Newsletter of the Multi-Ethnic Study of Atherosclerosis

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MESA Messenger

Investigating the Mysteries of the Structure of our Lungs

By Benjamin Smith, MD, Columbia University

Our lungs have an "airway tree" that helps bring oxygen to the heart and the rest of the body. Just like a tree in a forest, the airway tree also cleans the air by filtering out harmful particles, like cigarette smoke.

Thanks to the participants in the MESA Lung Study, researchers were able to look at the airway tree using high-tech lung CT scanning (CAT scanning), as performed in MESA Exam 5 and 6. These pictures allowed us to study the details of the airway tree branches (Figure) in thousands of MESA participants! Similar to the large number of ways that trees branch in a forest, we found many different branching patterns in airway trees: some peoples' airway trees had extra airway branches compared to 'textbook' anatomy, and other airway trees were missing airway branches. Overall, about one in four people had an airway tree with different branching compared to what the 'textbook' shows! We also found that people who were related were more likely to have the same kind of airway branches than people who were not related, that these changes in branching were present in all four race/ethnic groups in MESA, and that some branches were linked to a gene that is important for lung development.

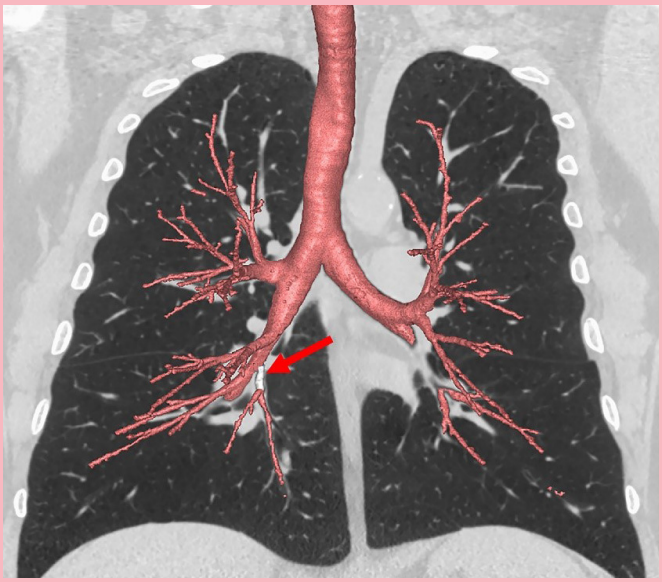


Figure: CT scan (CAT scan) image of lungs with the airway tree colored pink. The red arrow points to an extra branch in the airway tree. *Image courtesy of Eric A. Hoffman, MESA Lung CT Reading Center, University of Iowa.*

Researchers wondered how these variations in airway tree structure might impact lung function. Participants in the MESA Lung Study may also recall performing a breathing test (spirometry) that measures how well air flows through the airway tree. If you did this test, you probably remember blowing as hard as you could into a plastic tube! Thanks to your effort, we discovered that some of these airway branches are associated with lower air flow, a condition that we call COPD (chronic obstructive pulmonary disease). This was especially true among smokers.

These findings were published in the *Proceedings of the National Academy of the Sciences* and highlighted in the journal *Science*. Together they suggest that a person's airway tree, which forms early in life, may play an important role in the possibility of developing lung problems later in life. With ongoing research in MESA, we think this discovery will help us learn how to prevent chronic lung disease in the future. In the meantime, remember that quitting smoking is the best way to protect your health!

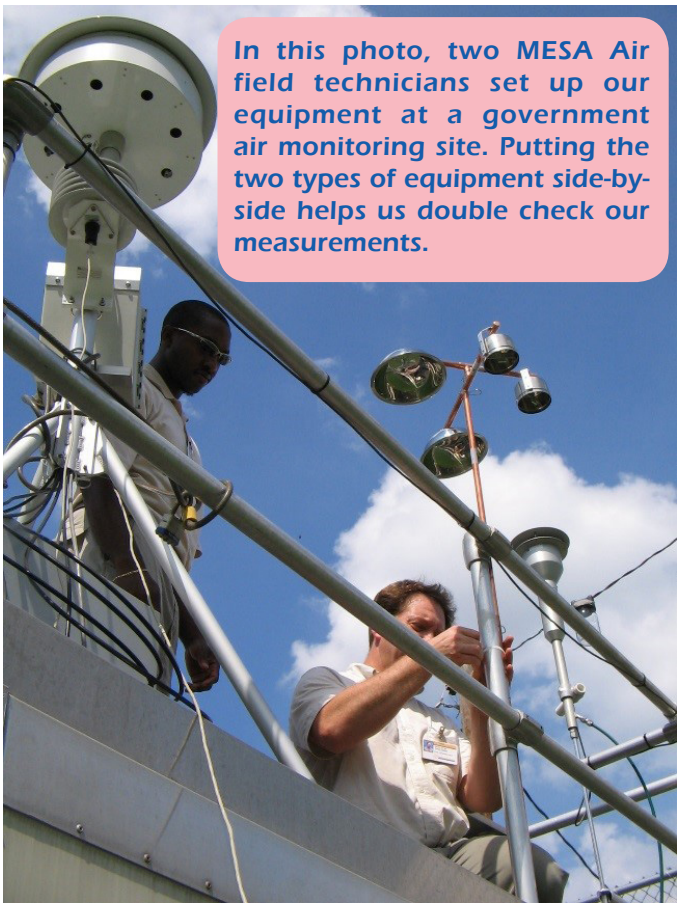
The Impact of Air Pollution on Heart Health

By Amanda Gassett, MS, University of Washington

Over the last several years, MESA participants have contributed to new understanding of the effects of air pollution on heart and lung health, through a project we call MESA Air. MESA Air recently published a landmark paper describing this work in one of the world's top medical journals, The Lancet. The research was designed to learn more about the link between long-term exposure to air pollution and cardiovascular disease.

Air pollution includes gases and tiny particles that we often refer to as soot, smoke, smog, or haze. These particles are small enough for humans to inhale deep into our lungs. To help estimate this "particle air pollution," over 600 MESA participants generously hosted air pollution monitors at their homes as a part of this study! All MESA participants described their homes for us, told us where they had lived for many years before the study, and provided information about the time they spend outdoors. All of this detailed information helped us accurately estimate the level of air pollution at each MESA residence between 1999 and 2012. No other study has examined individual-level pollution data like this before. We learned a lot about these pollution levels, and are happy to report that particle air pollution levels fell in all MESA communities over the course of the study, which is good news for our health.

This photo shows a MESA Air monitor on the roof of an elementary school in Los Angeles. This school is near a major freeway, where many cars and trucks pass by every day.



In this photo, two MESA Air field technicians set up our equipment at a government air monitoring site. Putting the two types of equipment side-by-side helps us double check our measurements.

With these detailed local pollution data, we looked at the relationship between air pollution levels and coronary artery calcium (CAC). CAC is calcium that builds up in plaque on the walls of the arteries of the heart. CAC can be measured by CT scans and most MESA participants had CT scans at least a few times over the years. We looked at how CAC changed over time, at the same time that air pollution levels were changing throughout the cities. We found that higher levels of small particle air pollution and nitric oxide were each associated with an increase in CAC. As a general estimate, we found that a person living in a high pollution area has as much CAC as someone who is two or three years older living in a low pollution area. In other words, air pollution seems to contribute to an acceleration of the CAC build-up that occurs with age. Although we still don't know what a safe level of air pollution is, this research helps us understand how the air we breathe impacts heart health.

Thanks to all the MESA participants for their help.

Heart Rhythm and Changes in Brain Structure and Function

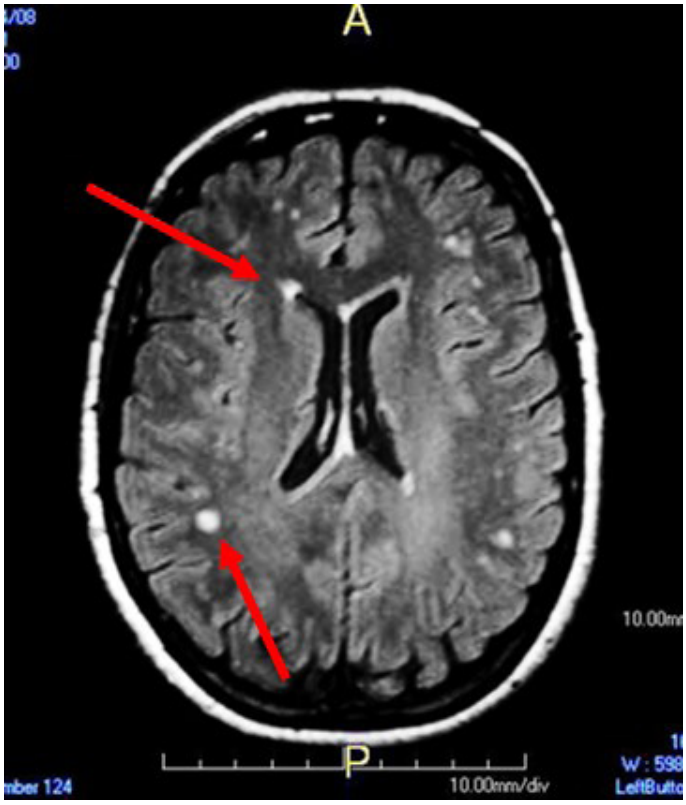
By Susan Heckbert, MD, PhD, University of Washington

A regular heart rate is important to ensure that enough blood is pumped to the body, including the brain. An irregular heart rhythm, called atrial fibrillation, can affect blood flow to the brain by interfering with the normal pumping ability of the heart or through the development of blood clots. In MESA, we are interested in how irregular heart rhythms might affect the structure of the brain and brain function.

To study this, we have been asking some MESA participants to wear a heart monitor patch, which can record a person's heartbeat for up to two weeks. This patch lets researchers identify participants with an irregular heartbeat. After the heart monitoring is complete, we will bring back those people who wore the patch for a brain MRI test. The brain MRI provides valuable information on brain structure and function. We're interested in a lot of different factors that may affect the brain's health so we will also ask a few questions about past head injuries.

Together with the cognitive function (memory) testing that was part of Exam 6 and all the other valuable information you have contributed to MESA, the brain MRI and heart monitor will allow us to better understand the complex effects of heart rhythms on memory, brain structure, and brain function.

Woman wearing a heart monitoring Zio Patch.



Brain MRI image from an older adult. The arrows point to changes associated with heart disease and commonly seen on MRI.

If you participated in the heart monitoring study with the Zio Patch at Exam 6, you will likely be invited to return in 2018-2019 for a brain MRI test. Thank you for your interest in contributing to knowledge about how the heart and brain work together!

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New Definition for High Blood Pressure

Seamus P. Whelton, MD, MPH and John W. (Bill) McEvoy, MB BCh BAO, MEHP, MHS

High blood pressure, also known as hypertension, is the leading cause of cardiovascular disease worldwide. It is known as the “silent killer” because, contrary to popular belief, you cannot feel when your blood pressure is too high in most circumstances.

The American Heart Association and American College of Cardiology announced new blood pressure treatment guidelines in November 2017. These guidelines now define hypertension as a blood pressure of ≥130 mmHg for the top reading (systolic) AND/OR ≥80 mmHg for the bottom reading (diastolic). The previous definition of hypertension was ≥140 mmHg / ≥90 mmHg. The new, lower definition was based on information from clinical trials showing that people treated to a systolic blood pressure of between 120 and 130 mmHg had fewer heart attacks or strokes and lived longer.

Based on this new definition, almost half of all adults in the United States have hypertension. Many people with hypertension do not even know they have it, so it is important to have your blood pressure regularly checked by your doctor. In addition, many people with known hypertension may benefit from further treatment.

The good news is that the new guidelines recommend starting with changes to your diet and lifestyle for most patients whose blood pressure is between 130-140 mmHg / 80-90 mmHg. Losing weight, exercising, eating more fruits and vegetables, and eating less salt can all help to lower your blood pressure. Your doctor may also decide that you need medication to further control your blood pressure.

Working with your doctor to make sure your blood pressure is well-controlled through diet, lifestyle, and if necessary, medications, will lower the chance that you have a heart attack or stroke and may also help you live a longer life.

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