Sep 21, 2023

Behavioral Research of Environment and Air pollution Through Education (BREATHE) Study

DOI
dx.doi.org/10.17504/protocols.io.j8nlko9bxv5r/v1

Yorusaliem Abrham[1,2], Siyang Zeng[1,2,3], Rachel Tenney[1,2,4], Caroline Davidson[1,5], Emily Yao[1,2], Chantal Kloth[1,2], Sarah Dalton[1,2], Mehrdad Arjomandi[1,2]

[1]Department of Medicine, University of California, San Francisco, California, USA;
[2]San Francisco Veterans Affairs Health Care System, San Francisco, California, USA;
[3]Department of Biomedical Informatics and Medical Education, University of Washington, Seattle;
[4]Department of Medicine, Weil Cornell University Medical Center, New York, New York, USA;
[5]National Council for Mental Wellbeing, New York, New York, USA

Yorusaliem Abrham

OPEN ACCESS

DOI: https://dx.doi.org/10.17504/protocols.io.j8nlko9bxv5r/v1

Protocol Citation: Yorusaliem Abrham, Siyang Zeng, Rachel Tenney, Caroline Davidson, Emily Yao, Chantal Kloth, Sarah Dalton, Mehrdad Arjomandi 2023. Behavioral Research of Environment and Air pollution Through Education (BREATHE) Study. **protocols.io https://dx.doi.org/10.17504/protocols.io.j8nlko9bxv5r/v1**

Protocol status: Working
We use this protocol and it's working

Created: September 08, 2023

Last Modified: October 20, 2023

Protocol Integer ID: 87573

Keywords: Behavioral Research of Environment and Air Pollution Through Education, Air pollution, Climate change, Air pollution education, Adolescent's education , Behavior, air pollution through education, short interactive teaching session on air pollution, health effects of air pollution, air pollution, behavioral research of environment, behavioral choices of adolescent, detrimental towards the environment, behavioral research, breathe, environment, behavioral choice, health effect, adolescent, daily living choice, study, purpose of the study, short interactive teaching session, education, research

Abstract

This protocol details behavioral research of environment and air pollution through education (BREATHE) study.

Background-Despite the wealth of scientific information on the health effects of air pollution, the adult public's daily living choices continue to be largely detrimental towards the environment.

Objective-The purpose of the study is to determine whether a short interactive teaching session on air pollution could shift the behavioral choices of adolescents towards environmentally friendlier options.

Attachments

DOCX

BREATHE Scientific P...

30.6MB

Guidelines

INTRODUCTION

Air pollution continues to have proven negative impact on the health of children and adolescents. Air pollution is a major environmental problem with important health consequences including cancer and cardiopulmonary diseases that affects billions of people around the world. Multiple studies have shown air pollution in general and its individual components, such as ozone and particulate matter, to be associated with increased morbidity and mortality in humans. Despite the wealth of scientific literature on the health effects of air pollution, the public support for generation of policies and regulation of the sources of pollution has remained modest at best. One potential cause of this disconnect between the state of scientific knowledge and the public and political support for aggressive regulation for protection of environment may be the lack of awareness and understanding of the available knowledge. However, there has been substantial media attention to the ongoing environmental problems in the recent years, and despite this publicity, the public and political support for the necessary steps to battle air pollution remains low. Perhaps, an important impedance for the support is the established lifestyle demands of the current generation of adults. The current generations have grown with little understanding of environmental and air pollution, which may make substantial changes in their attitudes more difficult. Given above, an important way to affect the future personal choices and public support for necessary regulation and policies would be to provide adequate education to the children who will form the future generations of our society.

Preliminary Studies

Multiple longitudinal studies have demonstrated the association between air pollution and reduced lung function (Lippmann et al., 2014, Dons et al., 2014, Fruin et al., 2014). A 2004 study from Gauderman and colleagues demonstrated the significant association between exposure to pollution in the form of NO2, acid vapor, elemental carbon, and particulate matter (PM2.5) and a reduction in forced expiratory volume in the first second (FEV1) (Gauderman et al., 2004). In particular, exposure to tropospheric ozone has been linked to an increase in bronchial hyperirritability in healthy individuals (as well as rhesus monkeys). Reducing exposure to pollution is of both a policy and public health importance. Focusing on public health, behavioral intervention is key for reducing individual exposure. Intervention has had success in positively impacting individual environmental behavior through various means, including an increase in curbside recycling (Schultz et al., 1999) and a reduction in the number of miles driven and trips taken during days of poor air quality (Henry et al., 2002).

SIGNIFICANCE

Air pollution is a global public health issue affecting billions of people around the world. Air pollution is on the rise, and any intervention that could potentially improve air quality would be highly beneficial to the broader society. It is increasingly important to provide a method through which the public could be better educated about air pollution in a way that would positively impact their understanding and future behavior towards environmentally friendlier choices.

STUDY RATIONALE

Air pollution is a major environmental problem with important health consequences including cancer, cardiovascular, and pulmonary diseases that affects billions of people around the world. Multiple studies have shown air pollution in general and its individual components, such as ozone and particulate matter, to be associated with increased morbidity and mortality in humans. Despite the wealth of scientific literature on the health effects of air pollution, the public's personal choices in their daily lives continues to be largely detrimental towards the environment, and the public support for generation of policies to regulate sources of pollution has remained modest at best.

One potential cause of the disconnect between the state of scientific knowledge and the public and political support for aggressive regulation to protect the environment may be the lack of awareness and understanding of the available knowledge. However, there has been substantial media attention to the ongoing environmental problems in the recent years, and despite this publicity, the public and political support for the necessary steps to battle air pollution has remained low. An important impedance to the required support for environmental protection may be the established lifestyle demands of the current generations of adults. The current adult generations have mostly grown with little understanding of the human contribution to air pollution and their impact on the environment, making any substantial change to their behavior challenging.

A potential solution to this problem may be to focus on the future generations to see whether providing appropriate education may result in lifestyles that include beneficial behaviors towards the environment since their lifestyles and habits are as yet unformed and more amenable to influence. However, whether teaching the adolescents about the health effects of air pollution would affect their future understanding and awareness of air pollution or forms their future behavior to more environmentally sound life choices is unclear.

Risk/Benefit Assessment

The risks of this study are minimal compared to potential benefits it holds for public health, both locally and globally. Air pollution is a significant and escalating problem affecting numerous countries. The findings of this study can inform the development of future interventions aimed at promoting environmental awareness and behavior change among adolescents and ultimately contribute to reduction of the global public health burden of air pollution.

STUDY OBJECTIVES

Primary Objective

The hypothesis of this study is that, educating adolescents about health effects of air pollution through a short interactive evidence-based teaching session will shape their behavior to make personal choices that are more environmentally friendly.

Secondary Objectives

The secondary objective of the study is educating adolescents about health effects of air pollution through a short interactive evidence-based teaching session can improve their long-term understanding of human contribution to

air pollution.

STUDY DESIGN

Overview

This is a double-blind randomized placebo-controlled clinical trial to examine the long-term efficacy of a short classroom-based teaching session about air pollution on the understanding and behavioral choices of middle school students, The study will be using a repeated measure design. A one-hour interactive script-based evidence-supported teaching curriculum about air pollution will be developed and its effects on climate change and human health.

Furthermore, to assess the effect of the teaching session, we developed a survey questionnaire with two topic domains to evaluate the understanding and future behavioral choices of the participating adolescents towards air pollution. We also developed a one-hour teaching session about health benefits of vaccination to be used as the control teaching session.

Questionnaire

The questionnaire was developed to assess two domains: (1) adolescents' understanding of air pollution, its sources, and its environmental and health effects and (2) adolescents' future behavior based on their report of personal behavioral choices as well as their support for public policies with potentially important effects on air pollution, environment, and climate change (https://arjomandilab.ucsf.edu/questionnaires-powerpoints). It consisted of 15 questions which were divided into the two domains gauged towards quantification of adolescents' understanding and behavioral choices.
The questionnaire is designed to generate two scores. The multiple-choice answers to each question were weighted to have a minimum score of 1 and a maximum score of 4 (Table 1). The understanding domain section contained 5 multiple-choice questions designed to target and quantify the understanding of the participants with a score ranging from a minimum of 5 to a maximum of 20 possible points. The behavior domain section contained 10 questions (7 multiple-choice and 3 free-narrative response) designed to target and quantify behavioral choices of participants with a score ranging from a minimum of 10 to a maximum of 38 possible points.

Teaching session

The teaching sessions are one hour in duration, script-based, and associated with a PowerPoint slide presentation (https://arjomandilab.ucsf.edu/questionnaires-powerpoints). The intervention (air pollution) teaching session was developed by our research group based on the available scientific literature. The intervention session will also involve two activities:

- One will involve breathing through a straw to replicate the effect of breathing with lung inflammation.
- The second activity will be spirometry forcefully exhaling through an electronic spirometer to measure lung function.

CRITERIA FOR EVALUATION

Efficacy Endpoints

The study primary and secondary outcomes are listed below:

- The primary outcome of the study is the questionnaire behavioral domain score.
- The secondary outcomes are the questionnaire total and understanding domain score.

Safety Evaluations

Not applicable.

SUBJECT SELECTION

Recruitment, Eligibility, and Study Population

Middle school students in the age range of 13 to 15 from two schools will be recruited from Piedmont Middle School and KIPP Heartwood Academy. Two to four weeks before the intervention is scheduled to take place, the participating teachers will be provided with a list of eligibility criteria, and will assess the eligibility of students, then provide the study personnel with a list of eligible students. These eligible students will be given the Information Letter and the Consent/Assent form to take home and complete. Those who complete the form and provide assent to participate in the study will be enrolled, and their eligibility will be further verified by study personnel through the demographic questionnaire.

Vulnerable population

It is appropriate to include children in this study because the main purpose of this study is to focus on the efficacy of school-based intervention in changing the behavior of middle-school adolescents, and it is therefore essential to include children in this research so that the study population can properly reflect the target population.

Guardian/ parental consent

The prospective student's parents or guardians will receive information regarding their child's invitation to participate in the study. They will be provided with a detailed description of the research study, including its nature and purpose, and asked to provide consent for their child's participation. Only participants who have provided both assent and parental or guardian consent will be enrolled in the study, ensuring that participation is voluntary and contingent upon appropriate authorization.

Inclusion Criteria

1. 13-15 years of age.
2. Middle school student.

3. Ability to read, understand, and write in English (at the middle-school level).
4. Willingness to participate in follow-up visits of the study.

Exclusion criteria

1. Learning disabilities (such as autism).
2. Moving out of the area within the next 6 months
3. Inability to complete pre-intervention questionnaire.

RANDOMIZATION

In this randomized control trial, eligible students will be randomized by block randomization, as explained below. The students will be assigned a study ID number through sorting their last names (and first names if necessary) alphabetically and then assigned a study ID number. They will then be partitioned by simple randomization of their subject ID number within their classrooms using STATA software to either receive a one-hour script-based teaching on either the effects of air pollution on lung health (intervention group) or the role of vaccination in public health (control group), such that about equal numbers of students in each classroom were assigned to intervention and control groups.

BLINDING

In this study, blinding of participants and study staff to the intervention will not be feasible. However, to minimize bias, the data from the questionnaires will be entered into a database by two research assistants who will also be blinded to the assignment of the participants. Furthermore, the scoring of the free-narrative survey responses will be carried out by two observers who will be blinded to the participant assignment. These observers will adhere to the pre-defined guidelines that categorizes response from no response or an irrelevant response to a relevant response or a response related to a recent relevant event. This blinding procedure will ensure that the scoring of free-narrative responses and the data entry into the databases are conducted objectively and without knowledge of the participant assignment.

TRIAL REGULATORY MATTERS

The University of California San Francisco (UCSF) Institutional Review Board (IRB) and the San Francisco Veterans Affairs Health Care System (SFVAHCS) Committee on Research and Development approved the study protocols. The study is registered with the United States (U.S.) National Library of Medicine (Behavioral Research of Environment and Air Pollution Through Education (BREATHE) study; ClinicalTrials.gov identifier NCT02471872).

ADVERSE EXPERIENCE REPORTING AND DOCUMENTATION

This study is a category 7 low risk behavioral research, and it will be performed under no greater than minimum risk (45 CFR 46.404,21 CFR 50.51).

Risk/Benefit Assessment

The risks of this study are minimal compared to potential benefits it holds for public health, both locally and globally. Air pollution is a significant and escalating problem affecting numerous countries. The findings of this study can inform the development of future interventions aimed at promoting environmental awareness and behavior change among adolescents and ultimately contribute to reduction of the global public health burden of air pollution.

Troubleshooting

Before start

Prior to conducting any study-related activities, written informed consent and the Health Insurance Portability and Accountability Act (HIPAA) authorization will be signed by the parent or guardian and we will also get an assent from the participant.

Clinical Assessments

1 **Demographics:**
Demographic information (date of birth, gender, race, family income) will be recorded at Visit 1.

2 **Clinical Laboratory Measurements:**
Not applicable.

Evaluations by visit

3 Participants will be asked to complete a total of three in-person visits and one at-home over a period of at least 12 months.

4 Acquisition of Informed Consent: Parents/guardians of students who meet the eligibility criteria will be sent a set of papers containing:
- A letter explaining the purpose and methods of the study, and
- A letter of consent and assent for both the parent and student to sign.

5 All documents will be written in simple English and Spanish (<8th grade level). These forms will be brought to school, and those students with completed consent/assent forms will be eligible to participate in the study.

6 To ensure understanding of the consent and assent material, study staff will review the consent document over the phone with the potential subjects/ guardian.

Evaluations by visit: Visit 1

7 **Questionnaire**: The enrolled students will complete a survey (15 multiple-choice questions; five targeting understanding (score range 5-20); ten targeting behavioral choices (score range 10-38)) designed to evaluate their understanding and predict their future behavior towards air pollution immediately before the intervention.

8 **Teaching session**: participants will be given a one-hour script-based teaching on either the effects of air pollution on lung health (intervention group) or the role of vaccination in public health (control group). The teaching session also includes offering students to breathe through a straw and also undergo spirometry.

9 **Questionnaire**: The enrolled students will complete the same survey immediately after the intervention.

Evaluations by visit: Visit 2

10 **Questionnaire**: The enrolled students will complete the same survey in about three months after the intervention.

Evaluations by visit: Visit 3

11 **Questionnaire**: The enrolled students will complete the same survey in about six months after the intervention.

Evaluations by visit: Visit 4

12 Questionnaire: The enrolled students will complete the same survey in about twelve months after the intervention.

Note

Due to scholastic schedules and holidays the questionnaires may be applied within 8 weeks of the planned schedule (for example 1 to 5 months or 4 to 8 months or 10 to 14 months).

STATISTICAL METHODS AND CONSIDERATIONS

13 Data will be collected, entered into a database, and analyzed using statistical software. The distribution of the data, and the appropriate statistical measures will be calculated. The questionnaire scores before and after the teaching sessions will be compared using paired-t-test. In addition, multivariable regression analysis will be performed to determine whether or not the independent variable is predictive of the outcome and to determine the contribution of covariates.

14 **Sample size:**
For sample size and power calculation, we made the following assumptions:

- Minimally important difference in questionnaire score of 10% change due to the intervention.
- Standard deviation of change in score of 40%.
- A drop-out rate of about 20% due to factoring including movement of subjects out of the area.

A sample size of 504 subjects (252 subjects in each group) will provide a power of 80% to detect a change in questionnaire score by t-test with a two-sided type I error of 0.05. Considering the drop-out rate, we proposed to recruit a total of 600 subjects (300 in each group).

15 **Measured variables.**

15.1 **Independent variable**

- One hour teaching session about air pollution and climate change

15.2 **Dependent Variables**

- Behavior domain score (primary outcome).
- Total domain score (secondary outcome).
- Understanding domain score (secondary outcome)

16 **Covariates**

- Age
- Sex
- Income level
- Race
- Ethnicity
- Assigned classrooms.

17 **Statistical Models**

- Paired t-test comparison of pre versus post teaching session.
- Linear regression modeling analysis will be performed to compare the scores and change in them between the intervention and control group with adjustment for covariates including age, sex, race, ethnicity, income level, and assigned classrooms as appropriate.
- Multivariate generalized estimating equation regression analysis will be performed to determine whether there is an incremental effect from “time” on scores and change in scores with adjustment for covariates including age, sex, race, ethnicity, income level, and assigned classrooms as appropriate.

18 **Interim Analysis**

The progress of the trial will be monitored as detailed in Data Safety and Monitoring Plan. An interim analysis to evaluate the reliability and validity of the study instrument, the survey questionnaire will be performed.

19 **Medical Monitoring**

Internally, the investigator and co-investigator will perform the quarterly safety reviews. Externally, a Data Safety and Monitoring Board (DSMB) has been created to evaluate the study with respect to the following:

- Participant safety, burden, confidentiality, and any other matter pertaining to protection of study subjects.

- Quality control, including follow-up for events, and Study productivity in terms of significant research results in addressing the primary study aims.

The DSMB members will include two senior investigators not directly involved with the study.

QUESTIONNAIRE SCORING

20

	A	B	C	D	E
	SCORING OF THE QUESTIONNAIRE: 58 TOTAL POSSIBLE POINTS - 20 in Understanding, 38 in Future Behavior				
	Number	**Domain**	**Question**	**Value**	**Possible Response**
	Q1	Ustdg	What do you think makes our air polluted?	1	Acid Rain
				1	Trees releasing CO2
				4	Cars and factories releasing smoke and fumes
				1	I don't know
	Q2	Ustdg	Which one of the following does NOT contribute to air pollution?	1	Wood burning fire places
				3	Hybrid (gasoline-electric) cars such as Toyota Prius
				1	Landfills
				4	Recycling
				1	Farmers and livestock
				1	Smoking tobacco
	Q3	Ustdg	What makes you think the air around you is clean?	1	I don't smell pollution in the air
				1	I don't see smog in the air
				1	I can breathe the air in
				4	None of the above; air pollution may be odorless, invisible
	Q4	Ustdg	How do you think air pollution affects your body	2	Air pollution makes it harder for you to breathe.

	A	B	C	D	E
				3	Air pollution makes it harder for you to breathe, and it damages your lung tissue.
				4	Air pollution makes it harder for you to breathe, it damages your lung tissue, and it could cause lung diseases like asthma.
				1	I do not think air pollution affects my body.
	Q5	Ustd g	How do you think air pollution affects the health of your family and community?	1	Air pollution has no real effects on my health.
				2	b. Air pollution has some effects, but they aren't very important.
				3	c. Air pollution would have big effects on my health, but my community is not polluted.
				4	d. Air pollution has major effects on my family and my community's health.
	Q6	Behv r	How concerned are you about air pollution?	1	Not very - it doesn't really affect me.
				2	b. Somewhat - I know it's there, but I think there are more serious issues to worry about.
				3	c. Moderately - I would like to take some steps to decrease air pollution.
				4	d. Very - I am passionate about air pollution and would like to take as many steps as possible to reduce it.
	Q7	Behv r	How much do you take air pollution into account when choosing your daily activities?	1	Not at all - it's not something I really worry or think about.
				2	b. Somewhat - I worry about it sometimes, but I don't usually choose differently to avoid pollution.
				3	c. Moderately - I think about it often, and sometimes

	A	B	C	D	E
					choose to do something else to avoid pollution.
				4	d. Very - I think about it a lot, and I choose to avoid pollution as much as I can.
	Q8	Behvr	It's Friday and you want to go to the movie theater to hang out, but it's too far to walk. What would you do? (Pretend you own a bike, money for the bus, and your parents are home to drive you around)	1	Have my parents drop me off.
				3	b. Bike.
				4	c. Walk. I like walking even if it's far.
				2	d. Take the bus/BART.
				2	e. Carpool with friend(s).
	Q9	Behvr	Would you rather buy food that is...	2	Nearby, but more expensive
				1	b. Farther away but cheaper
				1	c. No preference
	Q10	Behvr	Do you care about the environment?	4	I care about the environment and I would change my behaviors to protect it.
				1	I care about the environment, but I don't really want to change my behaviors.
				2	I care about the environment, but I don't know how to change my behaviors to protect it.
				3	I care about the environment, but I don't have the money or time to change my behaviors.
				1	I do not care about the environment.
	Q11	Behvr	In the past two months, what current events regarding the environment have you read about on your own/outside of class? Include as many examples as you can think of.	1	no answer/irrelevant answer
				4	any current event(s) stated

	A	B	C	D	E
	Q12	Behvr	In the past 6 months, how many times have you walked, biked, or taken public transportation to school instead of driven?	1	Never
				1	A few times
				2	Several times
				3	Almost every day
				4	Every day
	Q13	Behvr	In the past 6 months, how many times have you told an adult what you know about the health effects of air pollution?	1	Never
				1	A few times
				2	Several times
				3	Almost every day
				4	Every day
	Q14	Behvr	What are some steps you currently take to help the environment?	1	no answer/irrelevant answer
				3	only 1 answer
				4	2 or more examples
	Q15	Behvr	What (if any) new steps would you like to try to improve air quality?	1	no answer/irrelevant answer
				4	at least one new behavior

TEACHING SESSIONS

21 **BREATHE INTERVENTION SCRIPT**

BREATHE Intervention Script

Slide 1

everyone/anyone: Hello, I'm _____

next person: I'm _____

third person: I'm _____, and we're here to talk to you about air pollution and its effects on
you.

Slide 2 – Chemistry of Air Pollution

So what exactly is air pollution? Would anyone like to give some possibilities? (pick a few answers) You're all very close/correct/essentially correct – air pollution is composed of harmful chemicals and small particles. How this pollution is made is that vapors, gas, dust, and fumes (or VGDF) from many sources mix in the air. A combination of radiation, heat, and the oxygen in our atmosphere oxidize these different materials, creating gases like carbon monoxide and sulfur dioxide that are easy to inhale and harmful for your body.

Slide 3 – Air pollution is a local problem

Air pollution is a problem, even around us. The different colors make up the Air Quality Index that tells us how clean or polluted the air is. Areas that are green mean the air quality conditions pose little risk. As we gradually go from yellow to orange to red, the quality of the air becomes worse. As we can see in the maps, in California, sometimes the air quality is good, like in the picture on the
right, but sometimes it is fairly bad, like in the picture on the right. The variation in air quality can be dangerous for those with sensitive lungs, or people in general.

(Let's see what air pollution is like in your area! To do this we're going to use a tool called AirCompare. Let's bring it up now. [bring up website (http://www.epa.gov/aircompare/compare.htm) on screen]

First let's select our state - California. Now let's select the counties we want to compare - let's start with San Francisco County. What other county(ies) do you want to compare it to? - what counties do you live in? What counties do your friends and/or family live in? Now that we have our counties selected, let's click 'Compare My Air.'
Now all of these counties have a similar number of days that are unhealthy from a general perspective, but what happens when we compare them based on days that are unhealthy for those with asthma or lung conditions? [click the link to do that] Now the differences in air quality are a lot clearer...but what does this mean for people who breathe in that air? [click 'Learn more about the AQI... link] As we can see, pollutants can hurt people who have sensitive lungs from conditions
like asthma or emphysema (code orange), and those who do not have any lung problems (code red).)

Slide 4 – Air pollution is a global problem

But air pollution isn't just concentrated in these cities, or just in California for that matter! Air pollution is a global problem. What do we mean by that, and how do we know? [play video]

(while video is playing…) In this video, we are looking at the circulation of different materials and compounds in the air. (point to each color as you describe it) Red and yellow is dust, green is organic and black carbon, white is sulfates, and blue is sea salt.

Take a few seconds to watch the video. As we can see from the moving colors, even if a material, like dust, starts in one part of the globe (like china), it is quickly blown to other countries and even continents (follow red air eastward from China to the US)

Slide 5 – Exposure-related Lung Diseases (go through images)

And this air pollution can lead to *(skip a beat)* ***exposure-related lung diseases****,* which, like air pollution, are increasingly recognized as a growing global problem. The lung is constantly exposed to various environmental pollutants generated from a variety of sources, which interact with airways and alveoli and result in inflammation, injury, and disease.

Slide 6

Damage to the lungs can lead to serious problems with our body, causing coughing, asthma, chronic (long time) lung diseases, and even death. Also, pollution causes inflammation in your heart system as well, causing stroke and cardiovascular disease. And the World Health Organization estimates that pollution kills 7 MILLION people per year.

Slide 7 – What is air pollution doing to your body?

What is air pollution doing to your body? It contributes to obstructed lung diseases, such as ***asthma*** **and** ***emphysema***, which is a condition in which the air sacs of the lungs are damaged, making it hard to breathe.

Slide 8 – Impact of Asthma in Your Body

Today we will talk a little bit about asthma. While a normal airway has plenty of space for air to pass through, and is nice and smooth, during an asthma attack, the **airway becomes inflamed**, which narrows the amount of space air has to pass through. In addition, sometimes the airway produces a **thick and sticky mucus**, which also makes it difficult for air to pass through. This means it is very **hard to breath** during an asthma attack.

Slide 8 – Quick Check

Before we move on, let's see how much you all remember. What is one symptom of asthma? Any ideas? *[call on raised hands]* Yes and? …Which causes…? Correct! Asthma

can cause an inflamed airway, mucus in the airway, and ultimately difficulty breathing.

Slide 10 – How can we observe this?

How can we see and study these effects of air pollution on our body?
We use a special tool called *(click)* a bronchoscope. This is a tube, with a camera and light, which is inserted into your lungs and then used to view *(click)* the airways! So while we may not be able to see anything on the outside when someone is being harmed by air pollution, we can still see the impact on their lungs. And we can measure lung health without needing a bronchoscopy – we use a test called **spirometry**!

ACTIVITY 1 - spirometry

Slide 11 – What is air pollution doing to your body?

[*perform animation*]
This is an image of a healthy airway, which is not inflamed. [*perform animation]* On the other hand, this is an inflamed airway. As you can see, there is a lot less space for air to pass through the lungs because the alveoli are irritated. This makes breathing difficult because the oxygen has a harder time entering the blood.

Slide 12 – How is this impacting you personally?

ACTIVITY 2!
We will now use straw(s) to demonstrate the effects of pollution on our airways. If anyone has asthma or other respiratory problems, please skip this activity and just watch and learn from your classmates or share your thoughts with them.

Slide 13 – Timer

To start off, we're all going to stand up. When we tell you to start, you're going to hop up and down for 30 seconds. Everybody ready? Go!

How did that feel?

For this next part of the activity, we will give you each a straw, and while we are handing out straws, please stand up. When we tell you to go, you'll start hopping up and down, while breathing in and out ONLY through the straw. We will do this for 30 seconds, then we'll tell you to stop.

Everyone ready?

Slide 13 – Timer

Okay, go! Start hopping!

How did that feel? Was it easy? Hard? [*wait for responses*]

Raise your hand if you could breathe normally. Raise your hand if it was harder to breathe.

So it looks like most of you found breathing more difficult with the straw. This is what it feels like to have a restrictive lung disease, such as asthma or emphysema. The straw simulates the constriction in your airways – there is less room for air to get through when your airways are inflamed.

Now you may be thinking, "Why does this matter to me?"

Even if you do not have asthma, emphysema, or another lung disease, breathing in polluted air gradually harms your airways, which can lead to lung conditions, or even more harmful conditions. We can't see it from the outside, but with continued exposure to this polluted air, a lot can happen on
the inside of our body.

Slide 14 – So what's causing this pollution?

So what do you think is causing this air pollution? Do any volunteers want to share their ideas [students raise hands, listen to answers]

Those are great answers! Factories are needed to make the iPhones, laptops and TVs that we use every day.

Slide 15

Everything we use needs to be produced. But making these items produces a lot of carbon monoxide and lead, which are bad for our health. Also, using a lot of electricity produces sulfur dioxide and nitrogen dioxide, and cars burn fossil fuels that produce carbon monoxide. These harmful gases react together to pollute our air even more.

Slide 16

And anything we discard becomes waste, which pollutes the air
with particulate matter and harmful chemicals.

Slide 17

All this can seem a little overwhelming and kind of scary, but thankfully there are definitely ways you can help yourself and those around you! On the screen, you can see that there are many familiar items that we use every day. What do you think we should do for each item to reduce air pollution? *[students raise hands, listen to answers*]

Great ideas! You should definitely turn off lights and appliances, like the TV, computer, radio and fan when they are not in use. If possible, carpool, walk, or bike to get around your neighborhood. You could also lower heating and air condition use by setting the thermostat to 78 F during warm months and 68 F during cold months. This will reduce pollution that usually comes from cars.

Slide 18

The three R's, reduce, reuse, and recycle, can also be used in everyday activities to reduce pollution.

For example, bring your own bags to the grocery store and continue **re-using** it every time you go shopping. Plastic bags can be used for trashcans at home, and paper bags can be **recycled** by using it for gift-wrapping. This **reduces** the amount of plastic and paper bags that we throw away.
Also, recycling isn't just for cans and bottles – you can also recycle your old clothes and electronics,
so you don't have to throw them away!

Slide 19

Now we're going to split into groups of threes - turn to your neighbors, and see if you can come up with 2 more ideas for how you can reduce air pollution. Write them down and be ready to share with us.
Does anyone want to share what they came up with in their small group? [*write up ideas on the board]*

Slide 20 YOUR lung function

[show lung function graph from spirometry]

****Please find the associated slides attached as PDF below.**

FILE BREATHE Intervention Powerpoint.... 3.8MB

22 **BREATHE ALTERNATE ACTIVITY SCRIPT**

BREATHE Alternate Activity *Script*

1. ***15 min. before Control Group*– Introductions, Q&A (15 min.)
2. Introduction (3 min.)
3. Infectivitis* Simulation (20-25 min.)
4. Vaccines (15 minutes)
5. Flu vaccine?
6. Answer questions (3-5 min.)
7. ***15 min. after Control Group goes back*– Q&A (max 15 min.)

1. Brief introduction! Who you are, what you will be doing today, what will the students be doing today (1 min.)

***Control Group arrives*

2. Slightly more detailed introduction (3 min.)

a. Introduce who we are, why we're there
b. What we will be doing today

3. Infectivitis* Simulation (~20-25 min.): You will participate in a simulation to see how disease spreads in a population without vaccines and with vaccines. The simulation uses a fictitious disease called **Infectivitis***, which makes people sick for two days:

a. Activity introduction: Describe that this will be an activity to demonstrate.
b. Read activity script
c. Explain instruction
d. Discussion:

i. What observations can you make about disease transmission from the stimulation?
ii. Why did some people did some people never get sick in round two?
iii. What might happen if fewer people or more people were vaccinated?

4. Vaccines (15 min.)

a. *What is a vaccine? **'teacher' of the immune system***

* A biological agent that improves the body's immunity to a particular disease. It stimulates the body to recognize the foreign invader and "remember" it so that the immune system can more easily and rapidly recognize and destroy the disease if it encounters it again.

b. Types of vaccines (can be turned into skit activity if wanted!)

i. *[Divide students into 3 groups, then hand out info papers. Give students ~1 min. to develop a quick skit showing how the vaccine works]*

ii. Three types of vaccines:
Imagine the zombie virus as the antigen of our vaccine:

1. ***Killed vaccine:***

**take some zombie virus and kill the disease-causing parts before injecting into bodies. More safe because the vaccine virus will not change, but this vaccine is teaching the body to defend the
none-disease-causing version of the virus which is weaker than the real virus. For example, people need to receive 3 doses to be securely shielded from the virus.**

2. ***Live, weakened vaccines***

take live zombie virus, weaken the virus in lab, and inject into uninfected bodies. Because they are live, they behave closest to what the original virus does, the bodies that 'learned' to recognize these live weaken viruses would react more effectively when meeting the real zombie virus. But the downsides to this kind of vaccine are the risk of uncontrollable changes happen after injecting into bodies and people with weaker immune system may have the risk of being infected by the vaccine. For example, the zombie virus mutated and changed into a new type of virus after injected into the body. Or a person who gets sick easily may actually be infected and turn into a zombie when he/she receives the vaccine

3. ***Subunit vaccine:***

take some zombie virus, study in the lab, and pick the most infectious and disruptive subparts of the virus to be the vaccine. But this vaccine only contains a certain part of the virus, say if we missed the wrong subparts of the zombie virus, the vaccine will be not strong enough to prevent people from being infected.

4. *(**toxoid vaccine** has been removed from this activity for simplicity's sake, but could be modeled by person leading activity)

iii. Have them explain briefly what their skit means
Use the chart that they figure out where the outbreak starts, choose one or two subjects and say if they had received the Zombie Vaccine, what will be different? Which victims would have saved from being infected?

5. Flu vaccine?
6. Answer any questions they have! (3-5 minutes)

***Control Group leaves*

7. Answer any questions they have/discussion time/wrap up