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Volatile Organic Compounds May Worsen Allergies and Asthma

Children who sleep in bedrooms containing fumes from water-based paints and solvents are two to four times more likely to suffer allergies or asthma, according to a new scientific study

By [Marla Cone](#) and [Environmental Health News](#)

Children who [sleep](#) in bedrooms containing fumes from [water](#)-based paints and solvents are two to four times more likely to suffer [allergies](#) or asthma, according to a new scientific study.

Scientists measured the compounds – propylene glycol and glycol ethers, known as PGEs – in the bedroom air of 400 toddlers and preschoolers, and discovered that the children who breathed them had substantially higher rates of asthma, stuffy noses and eczema.

It is the first human study to link harmful effects of these chemicals to common exposures in households, and it suggests that they might exacerbate or even cause allergic disorders and asthma, according to the team of scientists from Harvard University and Sweden's Kalstad University.

“Apparent risks of PGEs at such low concentrations at home raise concerns for the vulnerability of infants and young children,” according to the report, published Monday in the journal of the Public Library of Science, *PLoS ONE*.



ASTHMA TRIGGER: A new study finds that fumes from water-based paints and solvents may make children more likely to suffer allergies or asthma.

Image: courtesy Flickr

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The aim of the study was to investigate the health effects of chemicals called volatile organic compounds that are widely used inside homes. The result: Of the hundreds of compounds tested in eight different categories, only one group -- the PGEs - was associated with the children's allergies and asthma.

That discovery is particularly surprising, since PGEs are widely used in water-based paints and varnishes, as well as in cleaning fluids such as glass cleaners. They are considered healthier substitutes because they have low volatility, which means they emit less fumes than the high-polluting, oil-based paints and solvents.

For several decades, scientists have tried to unravel why allergies and asthma have skyrocketed among children throughout the developed world since the 1970s.

Experts suspect that exposure to some environmental factors in the womb or early in life might trigger the disorders. The findings of the new study add to the many theories that have evolved, including ones about other indoor air pollutants, diesel exhaust, viruses and cockroach allergens.

Michael Laiosa, an assistant professor at the School of Public Health at University of Wisconsin, Milwaukee, who studies children's allergies and immune disorders, called it "a very interesting article and well-conducted study."

If these findings are confirmed by other studies, "it may be another piece of the puzzle as to why atopic diseases like allergy and asthma are on the rise, particularly in kids," said isa, who was not involved in the research.

"It also is concerning given how ubiquitous these compounds are, particularly at low levels like those found in this study," he said.

The research involved 198 children in Varmland, Sweden, between the ages of 1 and 5, who had asthma or at least two symptoms or wheezing or rhinitis without a cold or eczema in the previous year, as well as 202 children with no symptoms.

For children with rhinitis – or nasal allergies – the average PGE concentration in their bedrooms was twice as high as the concentration found in rooms of the children with no symptoms. The higher the dose, the more likely the children were to suffer from rhinitis, asthma, or eczema, even when concentrations were low.

Children in bedrooms with the highest concentrations were 4.2 times more likely to have rhinitis, twice as likely to have asthma and 2.5 times more likely to have eczema, compared with children with the lowest concentrations in their rooms.

High concentrations of the chemicals also doubled their likelihood of testing positive for immunoglobulin E, an antibody that develops when people are exposed to something that inflames their airways. None of the other VOCs led to similar associations.



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The researchers did not identify the sources of the PGEs in the bedrooms. But children living in a house where at least one room was painted right before or after their birth had 63 percent more PGEs in their room than those whose houses had not been repainted. "Thus, repainting might have provided a sustained exposure since the gestational period or shortly following the birth," the study said.

The airborne compounds can remain inside homes for months, perhaps even years.

"Overall, the question of long-term airway injury from the glycol ethers and other organic solvent exposure requires clarification," wrote the scientists.

How the glycol compounds might trigger allergies and asthma "is not well understood," the authors said, but they added that "it has been known for more than three decades" that inhalation of propylene glycol methyl ether irritates nasal passages of people and lab rats.

Asthma, eczema and allergies are inflammatory, immune system disorders, so it is possible that the compounds disrupt a baby's or child's immune system development. Some of the compounds already are known to alter hormones.

"Several glycol ether compounds join a growing list of VOCs that are suggested to contribute to allergic diseases in humans," the study says. "While several PGEs are well-known endocrine disruptors, very little is known whether and how they influence developing immune systems."

Laiosa added that "one of the most interesting aspects for me is that our understanding of how VOCs in general, and PGEs specifically, affect the immune system, is quite limited."

Previous studies of house painters and some adult volunteers exposed to some PGEs have found higher incidence of nose and throat irritation, wheezing and shortness of breath. But the levels found in the children's bedrooms are "more than 400-fold lower than exposure ranges reported in occupational and experimental settings," according to the report.

"Several lines of evidence support that our findings are not due to a chance or a bias," the authors reported. For instance, the increase in allergies, eczema and asthma were observed for every rise in exposure, from the lowest-exposed children to the highest-exposed. In addition, it wasn't driven by any single compound.

"This suggests that multiple compounds, rather than a single one, contribute to the observed risks," the report says.

A compound called 1-methoxy-2-propanol was the most prevalent glycol ether in the children's rooms. But because multiple types of PGEs were found in the children's homes, "we currently cannot distinguish the risks of the individual compounds," the authors said.

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In their analysis, the researchers accounted for other factors that might raise the children's risk, including secondhand smoke, allergies of parents, cleaning with chemical agents, age of the homes, pet allergens and exposure to other indoor chemicals called phthalates.

Laiosa said that testing for VOCs is tricky, but the researchers "did an admirable job" of identifying the limitations of their study and ensuring the testing methods were reliable.

The levels found in the bedrooms were strikingly similar to those found in previous studies of homes in other Scandinavian countries.

That finding "is a strength of this work," Laiosa said. "In other words, I don't think anyone can question the validity that these PGEs are present in the children's bedrooms, even at such low levels. "

Many volatile organic compounds have been regulated in recent years to clean up smog. The petroleum-based compounds, found in car exhaust as well as consumer products, react in sunlight with nitrogen oxides to form ozone, the main ingredient of smog.

Carl-Gustaf Bornehag , a professor of public health science at Sweden's Kalstad University, and John Spengler, an environmental health professor at the Harvard School of Public Health, conceived of and designed the experiments, while the lead author was Harvard's Hyunok Choi.

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02:46 PM 10/20/10

'Suffer the little children'- and why, may we ask ourselves?
Is it because of our human obsession to 'keep up with the Joneses', and using synthetic colours as territorial markers (as explained in my book on 'Colour Eating') that we are turning our newborn babies into involuntary paint sniffers , with all medical consequences?
The olfactory bulbs, not to forget,provide a direct link into the brain - be it ever so little...

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2. rodrigobernardo
07:44 PM 10/20/10

What about heaters making paint even more volatile?

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3. gwernymnydd

Having had an interest in VOCs as smog participants and an

03:44 PM 10/21/10

interest in indoor pollution this article makes a lot of sense. There is much evidence of indoor pollutants in total causing problems such as asthma, bed wetting or wheeze but little success in isolating individual components (there may not be a single causal agent - some fungal infections such as farmer's lung appear to require more than one fungus to be present). Asthma rates in UK don't correlate with traffic or industrial pollution, e.g. they are high in parts of the east coast of Scotland and low in some parts of a more polluted southern England. However, babies spend most time indoors as do late pregnant women. The tradition is to paint a room as a baby's room in the last few months of the pregnancy and many parents-to-be choose water based paints as they are considered odour free and don't have VOC warnings. In cold, wet areas the windows would be closed and the release of VOCs could be expected to produce a higher concentration than the same release in well ventilated rooms in warm dry areas. Rodrigobernardo's comment on heaters would agree with this idea. It would also suggest that a 'forced removal' of VOCs might be possible by heating or other means before use of a room.

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