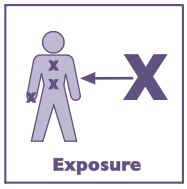
Many people, including some professional athletes, have **exercise-induced asthma (EIA).** EIA is a type of asthma that is triggered by physical exercise. Usually, after 5-20 minutes of physical activity, the person will feel difficulty breathing, tightness in the chest or will begin to wheeze or cough. People with EIA often take a special asthma medicine prior to beginning to exercise to keep their EIA in check. People with EIA may have a sensitivity to sudden changes in air temperature and humidity. For example, if a woman with EIA leaves her warm house on a cold, dry winter morning to go jogging, the cold air might trigger an asthma episode if she is not properly managing her asthma.

Exercise Induced Asthma (EIA): A type of asthma that is triggered by physical exercise. People with EIA have a sensitivity to sudden changes in air temperature and humidity (moisture in the air).

Exercising Tips for People with Asthma

People with asthma sometimes have to be careful when exercising. Here are some things they may need to do:

- **Avoid cigarette smoke**. Cigarette smoke triggers asthma episodes in many people who have asthma. When Tom Poti travels with his team, he needs to stay in non-smoking hotel rooms and eat in restaurants that do not allow smoking.
- **Avoid exercising in polluted air**. Air pollution from cars, trucks, buses and other sources can trigger an asthma episode. People with asthma or other lung problems should avoid exercising near busy roads or freeways, especially during rush hour or on warm days.
- **Avoid breathing cold, dry air**. People with asthma may need to wear a scarf or mask over their nose and mouth when they exercise in the winter to help warm the air before they breathe it.
- **Warm up and cool down during each workout**. People with asthma can have a reaction if they exercise too hard or too fast without a proper warm up. They need to let their lungs adjust gradually to a workout.



Source: Michael O'Reilly. 2002. Athletes vs. Asthma. *Secondwind Magazine.*

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Student Handout

ATHLETES WITH ASTHMA
Student Handout #2

Name _____

Date _____

The following list includes some professional athletes who have asthma. You may select an athlete from this list, or find your own favorite athlete that has asthma. The information below includes some website links that provide information about the individual athlete's experiences with asthma. See what other information you can find on the internet and from other sources.

BASKETBALL

Hakeem Olajuwon
Hakeem "the Dream" Olajuwon is a NBA star center for the Toronto Raptors and was selected as "One of the 50 Greatest Players in NBA History." He is from Lagos, Nigeria and was born in January, 1963.

http://espn.go.com/nba/news/2000/1027/840984.html
http://www.nba.com/players/

FOOTBALL

Chad Brown
Chad is a NFL linebacker for the Seattle Seahawks. He is also a spokesperson for the American Lung Association of Washington. He is from Altadena, California and was born in July, 1970.

http://www.alaw.org/support_alaw/media_center/1999_media_release/october_26.html
http://www.seahawks.com
http://www.nflplayers.com

Martin Chase
Martin is a NFL defense tackle for the Jacksonville Jaguars. He is from Lawton, Oklahoma and was born in December, 1974.

http://www.umdnj.edu/about/news_events/releases/04/r040526_asthmatic.htm
http://www.jaguars.com
http://www.nflplayers.com

Jerome Bettis
Jerome is a NFL running back for the Pittsburgh Stealers. He is from Detroit, Michigan and was born in February, 1972.

http://www.usatoday.com/news/health/spotlight/2001-09-04-bettis-asthma.htm
http://www.lungusa.org/site/apps/nl/content2.asp?c=duLUK900E&b=34893&ct=567025&notoc=2
http://www.steelers.com/
http://www.nflplayers.com

Amani Toomer
Amani is a NFL wide receiver for the New York Giants. He is from Berkeley, California and was born in September, 1974.

http://www.usatoday.com/news/health/spotlight/2001-10-22-toomer-asthma.htm
http://www.giants.com
http://www.nflplayers.com

Jimmy Smith
Jimmy is a NFL wide receiver for the Jacksonville Jaguars. He is from Detroit, Michigan and was born in February, 1969.

http://www.usatoday.com/news/health/spotlight/2002-01-04-smith-asthma.htm
http://www.nflplayers.com

HOCKEY

Tom Poti
Tom is a NHL defense player for the New York Rangers and has played on the U.S. Olympic Hockey Team. He is from Worcester, Massachusetts and was born in March, 1977.

http://www.newyorkrangers.com/
http://www.nhlpa.com/Content/THE_PLAYERS/player_bio1.asp?ID=6197

KAYAKING

Karen Furneaux
Karen is the former World Champion in Women's Kayaking. She is from Waverly, Nova Scotia in Canada.

http://www.canoekayak.ca/eng_bio.cfm?ID=9
http://www.cleanairchampions.ca/onetonnechallenge/champions.asp?title=champions&championid=11

RUNNING/TRACK

Rep. Jim Ryun
Jim is a former Olympic silver medal runner who is now a U.S. Congressmen. He still holds the male High School Mile Record. He is from Wichita, Kansas and was born in 1948.

http://www.drgreene.com/21_1332.html
http://www.umm.edu/careguides/asthma/asthma_jim.html

Jackie Joyner-Kersee
Jackie is an Olympic gold medal track and field star. She has earned four World Titles. She is sometimes called the "greatest all-around female athlete in the world." She is from East Saint Louis, Illinois and was born in March, 1962.

http://www.heathtalk.com/aen/path/jackie1.html
http://www.nlm.nih.gov/hmd/breath/Faces_asthma/present_html/VIIB15.html
http://www.usatoday.com/news/health/spotlight/2002/01/31/spotlight-kersee.htm

SWIMMING

Amy Van Dyken
Amy is an Olympic gold medal swimmer. She won four gold medals in a single Olympic Games. She was on the cover of a Wheaties cereal box in 1996. She is from Englewood, Colorado and was born in February, 1973.

http://www.geocities.com/Colosseum/8361/amybio.htm
http://www.cnn.com/HEALTH/9910/27/chat.vandyken/
http://www.usswim.org/superstars/template.pl?opt=biosearch&name=337
http://www.ahealthyme.com/topic/asthmaqu

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Tom Dolan
Tom is an Olympic gold medal swimmer and is a World Record Holder. He was featured on a Wheaties box in 1996. He is from Arlington, Virginia and was born in September, 1975.

http://www.savvyhealth.com/disp.asp?doc_id=159

Kurt Grote
Kurt is an Olympic gold medal swimmer. He once was quoted as saying, "I have asthma. I live with that fact every day, but I do not let my asthma control my life. I control my asthma." Kurt is studying to become a pediatrician so that he can help other kids with asthma. Kurt is from San Diego, California and was born in August, 1973.

http://www.aaaai.org/patients/just4kids/grote/letter.stm
http://www.sfgate.com/sports/olympics96/profiles/grote.html

Misty Hyman
Misty is a senior at Stanford. She plans to swim at the 2004 Olympics in Greece. She is from Phoenix, Arizona and was born in March, 1979.

http://www.ahealthyme.com/topic/asthmaqa

TRIATHLETE

Joanna Zeiger
Joanna is a world class triathlete (swimming, cycling and running) who has participated in Ironman competitions. She is from San Diego, California and was born in May, 1970.

http://www.aaaai.org/patients/just4kids/exercise_induced/default.stm
http://www.joanna-zeiger.com

Math

ASTHMA DIARIES
Student Handout #1

Name _____

Date _____

Student Handout

What is an asthma diary?

Have you ever kept a diary where you document your feelings and secrets? Some people with asthma keep a different kind of diary to help monitor their asthma. An **asthma diary** is a written record that charts how a person with asthma is feeling. It may also include information about any exposures to personal **asthma triggers, peak flow rates**, and what kind of medicines he or she took. An asthma diary can help an individual's doctor determine the patient's asthma triggers, adjust medication and better understand how to manage his or her asthma.

Asthma diary: A written record of a person's peak flow rates, daily activities and observations about asthma triggers. An asthma diary helps a person with asthma, and their doctor, keep the asthma under control.

Asthma trigger: Something that provokes an asthma episode. Oftentimes, triggers may be something that the person is allergic to, such as a feather pillow, a furry pet or dust mites. Air pollution can also trigger an asthma episode.

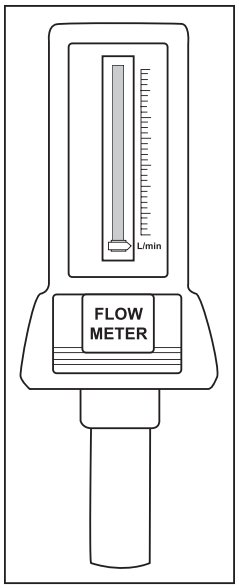
Peak flow rate: A measurement of the amount of air and the speed which a person can push out of their lungs. An individual's peak flow rate depends on their size and age. The rate is measured on a scale of 0 to 800 L/min. A lower than normal rate signals that the person's airways are having trouble.

Peak flow meter: A simple, hand-held device that measures a person's ability to push air out of their lungs. A peak flow meter is a tool that a person with asthma uses to monitor his or her asthma.

What is a peak flow meter?

A **peak flow meter** is a simple, hand-held device that measures a person's ability to push air out of their lungs. Peak flow meters are used by people with asthma to monitor their breathing. It can help an individual and his or her doctor determine if the asthma is getting worse over time, or if there is a particular time of the day when the asthma is worse. A peak flow meter is also a tool that a person with asthma can use to determine when to take their medicine, and in the case of a serious asthma episode, if they need to go to the doctor or emergency room. A peak flow meter may show that a person is having problems even before he or she feels any changes in their own breathing. It helps measure how a person's lungs are doing, almost like receiving a daily weather report.

A peak flow meter is usually shaped like a tube. It has a mouthpiece on one end, and a sliding marker that moves along a numbered scale along the length of the tube. The peak flow meter measures a person's peak flow rate using the measurement of liters per minute (L/min). The scale usually runs from 0 to 800 L/min.



Peak flow meter readings are especially important for young children who cannot always communicate how they are feeling. A peak flow meter allows a parent or a doctor to get an accurate reading on the child.

Everyone has differences in lung capacity. Some people just naturally have larger lung capacities than other people. Respiratory infections, like having a cold, will reduce lung capacity. Every person has variability in their own lung capacity.

Individual Susceptibility

How do you use a peak flow meter?

Using a peak flow meter is somewhat like trying to blow out a candle in a fast, hard breath. Try taking a deep breath and then emptying your lungs in a fast burst. A peak flow meter is used to measure the force of that burst of air. When a person blows into the meter, the air pushes a marker along a scale. The number is recorded and the test repeated three times. The highest of the three readings is the number used as the peak flow reading.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

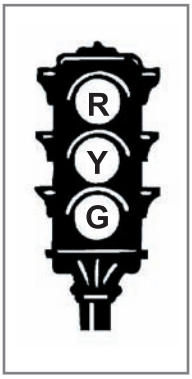
Peak flow meter readings are usually taken in the morning and evening, at the same time each day. Some people also take a reading both before and after taking their daily asthma medications. This information may help their doctor determine how well the medication is controlling their asthma and whether or not they need to increase or decrease their dose or how often they take their medicine.

What does the reading mean?

A peak flow reading tells a person how healthy their lungs are, or how constricted their lungs are, in the case of an asthma episode.

A peak flow meter is used to help a person determine their personal best peak flow rate. Using this number, the person's doctor can help them establish the three zones of their peak flow rates. These zones are just like the colors on a traffic light: red, yellow and green. The zones are based on a percentage of the individual's best peak flow rate and helps them to determine how well their asthma is under control, and if they need to take medication or go see their doctor. An individual's doctor may help develop an asthma action plan, so that the person knows what exactly they need to do if they have a reading within the yellow or red zones.

Peak flow zones: These zones (red, yellow and green) help a person with asthma decide if they need to take any action to control their asthma. For example, a rate within the red zone signals a medical emergency.



Peak Flow Zones

Red Zone: (0-50% of best peak flow rate): This reading signals a medical alert. You need to take your rescue medication and call your doctor. You may need to seek emergency medical care.

Yellow Zone: (50-80% of best peak flow rate): This reading signals caution. You may require extra treatment, such as using your inhaler and trying to relax.

Green Zone: (80-100% of best peak flow rate): This reading signals that everything is fine. Your asthma is under control.

Check Your Understanding

1. What does a Red Zone reading on a peak flow meter mean?

2. Why do peak flow meter readings for a person vary from day to day? Why do readings differ between people?

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Math

ASTHMA DIARIES
Student Handout #2

Name _____

Date _____

Student Handout

Examine the sample asthma diary. This is an example diary charting one week in the life of Sarah Wetstone, an 11-year old girl with moderate asthma. She has recorded information on her daily peak flow rates, along with information on how she is feeling and comments on possible **asthma triggers**. Sarah has recorded her peak flow readings both before and after taking her daily asthma medications. These medications help Sarah control her asthma and help prevent asthma episodes from occurring. The medications work by keeping her airways from becoming swollen and tight. Sometimes Sarah also needs to use an inhaler when she feels an asthma episode beginning. The quick-acting medicine in her inhaler relaxes the muscles in her lungs so that she can breathe easier right away.

Asthma trigger: Something that provokes an asthma episode. Oftentimes, triggers may be something that the person is allergic to, such as a feather pillow, a furry pet or dust mites.

Name: Sarah Wetstone

ASTHMA DIARY
PEAK FLOW

		12/8		12/9		12/10		12/11		12/12		12/13		12/14	
PEAK FLOW RATES	Take a.m. and p.m. readings at the same time every day	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
	Before medicine	140	150	120	130	160	150	150	160	160	170	140	170	140	170
	After medicine	180	200	150	160	170	170	170	160	170	180	180	170	180	190
SIGNS	Wheeze	0		1		0		0		0		0		0	
	Cough	1		1		1		1		0		1		0	
	Activity	0		0		1		0		0		0		0	
	Sleep	0		1		1		0		0		2		0	
TRIGGER COMMENTS		Feel good today		Cleaned bedroom, stirred up dust		Have a slight cold		Feeling better		Pretty active today		Cough from cold air		Very tired in a.m.	

My personal best peak flow is: 200
My green zone (80-100%of personal best) is: _____
My yellow zone (50-80% of personal best) is: _____
My red zone (below 50% of personal best) is: _____

SIGNS

WHEEZE
None: 0
Slight, during exhale only:1
During entire exhale: 2
During both inhale and exhale: 3

COUGH
None: 0
Less than one per minute: 1
One to four per minute: 2
More than four per minute: 3

ACTIVITY
Fully active: 0
Can run short distances: 1
Can only walk: 2
Missed school or stayed inside: 3

SLEEP
Fine: 0
Slight wheeze/cough: 1
Awake several times: 2
Awake most of the time: 3

Percentages

1. Determine Sarah's three peak flow zones. As you can see at the bottom of the diary page, her personal best peak flow rate is 200. Calculate the ranges of the peak flow rates within each of the three zones. Record your answers at the bottom of the diary page in the blank spaces.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Line Graph Activity

Create a line graph that charts Sarah's peak flow meter rates through the week. Draw the graph in the space below or attach a separate sheet.

- Place the dates and times (a.m. and p.m.) along the x-axis.
- Place the peak flow rates along the y-axis.
- Use a ● for readings before she took her daily medicine and a ■ for readings after she took her daily medicine.
- Make sure to label the axes, give your graph a title and to include a key to your symbols.

Check Your Understanding

1. What effect does Sarah's medication usually have on her peak flow rates?

2. On average, are Sarah's peak flow rates higher in the morning or the evening?

3. On what day did Sarah have her highest peak flow rate? How was she feeling on this day?

4. On what day did Sarah have her lowest peak flow rate? What happened that day that may have affected her peak flow rate?

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Math

THE COST OF CHILDHOOD ASTHMA
Student Handout #1

Student Handout

Name _____

Date _____

Directions

In this activity, you will be evaluating data from a research study that links together childhood asthma and exposure to air pollution. First, you will read a summary of the research study. Then you will perform some calculations and answer some questions related to the study.

What is this study all about?

The research study examined the cost, in dollars, of childhood asthma. One way to evaluate the impact of a disease on society is to look at how much money is spent diagnosing, treating and medicating the disease. Over 7.7 million children in the U.S. have asthma. Having an illness can cost a lot of money in doctor bills and prescription medicines. When looking at the cost of a disease or illness, researchers examine both the obvious costs and the hidden costs. For example, think about coming down with the flu. The obvious costs related to that illness might include going to the doctor and buying medicine. Hidden costs may include things like having to stay home from school or work. When an adult stays home from work, he or she is not able to accomplish work tasks and may not get paid for that day. When a child stays home from school, he or she misses out on important learning, which may impact his or her future job opportunities.

This research study attempted to look at all of the costs associated with children in the U.S. that have asthma. This study examined five-year-old children living in the United States. The researchers chose this age group to study because about 80% of children with asthma develop the symptoms of the disease before they turn five years old. Many children with asthma end up "outgrowing" the disease, while some people have asthma through adulthood.

Most young children with asthma are not able to manage their asthma by themselves. Sometimes it can be difficult for a young child to communicate how they are feeling or to recognize when they need to take their medicine. Young children must rely on their parents to help them manage their asthma. On the other hand, teenagers and young adults are often able to manage their asthma by themselves. As children grow older, become more mature and better educated about their asthma, they are better able to manage it. Teens are able to use peak flow meters and asthma diaries to manage their asthma.

When asthma is under control, a person has asthma episodes less often and these episodes are less severe. Proper asthma management reduces medical costs and time missed from work or school.

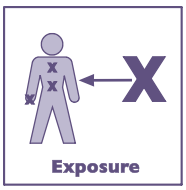
Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Why is it important to calculate the costs of a disease?

It is important for researchers to understand the economic cost of a disease and its impact on society. If researchers have accurate information about the costs of a disease, it will help them to make decisions about how to prevent more people from getting asthma and how to treat people who already have asthma. Researchers can also use this information to compare information from year to year, or to compare data from different countries. By studying the cost of asthma, researchers have learned that more money is spent on emergency or rescue medications than daily medicines that can help prevent an asthma episode in the first place. This tells doctors and researchers that more work needs to be done to improve the therapy for preventing asthma episodes. The information also tells the researchers that educating people on how to manage their asthma may help keep them from needing emergency medical care.

How are asthma and air pollution connected?

Asthma is caused by a complex combination of genetics and environmental factors. Depending on the individual, an asthma episode can be triggered by a viral infection, an allergy, an irritant or exercise. Air pollution can irritate the respiratory system and trigger an asthma episode.



This study examined the link between childhood asthma and outdoor air pollution. This study did not look at asthma triggers like household dust, feather pillows or cleaning products; it only looked at a child's exposure to environmental pollutants, such as exhaust from automobiles, fumes from a factory's smokestack, or smoke from a wood stove. The researchers estimated that about 30% of asthma episodes are triggered or made worse by exposure to air pollution. The researchers used this figure to adjust the total cost of asthma in order to relate it to environmental pollutants (see formula below).

(Total cost of asthma) x (.30) = Cost related to environmental pollutants

Air pollution often makes a person's asthma worse and can trigger an asthma episode. Therefore, knowing the cost of childhood asthma in the U.S. can also help lawmakers make decisions about future air pollution laws and regulations.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #ES10738 and #ES07033).

Math

THE COST OF CHILDHOOD ASTHMA
Student Handout #2

Student Handout

Name _____

Date _____

Costs of Childhood Asthma

Interpreting Tables

Examine the data table below. Then, answer the following questions about the data. Definitions of unfamiliar words are listed on the next page.

Estimated Costs of Children's Asthma in the United States, 1997

Study included five-year old children in the United States

	Medical and Indirect Costs	U.S. Dollars
Medical Costs	**Hospital Care**	
	Inpatient	$634 million
	Emergency Room	$323 million
	Outpatient	$154 million
	Physician's Services	
	Inpatient	$54 million
	Outpatient	$625 million
	Medications	$2810 million
	SUBTOTAL MEDICAL COSTS	**$4600 million**
Indirect Costs		
	Indirect Costs	
	School Days Lost	$1780 million
	Premature Deaths	$193 million
	SUBTOTAL INDIRECT COSTS	**$2000 million**
Total		
	TOTAL COSTS OF CHILDREN'S ASTHMA (per year)	**$6600 million**

From Landrigan, et. al. Environmental Health Perspectives. v.110, no. 7, July 2002.

1. Who is the focus of this study?

2. In 1997, what was the source of the most medical costs? What was the source of the most indirect costs?

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3. What percentage of the total cost of asthma was from medical costs?

4. What percentage of the total cost of asthma was from indirect costs?

5. The researchers estimated that 30% of asthma episodes were triggered or made worse from exposure to air pollution. What is the yearly cost of childhood asthma related to exposure to air pollution?

Vocabulary Words

Mortality rate: A measurement of death rates among a population.

Morbidity rate: A measurement of disease rates among a population.

Pediatric asthma: A form of asthma that occurs in young children. This study examines five-year old children in the U.S. with asthma.

Inpatient: Medical care associated with being admitted to a hospital for an overnight stay.

Outpatient: Medical services performed in a doctor's office, clinic or hospital that do not require an overnight stay.

Emergency room: Emergency medical care received at a hospital or urgent care clinic, including ambulance services.

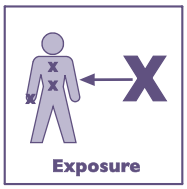
Physician's services: A doctor's services at an office, clinic or hospital.

Medications: Prescription medications used to treat asthma, including emergency or rescue medicines and daily medicines used to prevent asthma episodes.

School days lost: Asthma is the leading cause of days lost from school due to a chronic disease. Over 10.1 million school days annually are missed due to asthma. This figure includes the cost of parents who missed work to take care of their ill child.

Premature deaths: Someone who dies before the age predicted based on their current age and their gender. This figure includes an estimate of what that child may have earned during their lifetime in a job.

The Cost of Childhood Diseases



Now that you have examined the costs associated with asthma among young children, you may be wondering what this number really means. How does this compare to other childhood diseases linked to environmental exposure to pollutants (including pollution in air, water and food)? Examine the data below and answer the following questions.

Estimated costs of childhood diseases of environmental origin, U.S., 1997

Disease	Best estimate
Lead poisoning	$43400 million
Asthma	$2000 million
Cancer	$300 million
Behavioral disorders	$9200 million
Total	**$54900 million**

1. Rank the childhood diseases by their estimated cost, from most costly to least costly.

2. The total annual cost of these four childhood diseases linked to environmental exposures of pollutants is $54900 million.

   a. What is this number in billions?

   b. The total annual cost of the four diseases is approximately 2.8% of the total annual cost of all illnesses in the United States. What is the total annual cost of all illnesses in the United States (in billions)?

   c. What is this number in trillions?

These materials were developed by the Integrated Environmental Health Middle School Project
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