

Straw Breathing Exercise

Purpose

Students breathe through a straw at rest and after exercise to experience what it feels like to have asthma.

Overview

Students first fill out an anonymous questionnaire to explore whether they might have asthma. Next, they set up a spreadsheet to enter the data, decide on a definition of asthma, and figure out the prevalence of asthma in their own classroom. Then they simulate what it feels like to have breathing problems like asthma by breathing through a straw at rest and while exercising. Working in pairs or teams, they record with a stopwatch how their respiratory rate and breathing pattern changes with and without exercise. These data are then pooled for the team or class on a spreadsheet and graphed by hand or using computer software. Hypotheses are generated concerning the effects of various factors on breathing. Students finish by writing about how it would feel to have breathing problems such as asthma and

This activity is complementary with the Peak Flow Exercise.

Time

Three 1-hour class periods with team homework in between and after.

Key Concepts

Asthma is a restrictive breathing disorder characterized by the constriction of the airways.

Respiratory rate is a function of physical variables such as fitness, age, gender and health status.

Asthma symptoms can be exacerbated by exercise or stress.

Forming a case definition is an important aspect of establishing prevalence.

Skills

Working in teams

Generating and collecting different types of data

Entering data in a spreadsheet

Graphing data

Formulating hypotheses

Interpreting of data

Presentation of results

Creative writing

Materials

Hard copies of the enclosed anonymous Asthma Questionnaire

Nose clips

Straws (enough for 1 per person and can try different diameter straws) Stopwatch.

Computer access to spreadsheet and graphing software (optional)

A transparency, slide, or LCD projector

Facilitator Preparation

You will need to divide the students into groups or teams, monitor their progress performing the activity, as well as facilitate any oral presentations. Prior knowledge of the Teacher's Guide to Air Quality will prepare you for the range of issues addressed in this activity.

Background

Asthma is apparently increasing in prevalence in the US, probably due to both indoor and outdoor air pollution. Approximately 6% of the children in the US experience asthma, and it is particularly prevalent among inner city black and Hispanic children. Asthma can affect one's quality of life ranging from impact on sports activities to increased sick days and even emergency room visits. There are effective medications and environmental interventions that can be used to control asthma, but first asthma needs to be diagnosed.

In obstructive diseases such as asthma and emphysema, the amount of air you can get out of your lungs quickly (or the peak flow) is markedly decreased. The peak flow varies within the individual depending on the time of day (it is usually larger at night) and their health (for example, with asthma it is reduced but can be improved by the use of asthma inhaler medications), as well as other factors. Between individuals, there is marked variability based on a range of factors including: gender (men > women), age (adults>children), height (tall>short), physical fitness (fit>unfit), respiratory health (health>respiratory illness), race-ethnic category (in the past although changing with melding of populations, white>black and other minorities). Peak flow is also effort dependent (i.e. the best peak flows are performed after practice and with active coaching).

In addition to peak flow, lung diseases can also affect the respiratory rate (number of breaths/minute) as well as the amount of time it takes to breathe in (inspiration) and breathe out (expiration). Other factors can also affect these respiratory parameters, such as exercise or a respiratory illness.

This activity first evaluates the prevalence of asthma in the classroom in an anonymous fashion to give the students an idea of the extent of asthma even among their own classmates. Then using a simple straw exercise, the students who do not have asthma are able to experience how asthma affects their breathing.

NOTE: If a student is either noted to be "possibly asthmatic" on the provided Brief Asthma Questionnaire or to have significant breathing problems during the straw asthma activity, the student should be urged to seek medical evaluation if not already under medical care for asthma.

Problem Set -Up

This activity is divided into 4 sections: asthma questionnaire, straw asthma activity, analysis, and writing and discussion.

Anonymous Asthma Questionnaire:

1. Each student should fill out the enclosed anonymous asthma questionnaire.
2. As a class, create a spreadsheet to enter the data from all the asthma questionnaires.

3. As a class, discuss and decide what answers on the questionnaire will define a definite case of asthma (there is no correct answer but for example, you could define “definite asthma” as answering “Often” for shortness of breath or wheezing for questions 1-5, or you could define it as “often” or “sometimes” for wheezing for questions 1-5, etc). Of note, a key of symptoms and their common causes based on the Brief Asthma Questionnaire is included.
4. The prevalence of disease is the number of people who have the disease divided by the total number of people in the group; it is a percentage or proportion. Have the students calculate the prevalence of asthma (as they have defined it using the questionnaire) in their class expressed as a percentage.

Straw Asthma Activity

1. Place a noseclip over the nose throughout this activity so that people can only breathe through their mouths.
2. Working in pairs or teams, each person will first measure their respiratory rate (number of breaths per minute), the amount of time it takes to breathe in (inspiration) and the amount of time it takes to breathe out (expiration). Their partner or the rest of the team should make all measurements. This activity should be performed while the person is at rest.
3. These respiratory parameters should be recorded as “No Straw; At Rest” by the partner.
4. Each person will then repeat this same activity breathing through a straw while at rest.
5. These respiratory parameters should be recorded as “With Straw; At Rest” by the partner.
6. Each person should then perform 20 jumping jacks (or use a jump rope or run a set distance) and then immediately take their respiratory rate, and measure their inspiration and expiration times.
7. These respiratory parameters should be recorded as “No Straw; Exercise” by the partner.
8. Each person should then perform 20 jumping jacks (or use a jump rope or run the same distance) again, and then using the straw to breath through, immediately take their respiratory rate, and measure their inspiration and expiration times.
9. These respiratory parameters should be recorded as “With Straw; Exercise” by the partner.

PERSONS WHO ANSWER STRONGLY POSITIVE ON THIS QUESTIONNAIRE AND/OR HAVE A HISTORY OF ASTHMA MAY WANT TO AVOID THE EXERCISE-STRAW BREATHING PORTION OF THIS ACTIVITY

IF THE PERSON PERFORMING THIS ACTIVITY FEELS DIZZY, STOP THE TESTING AND SIT DOWN FOR FEW MINUTES BEFORE CONTINUING

10. At the same time, other information can be collected by the partner or group for each individual performing this exercise:
 - ❖ Name, or use initials or an identification number (to protect confidentiality)
 - ❖ Age
 - ❖ Gender
 - ❖ Height
 - ❖ Weight
 - ❖ Physical fitness (different levels of physical fitness can be used)

- ❖ Respiratory health (for example, does the person have a history of asthma, does the person have cold right now, is the person taking any medications?)
 - ❖ Race-ethnic group
 - ❖ Date and time of testing
 - ❖ Recent exposure to cigarette smoke
11. Can the students think of any other variables they would like to collect which could affect the respiratory rate as well as inspiratory and expiratory times breathing with and without a straw?

Analysis

1. Create a spreadsheet to enter all these variables for the pairs or groups or entire data of the class, including the respiratory rate, and the inspiratory and expiratory time measurement with and without a straw.
2. Compare the respiratory rate, and the inspiratory and expiratory time measurements before and after exercise with and without a straw.
3. Formulate hypotheses as to which variables collected could affect the respiratory rate and the inspiratory and expiratory time measurements among all the individuals of the class. For example, should athletes have different respiratory rates, and inspiratory and expiratory time measurements compared to non-athletes, and why? Write these hypotheses down.
4. Graph the data entered into the spreadsheet. First, look at just the range of respiratory parameters among the classmates. Discuss the hypotheses. Graph the data to look at different hypotheses.

Writing and Discussion

1. Write the results and interpretation of all the data, taking into account the hypotheses.
2. Write a paragraph describing what it would feel like to have asthma based on the simulation exercise as well as class discussions and research.
3. Each group can present the data and personal paragraph, and be prepared to discuss them with their colleagues.

Additional Activities

The students can administer the anonymous Asthma Questionnaire to family and friends, compile, and interpret these data. Do the answers to the Asthma Questionnaire change if the person answering has a cold?

The students can create their own Asthma Questionnaire and repeat the above exercise.

Students can try different sized straws or try different environmental exposures (such as cold or hot air or having a respiratory illness), and repeat the same exercise but over several days and under different conditions.

If willing, students with asthma or other respiratory diseases can discuss their condition in relation to what it feels like to have asthma, how it affects their lives and the lives of their friends and families (**Note:** Teachers need to be sensitive to the individual student and their willingness to discuss their chronic illness).

The class can research and discuss the effects of toxic respiratory exposures (such as tobacco smoke, occupational exposures such as asbestos) on respiratory rates and lung function.

A guest speaker (such as a respiratory therapist, a pulmonologist (lung doctor), or an allergist) can be brought in to the classroom to discuss respiratory diseases, lung function, and related issues.

Websites of possible interest:

<http://www.lungusa.org/asthma/astteenast.html>

<http://www.clearbreathing.com/living/teens.asp>

<http://allallergy.net/articles/articleskids.cfm?group=T>

<http://www.lungusa.org/asthma/>

http://dmoz.org/Kids_and_Teens/Health/Conditions_and_Diseases/Asthma/

<http://asthma.about.com/library/weekly/aa020700a.htm>

<http://www.asthmacentre.pe.ca/links.cfm>

Follow-up Activities

Class field trip to a pulmonary function laboratory and talk with a pulmonologist (lung doctor) or Respiratory therapist (specialist in evaluation and treatment of pulmonary disease)

Students can create educational materials (brochures, videos, fact sheets, or posters) on respiratory health, asthma and risk issues.

Student Assessment

Give the following components to each student team as a guide:

- ❖ As individuals, fill out the anonymous Asthma Questionnaire.
- ❖ As a class activity, develop a spreadsheet to enter the questionnaire data, define “asthma” and develop a prevalence of asthma in the classroom.
- ❖ In pairs or groups, obtain and record the respiratory rate, inspiratory and expiratory times with and without a straw before and after exercise.
- ❖ Record other variables with possible influence on the respiratory rates, and inspiratory and expiratory times.
- ❖ Formulate written hypotheses as to the effects of these variables on respiratory parameters.
- ❖ Design a spreadsheet to collect and calculate the data.
- ❖ Graph the data and evaluate.
- ❖ Decide if the results are consistent or not with the hypotheses, and why.
- ❖ Each student should write a 1 paragraph essay on how it would feel to have asthma based on this experience and their research.
- ❖ Present the data and results as written and/or oral presentation.

Assign points for the following components

- ❖ Were the data collected for each individual (both questionnaire and straw asthma activity)?
- ❖ Were the original hypotheses clearly formulated?
- ❖ Was the spreadsheet appropriately constructed?
- ❖ Were the graphs appropriately constructed?
- ❖ Did all members of the team collect data?
- ❖ Were data entered appropriately into the spreadsheet?
- ❖ Did each individual write a paragraph of how it feels to have asthma?
- ❖ If a presentation, was each group member actively involved in the presentation?
- ❖ Did the group report their sources?

- ❖ Could the group members answer questions from the audience about the facts and defend their point of view?

Brief Asthma Questionnaire

Please indicate whether you have shortness of breath, wheeze (that is a whistling noise coming from the chest) or cough with certain activities.

Use the following classification: **rarely** = less than two times a week
sometimes = 2 to 4 times a week
often = more than 4 times a week

	<u>Rarely</u>	<u>Sometimes</u>	<u>Often</u>
1. When you walk fast, run, or play sports, do you:			
a. feel short of breath	_____	_____	_____
b. wheeze	_____	_____	_____
c. cough	_____	_____	_____
2. When you get excited, upset, or angry, do you:			
a. feel short of breath	_____	_____	_____
b. wheeze	_____	_____	_____
c. cough	_____	_____	_____
3. When you are around dust, smoke, or animals, do you:			
a. feel short of breath	_____	_____	_____
b. wheeze	_____	_____	_____
c. cough	_____	_____	_____
4. Do you wake up at night because you:			
a. feel short of breath	_____	_____	_____
b. wheeze	_____	_____	_____
c. cough	_____	_____	_____
5. When you get a cold or the flu, do you:			
a. feel short of breath	_____	_____	_____
b. wheeze	_____	_____	_____
c. cough	_____	_____	_____
6. In the past month, have you missed school because of breathing problems?			
Never _____ 1-3 days _____ 4-7 days _____ more than a week _____			

(adapted from a School Asthma Questionnaire developed by Kunjana Mavunda, MD MPH, Pediatric Pulmonary Center, Miami, FL)

Brief Asthma Questionnaire: Symptoms & their Common Causes

Use the following classification: **rarely** = less than two times a week
sometimes = 2 to 4 times a week
often = more than 4 times a week

	<u>Rarely</u>	<u>Sometimes</u>	<u>Often</u>
1. When you walk fast, run, or play sports, do you:			
a. feel short of breath			
b. wheeze	decreased fitness**	decreased fitness**/asthma	asthma
c. cough	asthma	asthma	asthma
2. When you get excited, upset, or angry, do you:			
a. feel short of breath			
b. wheeze	psychogenic/asthma	psychogenic/asthma	psychogenic/asthma
c. cough	VCD*/asthma	asthma	asthma
3. When you are around dust, smoke, or animals, do you:			
a. feel short of breath			
b. wheeze	irritation/asthma	asthma	asthma
c. cough	asthma	asthma	asthma
4. Do you wake up at night because you:			
a. feel short of breath			
b. wheeze	night terrors	asthma	asthma
c. cough	asthma	asthma	asthma
5. When you get a cold or the flu, do you:			
a. feel short of breath			
b. wheeze	irritation	irritation/asthma	asthma
c. cough	rhinitis/bronchitis	bronchitis/asthma	asthma
	bronchitis/asthma	bronchitis/asthma	asthma
	rhinitis/bronchitis	bronchitis/asthma	asthma

***VCD** = Vocal Cord Dysfunction

****Decreased Fitness** may also be secondary to lack of regular physical activity, obesity, cardiac disease, or other chronic illness.

(adapted from Kunjana Mavunda, MD MPH, Pediatric Pulmonary Center, Miami, FL)