

The Dangers of Third-hand Smoke

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"Third-hand smoke is tobacco smoke contamination that remains after the cigarette has been extinguished," says Jonathan Winickoff, a pediatrician at the Dana–Farber/Harvard Cancer Center in Boston and author of a study on the new phenomenon published in the journal *Pediatrics*. According to the study, a large number of people, particularly smokers, have no idea that third-hand smoke—the cocktail of toxins that linger in carpets, sofas, clothes and other materials hours or even days after a cigarette is put out—is a health hazard for infants and children.

ScientificAmerican.com asked Winickoff to explain exactly what third-hand smoke is and why it poses a public health risk.

How exactly do you distinguish between second- and third- hand smoke?

Third-hand smoke refers to the tobacco toxins that build up over time—one cigarette will coat the surface of a certain room [a second cigarette will add another coat, and so on]. The third-hand smoke is the stuff that remains [after visible or "second-hand smoke" has dissipated from the air].... You can't really quantify it, because it depends on the space.... In a tiny space like a car the deposition is really heavy.... Smokers [may] smoke in another room or turn on a fan. They don't see the smoke going into a child's nose; they think that if they cannot see it, it's not affecting [their children]. Smokers themselves are also contaminated...smokers actually emit toxins [from clothing and hair].

Why is third-hand smoke dangerous?

The 2006 surgeon general's report says there is no risk-free level of tobacco exposure.... There are 250 poisonous toxins found in cigarette smoke. One such substance is lead. Very good studies show that tiny levels of exposure are associated with diminished IQ.

What do you consider the most dangerous compound in cigarette smoke?

I would say cyanide, which is used in chemical weapons. It actually interferes with the release of oxygen to tissues. It competitively binds to hemoglobin [meaning it competes with oxygen for binding sites on the blood's oxygen-carrying molecule, hemoglobin]. Basically people with cyanide poison turn blue.... [And] arsenic, that is a poison used to kill mammals. We [used to] use it to kill rats. And there it is in cigarette smoke.

Why are the risks associated with exposure to third-hand smoke different for children and adults?

The developing brain is uniquely susceptible to extremely low levels of toxins. Remember how we talked about the layers of toxin deposits on surfaces? Who gets exposure to those surfaces? Babies and children are closer to [surfaces such as floors]. They tend to touch or even mouth [put their mouths to] the contaminated surfaces. Imagine a teething infant. Children ingest twice the amount of dust that grown-ups do. Let's say a grown-up weighs 150 pounds [68 kilograms]. Let's say a baby weighs 15 pounds [seven kilograms]. The infant ingests twice the dust [due to faster respiration and proximity to dusty surfaces]. Effectively, they'll get 20 times the exposure. Studies in rats suggest that tobacco toxin exposure is the leading cause of sudden infant death syndrome (SIDS). We think it is [caused by] respiratory suppression.

What types of places or materials harbor the greatest amount of third-hand smoke?

Anywhere you see an enclosed space you should watch out for [it].

By introducing the phrase "third-hand smoke" in your research, what do you hope to accomplish?

This study points to the need for every smoker to try to quit. That's the only way to completely protect their children.... Really, I think that what this says is that we need to have sympathy for smokers and help them quit smoking.... [And also] that the introduction of this concept will lead to more smoke-free spaces in...public.