



## Weather and Breathing



Every patient with COPD or other breathing problems knows that the weather can impact how they feel on any given day. I've even known those that swore they could predict the weather based upon how they felt. Why does weather impact our breathing? More importantly, can we do anything to counteract it?

Very little information is available to this phenomenon. A Medline search (this is an internet tool that searches all indexed medical journals back to 1966) revealed several articles on weather and asthma, and one article on COPD.

The articles on weather and asthma focused on outbreaks of asthma flare-ups during periods of thunderstorms, especially in the late spring and early summer. These studies, conducted in Australia and Great Britain, did seem to find a correlation between spring storms and increased problems with asthma. Researchers speculate the phenomenon may have two possible causes. The most likely is related to the downdrafts of cold air that occur with these storms. These strong wind currents stir up more grass pollen, which can cause problems for those with allergies to the pollen.

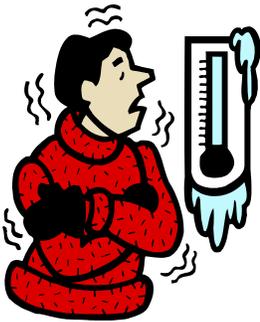
A second theory relates to the weather itself. Researchers found a correlation between the temperature drop that occurs during these storms and asthma flare-ups. Previous research had noted possible association between asthma and rainfall, high humidity, high pressure, high and low temperature, and lightning strikes.

Since there is a shortage of published information on weather and COPD, let's take a "common sense" approach to the question based upon our knowledge of airflow dynamics, physics, and physiology. One thing is certain; perception of the effects of environment varies greatly from patient to patient. While one patient feels best in a hot, dry environment, another may feel a humid environment is preferable. Though there are some generalizations that can be made, the "perfect breathing conditions" vary from one patient to another.

### Temperature

Changes in temperature seem to affect the level of dyspnea (the sensation of shortness of breath). How could temperature have an effect?

Extreme hot or cold conditions stress the entire body. In an effort to maintain a constant body temperature (98.6 degrees Fahrenheit), you expend additional energy to warm or cool your body. This additional energy requirement also increases the amount of oxygen your body is using (i.e. oxygen is required to create the additional energy). Since you are using more oxygen, this may further deplete your blood oxygen levels and increase your sensation of shortness of breath.



Breathing hot or cold air can also have a drying or irritating effect on the airway causing bronchospasm (contraction of the smooth muscle that surround the airway). Bronchospasm decreases the size of the airway and thus makes it more difficult to get the air in and out of the lung, increasing shortness of breath.

Many patients notice increased wheezing or shortness of breath when going out into cold air. This is especially true in asthmatic patients where “cold air-induced bronchospasm” is well recognized. However many COPD patients experience a similar response to cold air.

A Finnish study demonstrated that exposure of the body to cold air had a more deleterious effect on breathing than just breathing cold air. Although breathing cold air through a mask while in a warm room did decrease lung function, placing the patient in a cold environment further reduced airflow.

## Humidity

High Humidity is also a cause of increased complaints of shortness of breath. There are a few possible explanations for this phenomenon.

The amount of humidity in the air (water content) on the oxygen concentration. As water content increases, this reduces the oxygen content (called partial pressure) of oxygen in the air. Thus it would make sense that during humid conditions, less oxygen is available in the air. There is only one problem with this reasoning, the air we breathe is heated and humidified by our upper airway (i.e. nose, mouth, throat, windpipe, and larger bronchial tubes). By the time the air reaches the air sacs in the lungs (called alveoli), it is 100% saturated with humidity, even when we breathe very dry air. So breathing dry air versus humid air has no effect on the partial pressure of oxygen reaching our lungs.

A second explanation is more likely. As humidity increases, the density of the air increases. More dense air creates more resistance to airflow in the airway resulting in an increased work of breathing (i.e. more shortness of breath).

Another possible explanation is that as humidity increases, the prevalence of many known airborne allergens increases. Dust mites and molds both increase in high humidity. My wife never experienced asthma symptoms in her life until we moved to an old house with a damp, moldy basement. She also had difficulty breathing anytime we visited the Climatron (a large, tropical dome with lots of humidity and mold) at our local botanical garden.

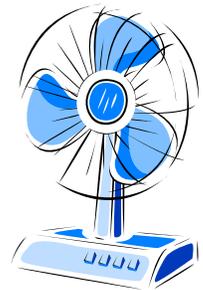
## **Barometric Pressure and Elevation**

As barometric pressure drops, less oxygen is available in the air. This is the same principle that causes a decrease in oxygen level as you travel to higher elevations. The total pressure is less and so the oxygen component is less.

When barometric pressure drops, as when a storm front passes, barometric pressure can change 30-40 millimeters of mercury (i.e. the units are in mm of mercury [abbreviated mmHg] or “torr” when measuring air pressure). Although the effect on the partial pressure of oxygen that reaches the air sacs in the lungs is small (maybe 5-10 mmHg), a change of just a few points could increase shortness of breath.

## **Circulating Air**

Some patients express relief of their shortness of breath by having air circulating. Many patients will run a fan all of the time. On the other hand, I have talked to patients that did not feel like it helped and some that even said it made them worse. One lady in a pulmonary rehab program had difficulty exercising on an “Air Dyne” bicycle because it generated too much air movement.



## **Allergens and Irritants**

Other environmental conditions can increase breathing problems. Both indoor and outdoor air pollution have been demonstrated to increase the need for hospitalization in asthma and COPD patients. Although it is difficult to control the air pollution in your area, (unless you decide to move), it is possible to improve air quality inside your home.

Common sources of allergens inside the home include pets (usually fur bearing), molds, dust, and cockroaches. Irritants may include smoke, sprays, perfumes, cleaning chemicals, or anything else that produces a smell, fume, or mist. With today’s home construction resulting in homes with less air circulation (e.g. drafts); indoor air pollution is a growing concern. Some speculate it is partially responsible for the increase in asthma and COPD cases.