Thirdhand Smoke Resource Center

What do we know about the health risks of thirdhand smoke?

The Short Answer

Thirdhand smoke is the chemicals left behind when someone smokes tobacco. Thirdhand smoke is unhealthy for people and pets. It can stick around for a long time in homes and cars. It gets into your body if you inhale, swallow, or touch the chemicals. Getting rid of it is really hard and can cost a lot of money.

From tiny cells to entire organ systems, thirdhand smoke affects both people and pets. We know about the health risks of thirdhand smoke from four major types of research:

1. Chemistry studies show that thirdhand smoke contains more than 25 chemicals known to cause cancer, affect a person's ability to have children, or cause birth defects.
2. Laboratory studies of lung, skin, liver, blood, and reproductive cells have shown that thirdhand smoke can impair cells' ability to function and repair themselves.
3. Animal studies have shown many health effects from thirdhand smoke exposure, including slow wound healing, increased "bad" cholesterol, liver function, and lung inflammation.
4. Studies with healthy human volunteers have shown thirdhand smoke exposure damages human cells and increases respiratory illnesses in children, including pulmonary illness, viral/other infectious illness, and bacterial infections.

The Long Answer

Thirdhand smoke is the chemical residue from tobacco smoke. It is also called "tobacco smoke residue" or "stale tobacco smoke." The chemicals in thirdhand smoke are toxic to humans, especially children. It can linger for years in dust and on household surfaces. It can also become embedded in carpets, furniture, clothes, and building materials. It is difficult and expensive to remove.

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Thirdhand smoke impacts the health of people and animals at multiple levels. It can harm genetic material, affect how individual cells function, interfere with the body's ability to fend off infections, and impair entire organ systems in the human body. Thirdhand smoke can worsen pre-existing conditions.
Scientific evidence about the health effects of thirdhand smoke exposure comes from four major types of studies.

1) Health effects of chemicals found in thirdhand smoke

Thirdhand smoke contains some of the same toxic chemicals as first- and secondhand smoke, including nicotine, tobacco-specific nitrosamines, polycyclic aromatic hydrocarbons, heavy metals, and ultrafine particles. Exposure to these chemicals is known to harm human health. Chemical studies show that thirdhand smoke contains at least 25 chemicals known to cause cancer, affect a person's ability to have children, or cause birth defects. Due to these health effects, California law lists these toxic chemicals under Proposition 65, which requires the state to maintain and update a list of chemicals known to cause cancer or reproductive toxicity. Additional harmful chemicals form when thirdhand smoke on surfaces and in dust comes in contact with other chemicals, such as ozone, in an indoor environment.

2) Health effects of thirdhand smoke exposure on human cells

Studies of human cells show that exposure to thirdhand smoke can directly damage DNA, the genetic material found in nearly every cell that contains the instructions our cells need to develop, function, grow, and reproduce. Thirdhand smoke causes oxidative stress in human cells, interfering with their normal functioning and repair mechanisms. Thirdhand smoke chemicals impair our cells' ability to regenerate and repair themselves. Thirdhand smoke can harm various cell types in the human body, including lung, skin, liver, blood, and reproductive cells.

3) Health effects of thirdhand smoke exposure on animals

Decades of examining the health effects of thirdhand smoke exposure on animals has clearly established that thirdhand smoke is dangerous to health. In 1939, Dr. A. H. Roffo published one of the first animal studies on thirdhand smoke. He showed that rabbits developed skin cancer when tobacco smoke residue (condensate) was applied to their skin. In 1953, Dr. E. L. Wydner conducted a similar experiment in mice, showing the same outcomes. A more recent study by Dr. Martins-Green showed that mice exposed to thirdhand smoke through their bedding material have the following symptoms:

- slow wound healing
- inflammation in lungs
- elevated levels of fat in the liver
- high blood sugar levels
- increased blood clotting
- hyperactive behavior
- poor weight gain after birth

- elevated LDL (“bad”) cholesterol and low HDL (“good”) cholesterol levels

4) Health effects of thirdhand smoke on humans

Researchers have found that people living in or visiting places where people have smoked in the past are exposed to the toxic components of thirdhand smoke. Researchers determined this by measuring thirdhand smoke biomarkers in people’s urine, blood, or saliva. They even found thirdhand smoke toxicants in newborns, infants, children, and nonsmoking adults living in thirdhand smoke-polluted environments.

Researchers at the University of California, San Francisco, studied the effects of thirdhand smoke exposure in human volunteers who do not smoke. They found that thirdhand smoke damaged the participants’ lung cells after only three hours of exposure.

Researchers from Cincinnati Children’s Hospital and San Diego State University found that children exposed to thirdhand smoke were more likely to be diagnosed with pulmonary illness, viral/other infectious illness, and bacterial infection.

Do you have more questions about the toxic legacy of tobacco smoke, how it affects human health, and what we can do about it? Learn more here.

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