



## Overview

While the public health impacts of smoking and secondhand smoke exposure are well documented, the concept of thirdhand smoke (THS) is a relatively new area of study in public health. THS is tobacco smoke residue that **remains** in indoor environments, **reacts** with air to make additional pollutants, and **re-emits** from surfaces back into the air. It is a distinct public health problem [1].

- The smoke from tobacco products sticks to indoor surfaces such as walls, windows, furniture, and floors. It does not simply blow away [1].
- THS sticks to skin, hair, and clothing, and can be transferred into environments where smoking is not allowed [1-3].
- Layers of THS residue can build up over time on surfaces and in household dust, and they can remain there for years. In places where substantial smoking has occurred, renovations such as replacing wall boards and furnishings may be necessary to reduce levels of THS [1, 4].
- Common cleaning methods such as vacuuming, wiping surfaces, and airing out rooms do not completely remove THS [5].

## Health Risks

- Some of the chemicals in THS are different from those found in fresh smoke because THS changes over time, becoming progressively more toxic [1, 6].
- THS is a source for long-term exposure to harmful pollutants, which have been shown to damage human cells and DNA, and may be associated with short- and long-term health problems such as asthma and cancer [1, 7].
- Researchers found that mice exposed to THS had health problems with their lungs, liver, blood vessels, and reproductive systems. These mice also became pre-diabetic, had problems with wound healing, and had behavior problems such as hyperactivity. After seeing the health impacts of THS exposure in mice, researchers are conducting more studies on THS and human health [1].

## Products that Contribute to THS

- All tobacco products, including but not limited to cigarettes, hookah, electronic cigarettes, and smokeless tobacco have been shown to leave nicotine and/or tobacco smoke residue in indoor environments [8-10].



# Routes of Exposure

You can be exposed to THS if you:

- touch a surface on which THS has accumulated, because it can be absorbed through your skin;
- inhale THS in the air; or
- ingest THS when you put household objects that are contaminated with tobacco smoke residue in your mouth (eating utensils, toothbrushes) [1].

## Unintentional Exposure

- THS has been found in the homes of non-smokers and in homes where smoking is not currently allowed, but where smokers have previously lived [1].
- In hotels with only partial smoking restrictions, THS has been found in both smoking and non-smoking rooms [11].
- Depending on smoking rates and vehicle turnover frequency, rental cars and used cars may have THS contamination [1].
- Used cars in which smoking was allowed or that were sold by smokers who had car smoking bans have been shown to be contaminated with THS at the time they were sold [1].
- THS contamination has been found in homes of smokers who quit long after residents stopped smoking. Elevated levels of nicotine and cancer-causing chemicals from tobacco in house dust has been found in homes of former smokers six months after they quit smoking [1].

## Health Equity Considerations

### Children and Families:

- Spouses, children, and others who come into close contact with smokers are more likely to be exposed to THS [6].
- Infants and children spend more time indoors, and have age-specific behaviors (crawling, mouthing household objects, active playing near the floor) that can increase exposure to THS in environments where smoking has occurred [1].
- Children's growing bodies make them more vulnerable to THS than adults [1].
- Even when parents and caregivers only smoke outdoors, children are not fully protected from tobacco exposure because THS remains on the clothes, skin, and hair of smokers, and smoke can drift indoors [2, 3].

### Rental Housing:

- People who live in rental homes or apartments are at a higher risk for THS exposure because these properties change occupants frequently, and smoking bans often do not apply to private spaces such as homes [5, 12, 13].
- Children who live in apartments show a higher level of exposure to tobacco chemicals than children who live in detached housing, even when they are not exposed to secondhand smoke. These children may be exposed to THS from previous tenants who smoked in the home, or from the smoke of neighbors that enters their home through open windows, air ducts, or other routes [5, 8, 14, 15].

### Occupational Exposure:

- Employees and customers in environments where smoking is allowed (such as hotels, casinos, or long-term health facilities that allow smoking indoors) are more likely to be exposed to thirdhand smoke [1, 5, 11, 12].



# References

- Jacob, P., et al., *Thirdhand Smoke: New Evidence, Challenges, and Future Directions*. Chemical Research in Toxicology, 2016.
- Northrup, T.F., et al., *Thirdhand smoke contamination in hospital settings: assessing exposure risk for vulnerable paediatric patients*. Tob Control, 2015.
- Northrup, T.F., et al., *Thirdhand Smoke in the Homes of Medically Fragile Children: Assessing the Impact of Indoor Smoking Levels and Smoking Bans*. Nicotine Tob Res, 2016. **18**(5): p. 1290-8.
- Bahl, V., et al., *Thirdhand cigarette smoke: factors affecting exposure and remediation*. PLoS One, 2014. **9**(10): p. e108258.
- Matt, G., et al., *Thirdhand tobacco smoke: emerging evidence and arguments for a multi-disciplinary research agenda*. Environmental Health Perspectives, 2011: p. 119(9): 1218-26.
- Martins-Green, M., et al., *Cigarette smoke toxins deposited on surfaces: implications for human health*. PLoS One, 2014. **9**(1): p. e86391.
- Hang, B., et al., *Thirdhand smoke causes DNA damage in human cells*. Mutagenesis, 2013. **28**(4): p. 381-91.
- Whitehead, T.P., et al., *Tobacco alkaloids and tobacco-specific nitrosamines in dust from homes of smokeless tobacco users, active smokers, and nontobacco users*. Chem Res Toxicol, 2015. **28**(5): p. 1007-14.
- Goniewicz, M.L. and L. Lee, *Electronic cigarettes are a source of thirdhand exposure to nicotine*. Nicotine Tob Res, 2015. **17**(2): p. 256-8.
- Kassem, N.O., et al., *Children's exposure to secondhand and thirdhand smoke carcinogens and toxicants in homes of hookah smokers*. Nicotine Tob Res, 2014. **16**(7): p. 961-75.
- Matt, G.E., et al., *Thirdhand smoke and exposure in California hotels: non-smoking rooms fail to protect non-smoking hotel guests from tobacco smoke exposure*. Tob Control, 2014. **23**(3): p. 264-72.
- Samet, J.M., D. Chanson, and H. Wipfli, *The Challenges of Limiting Exposure to THS in Vulnerable Populations*. Curr Environ Health Rep, 2015. **2**(3): p. 215-25.
- Kraev, T.A., et al., *Indoor concentrations of nicotine in low-income, multi-unit housing: associations with smoking behaviours and housing characteristics*. Tob Control, 2009. **18**(6): p. 438-44.
- Wilson, K.M., et al., *Tobacco-smoke exposure in children who live in multiunit housing*. Pediatrics, 2011. **127**(1): p. 85-92.
- Matt, G.E., et al., *When smokers move out and non-smokers move in: residential thirdhand smoke pollution and exposure*. Tob Control, 2011. **20**(1): p. e1.