

Thirdhand Smoke Might Spell Bad News for Children's Good Bacteria

Researchers report differences in the bacteria population of children exposed to thirdhand smoke compared to children who were unexposed.

SAN DIEGO, CA, USA, March 15, 2021 /EINPresswire.com/ -- Humans are home to a large number of tiny, invisible organisms, including bacteria, fungi, parasites, and viruses—aka the human microbiome. These microbial organisms live on our skin, in our mouth, nose, ears, and gut, helping us digest food, regulate the immune system, fight off foreign invaders, and produce vitamins. And amazingly, microbes outnumber human cells ten to one.



Toxic thirdhand smoke residue lingers on surfaces and in dust where it exposes children and alters their microbiomes.

Only recently have scientists begun to understand just how important the relationship between human health and the microbiome is. Microbes are overwhelmingly “good” and only occasionally “bad,” meaning a balanced microbiome will work with our bodily processes to ensure healthy functioning. Imbalances, then, have important consequences for our health.

If microbes live on us and with us, they too are affected by chemicals in the human environment. Tobacco smoke introduces thousands of foreign chemical compounds to our homes and bodies. Previous studies have linked first- and secondhand smoke to microbiome imbalances that favor harmful microbes, leading to worse oral health and higher rates of asthma, ear infections, and bacterial infections. But what about the chemical residue of tobacco smoke that lingers long after the smoke has disappeared? Thirdhand smoke, the notoriously hard to remove chemical residue left behind on surfaces, presents a lasting and little understood disruption to the microbiome.

Researchers from San Diego State University and Cincinnati Children's Hospital Medical Center, led by Drs. Scott Kelley and Georg Matt, set out to better understand how thirdhand smoke might affect microbiomes by comparing bacteria in and around thirdhand smoke-exposed children to those of children not exposed.

The research required identifying families and homes that were and were not exposed to thirdhand smoke. The researchers measured thirdhand smoke levels in San Diego homes and from the residing children to separate subjects into two groups: thirdhand smoke-exposed and no exposure. The final sample included 10 unexposed children and 19 exposed children. The researchers then swabbed surfaces in the homes and from the bodies of these children that they tested to determine the types and amounts of bacteria species as well as the amount of thirdhand smoke. The sampled surfaces included the floor, table, armrest, bed sheets, pillowcases, and bed frame, and the child samples included the finger, nose, mouth, and ear canal.

The study, published in [Pediatric Research](#), was the first of its kind to examine the microbiomes of both people as well as the “built environment” (human-constructed, non-living things) in relation to tobacco chemical changes. Just like any other living thing, microbes need food and water to grow which can be scarce on certain built surfaces. Dr. Kelley compares dry surfaces like the floor and armrests to bacterial “deserts” or “wastelands.” The sparse microbes in the built environment likely exist in a dormant, spore-like state on these dry surfaces, but once transferred to the human body where there are water and food, they grow and reproduce. Similarly, living creatures are “microbial hubs”, introducing skin, hair, saliva, and other bits and pieces to any environment they move through. The built environment microbiome and the human microbiome are constantly affecting each other. Tobacco smoke is another way people can change both the built environment microbiome as well as their own by introducing new and often toxic chemicals to bacteria.

The results of the study yielded some unexpected patterns of suppressed and enhanced bacterial growth in the thirdhand smoke-exposed homes. Because thirdhand smoke contains some microbe-killing chemicals, the researchers expected thirdhand smoke to kill off many of the microbes. On the contrary, the thirdhand smoke-exposed floors, armrests, and tables actually had a larger variety of different microbes than those in the unexposed homes. The sampled child microbiomes had more similar numbers of bacteria types regardless of their exposure. The effects of the thirdhand smoke chemicals on specific bacteria types were dependent on location: For instance, Staphylococcus species were more abundant in the ears of thirdhand smoke-exposed children than those unexposed, but the opposite pattern was observed for the mouth. Staphylococcus bacteria are known for causing “Staph infections” in the skin but can even cause life-threatening infections of the heart’s inner lining. Many of the microbes affected by thirdhand smoke had also been shown to be affected by first- and secondhand smoke in previous studies.

Dr. Matt believes findings from this study could inform more targeted further research. “We now

have a better sense for the specific types of bacteria that are impacted by thirdhand smoke in children and that may play a role in changing their health or quality of life.” He hopes that this study, while only examining a relatively small sample size of 29 children from the San Diego area, inspires future research. Now that some “signature” tobacco-affected bacteria families have been identified, Dr. Matt foresees further studies that expand the sample size and geographic area while targeting selected bacterial strains in order to cast light on how different thirdhand smoke exposure levels might lead to microbial changes.

While more research is undoubtedly needed on the subject, there are still a few take-home messages from this groundbreaking study. Dr. Kelley brings attention to their finding that the microbiome at different locations showed variation in response to the thirdhand smoke exposure, which could inform cleaning habits and other home practices. The largest microbial differences between thirdhand smoke-exposed and unexposed homes were measured on the armrests, floors, and tables. Dr. Kelley says this could be due in part to the two-dimensional nature of these surfaces, as well as less frequent cleaning norms of these places.

Dr. Matt also emphasizes the importance smoking bans and policies: “Even if you are a non-smoker, you need to pay attention to what the smoking rules are in your building and ask questions as you travel or buy a used car. A former occupant may have smoked and left behind thirdhand smoke residue that could affect your microbiome.”

The study was funded by a grant from the California Tobacco Related Disease Research Program (TRDRP). More information about thirdhand smoke pollution and exposure can be found at the [Thirdhand Smoke Resource Center](#).

Georg Matt PhD
San Diego State University
[email us here](#)

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