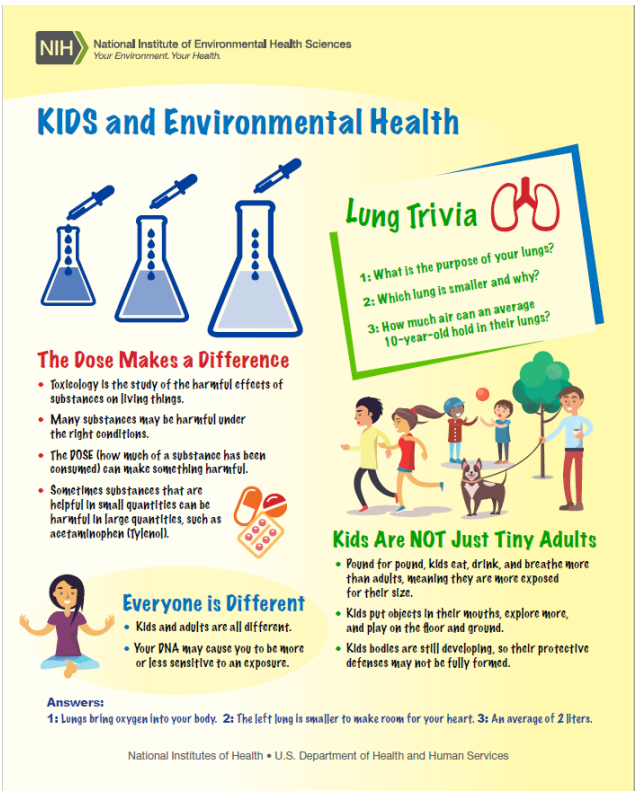
Kids and Asthma Display and Activities

Created by Christie Drew, Mike Humble, Huei-Chen Lee, NIEHS – March 2018

NIEHS was approached by a Girl Scout organizer to participate in a community event for Scouts and Families. We developed two posters and several experiments related to environmental health and asthma. We created a booth and engaged in these activities in March 2018. We are making these materials are available for others to use via the PEPH Resource Center. You are welcome to use the materials.

The posters, shown below are available as PDFs:



For more information, questions, suggestions, or copies of the PDF posters, contact:

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If you use or adapt these materials, please drop us a line to let us know what you did and how it went.

Visual Display: "Dose makes a difference"

Part I

Materials: Three 250mL Erlenmeyer flasks beakers with the same level of water (~100-150mL), food coloring.

Setup: Add drops of food coloring to the water: 1 drop in the first flask, 2 drops in the second flask, 4 drops in the third flask (or whatever looks good given your lighting and setting). The concentrations (and coloration) in the flasks should look different by sight. Depending on the size of your flasks, you may need to multiply the concentrations by a factor of 2 or 3.

Part II

Materials: Three Erlenmeyer flasks of different sizes (50, 125, 250 mL) each about half-full of water, food coloring.

Setup: Add 2 drops of food coloring to each flask. (More drops can be added if needed for better visualization – just make sure the same number of drops are added to each flask)

Discussion: This visual display complements the figure on the top half of the right-hand poster, above. The flasks represent human body sizes. Part I shows that adding increasing doses to the same sized containers produces different concentrations. As shown on the poster, Part II demonstrates that adding the same dose to different sized containers (representing infants, teens, and adults) also produces different concentrations. This helps explain that kids may have higher exposures (the same exposure, or dose, produces a higher concentration in the smaller body). Both visuals can be done in glass if you have the table space/containers. And this could be adapted for small groups as a hands-on experiment, allowing kids to add the drops to different containers themselves.

Interactive questions: A variety of questions can be used to engage the audience on this topic:

- Suggest that the beakers of water represent human bodies.
- Ask students to tell you what they know about the relative sizes of the three "bodies." Once they recognize that all the bodies are the same size (Part I) or that they can represent different ages (Part II), discuss the added chemicals using questions such as these:
    - If we found out that the mystery chemical is harmful to people, which of these beakers would you rather be right now and why?
        - Students probably will say that they would rather be Beaker #1 because it contains the smallest amount of the harmful chemical.
    - Are you sure that the amount of chemical in Beaker #2 is enough to cause harm?
    - Is there enough in Beaker #3 to cause harm?
        - Students may realize that they do not know how much of the chemical must be present to cause harm, but they would want to err on the safe side and choose Beaker #1.
        - Some students may wonder if even the small amount in Beaker #1 is harmful.
    - What if we learned that the chemical is good for you? Which beaker would you choose to be and why?
        - Students probably will choose Beaker #3 because it has more of the beneficial chemical in it. Some students may recognize that they don't know enough about the chemical to know how much of it is good for a person. They may wonder if it is possible for too much of even a good chemical to be harmful.

- Some chemicals are good for you in small doses but bad for you in large doses. If that were the case here, which beaker would you want to be?
    - Some students may opt for Beaker #1 because the amount of chemical is small. Others may choose the middle road, Beaker #2, so that there is enough of the chemical to be beneficial but not enough to do harm. Others may say that they cannot choose because they do not know enough about the amount of chemical that is beneficial or the amount of chemical that is harmful.
- What happened when the same dose was given to different sized "people?"
    - They should recognize that the same dose given to both an "adult" and a "child" results in a higher concentration in the child. You can then discuss the potential consequences.

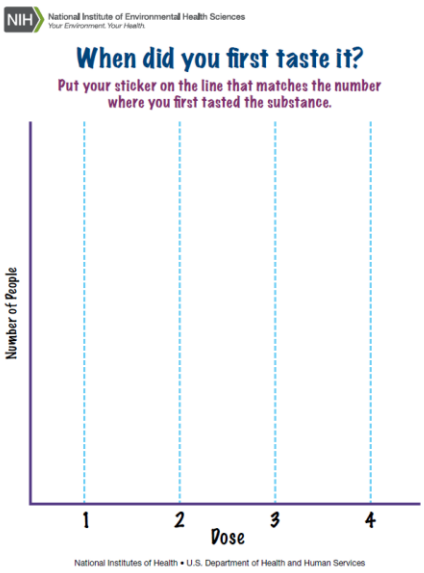
Comment: This works great with all ages… nice way to engage both kids and parents in EH issues

Reference: This activity is adapted from an NIH Curriculum Supplement titled "Chemicals, the Environment, and You: Explorations in Science and Human Health," available from the NIH Office of Science Education. Information on this activity can be found within *Activity 2: The Dose is the Poison*.

Activity 1: When can you taste it?

Materials: 5 gallons of water, salt, pitchers for easy pouring, small cups or pill dispensers for tasting, recycling bag, poster with graph, sticky dots for "voting".

Setup: Leave one gallon of water plain (the "control"), then mix different doses of salt into the gallons of water. The goal is to have one that is plain water (as a starting point), one that has barely any salt (more or less undetectable), one at the high end that everyone will taste, and two in the middle that some will taste some may not. Put 1 grain of salt into the first one, a "dash" in the 2nd, a teaspoon in the 3rd, and a 1/4 cup in the fourth. More salt can be added to the high end to make it really gross. Pour small cups of each and set them out on the table in marked groups (1, 2, 3, 4) for participants to choose.



Activity: If space allows, include cups with plain water as a starting point (since people are used to the taste of their own plain water). Ask each person to select a cup from each group and taste it, in order. Ask them when they could first taste the salt. Have them place a dot by the group number where they could first taste salt. You'll likely see/create a steep bell curve.

Discussion topics:

- Data collection, graphing: What do they notice about the responses?
- People are different, not everyone first tastes the same group. Ask why.
    - "Individual susceptibility" - You can also discuss that not only do people have different abilities to taste things, but they might react differently to prescription drugs or pollutants in the environment.
- How much is too much?
- If you can't taste something, does it mean it's not there?
- Is tasting water a good way to determine if there's something in it?
- Where did you fall within the spectrum? Are you in the "normal like everyone else" range or are you "exceptional" (an exception to the norm)?
- Ingestion is a potential route of exposure.

Comment: This works great with all ages… nice way to engage both kids and parents in EH issues

Reference: This activity was adapted from Tox-in-a-Box™ developed by the Community Outreach and Education Program at the University of Washington.

Activity 2: Forced Vital Capacity (FVC) estimator

Materials: One 5-liter clear container, measuring cups (liters), a cork, a sharpie, a 5-foot length of flexible tubing, straws, one clean 5-gallon bucket, an empty 2-liter bottle of soda (label removed).

FVC Estimator showing plastic container, cork, straw, tube, and measurements.

Setup:

- Cut straws into approximately 4-inch lengths. Ensure straws fit snugly in one end of the flexible tubing. Keep the paper wrapping on the straw until use to ensure hygiene.
- In the clear container, use measuring cups to measure and mark, with the sharpie, half liter increments up to 4 liters.
- Cut a hole in the bottom of the container so the cork fits and seals the hole.
- Flip container so the bottom side is up and label the measurements from the top down 0.5 liters, 1.0 liter, 1.5 liters, etc… to 4 liters.
- Fill the 5-gallon bucket with water about 2/3rd full.
- Place the clear container in the bucket so the end with the cut hole sits flat on the water's surface. Place the cork in the hole, keeping as little air in the clear container as possible.
- Add the flexible tubing so one end is outside the bucket, and the other travels through the water and into the clear container from underside.
- Place a clean straw in the flexible tube emerging from the bucket.
- Instruct participants to take a deep breath and then, ONE time, blow air as much air into the tube as they can. (Do not breathe back in through the tube).
- Instruct participants to inspect the lines and determine how many liters of air they were able to expel from their lungs. (Measurement skills).
- Show participants a 2-liter bottle (familiar item) as a relative comparison to how much air they could expel.
- Reset the experiment by popping the cork and returning the bottom of the clear container to the level of the water in the large bucket.

FVC Estimator in action, showing the bucket, plastic container and a volunteer blowing into the tube.

Discussion:

- Did you think that you might have a 2-liter bottle's worth of air in your lungs at any given time?
- Why can some blow out more than others (body build, age, physical conditioning such as illness (e.g. asthma), singers, swimmers)?
- Ask about other environmental triggers (dust, pets, wood smoke, first, second or third-hand smoking, mold, pesticides in homes, etc.)

Comments: This works great with grade-schoolers. Their eyes pop when they make the connection between the amount of air in the bottle and the amount of air in their own lungs.