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CLEAN HOUSE, CONSTRICTED AIRWAYS

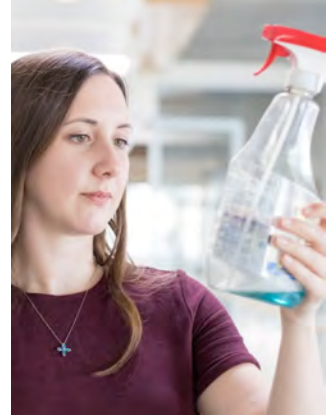
Not all cleaning products are created equal – and new research shows that frequent use could predispose children to developing asthma

Walk through the cleaning aisle in a supermarket and you'll find a product for every cleaning need: a lemony spritz to wipe down kitchen counters, a dazzling blue liquid for getting windows to shine, a scouring foam to clean ovens, a lavender-scented spray to freshen the air ... and the list goes on.

But some cleaners can do more harm than good. For instance, exposure to certain chemicals in household cleaning products has been linked to the development of asthma in adults. One might wonder, then: How safe is it to use cleaning products around kids?



Dr. Tim Takaro, Professor
Simon Fraser University



Jaclyn Parks, Graduate Student
Simon Fraser University

Research led by Dr. Timothy Takaro, a professor of Health Sciences at Simon Fraser University (SFU), has helped to answer this question. "In our study of more than 2,000 babies, we found that those more frequently exposed to cleaning products in their first few months of life had a significantly higher risk for asthma and other breathing problems by age three."

Some of the prime cleaning culprits, he says, were air fresheners, plug-in deodorizers, dusting sprays, and oven cleaners.

"We looked at the combined use of a wide array of products, not just each product in isolation," Takaro explains, "In so doing, we were able to identify the 'worst offenders' and to assess the impact of cumulative exposure on a child's asthma risk."

Bringing it all back home

For Takaro – whose training includes occupational and environmental medicine, public health, and toxicology – this study caps years of research into the factors contributing to asthma. In earlier work, he focused on understanding how tobacco smoke, pet dander, dust mites, and mould affect the condition.

The inspiration for the current study was sparked by Jaclyn Parks, a graduate student at SFU's Faculty of Health Sciences. Parks had a special interest in household contributors to

asthma risk, and she approached Takaro with the idea of looking into the potential risks posed by cleaning products. "I was studying cleaning products in a class project around that time," Parks recalls. "Before that project, I had assumed there was strong regulation around these products, but I learned that this was not the case."

"Asthma is the most common chronic childhood disease and the primary reason why children miss school or end up in hospital, so this seemed like an important area to investigate," says Takaro. "There is evidence linking cleaning product exposure to asthma in adults, but we believe ours is the first study to look at exposure among infants."

Takaro took Parks on as a research trainee and they launched the project using data from the CHILD Cohort Study (CHILD) – one of the largest studies in the world to look in detail at how a baby's genes and environment interact to impact the development of asthma, allergies, obesity, and other chronic diseases. Nearly 3,500 Canadian children and their families are participating in CHILD and it is an "unprecedented, ongoing resource" that has collected more than 40 million data points, according to Takaro.

When CHILD babies were just a few months old, their parents completed questionnaires about the family's use of dozens of household products – everything from multipurpose cleaning sprays and toilet bowl cleaners to polishes and air fresheners. CHILD research teams also visited the families' homes to perform environmental assessments

and analyze the babies' exposure to dust; mould; furry pets; chemicals and cleaning products; cooking emissions; second-hand smoke; and air pollution in the surrounding neighbourhood. This in-depth home assessment was unprecedented; CHILD became the first study of its kind to analyze the home environment of such a large number of study participants in such detail.

Using this data, Takaro and Parks focused on data from 2,022 CHILD participants and examined their daily, weekly and monthly exposure to 26 types of household cleaners. They assigned a Frequency of Use (FUS) score to every participant by summing up the household usage patterns for each type of cleaner. "It's a cumulative score, so it doesn't tell you much about the individual products used. For example, a family using four products every day might have the same FUS as a family using eight products every month," Parks explains. The FUS scores served as a basis for grouping the families into three categories of exposure to cleaning products – low, moderate or high – and for assessing the risk of negative health outcomes as the FUS score increases.

Their research question was simple: To what extent might the level of exposure to these cleaning products, alone or in combination, impact the risk of a baby developing asthma by age three?

Trouble in the air

The answer to that simple question? "Enough to encourage change."

Their analyses, adjusting for other factors, found that babies with a high frequency of exposure to cleaning products had a 37% greater likelihood of being diagnosed with asthma by three years of age compared to babies with a low frequency of exposure. The babies from high-FUS homes also had a 35% higher likelihood of developing recurrent wheeze by the same age, and a 49% greater likelihood of having both recurrent wheeze and at least one allergic sensitization – a combination of conditions that makes a child more likely to develop asthma later on.

The analysis considered other factors known to impact the development of asthma, such as family history, geographical location, and early exposure to tobacco smoke. Parks says, "We sufficiently accounted for enough other factors that could possibly affect asthma development that we were confident the cleaning product relationship was real."



Poster (detail) by CHILD participant Mikaela (8 years old), from Vancouver, BC

But how exactly do cleaning products impact asthma risk?

Takaro doubts that overstimulation of the adaptive (specific, learned response) immune system can explain the effect: "We didn't find an association between the use of cleaning products and a risk of atopy (a heightened immune response to common allergens) alone. We think, instead, that the body's innate (general, rapid response) immune system is more likely involved, and that the chemicals in cleaning products may damage the cells lining the respiratory tract by triggering inflammatory pathways, leading to asthma and wheeze."

Exposure to cleaners may also cause changes to an infant's gut microbiome – the trillions of microbes that live in the human digestive tract – and this may also play a role, he added.

Another unexpected discovery: exposure to cleaners impacted girls more than boys. According to Takaro, some previous research already suggested that females are more inclined to have severe reactions to inflammatory exposures such as cigarette smoke. "There may be some differences in immune system tuning between the genders. This question calls for more research."

Babies may be especially vulnerable to airborne chemicals because their breathing rates are faster than adults. Also, they are frequently in contact with surfaces such as counters and floors, which can increase their exposure to chemicals in cleaning products. "There's also the fact that infants typically spend 80% to 90% of their time indoors," Takaro notes.

In addition to FUS scores, Takaro and Parks considered the effect of different product categories. They found that sprayed, fragranced, and disinfecting products carried the

greatest potential for harm, when used at a higher frequency. “We didn’t see a strong or conclusive association with products that may be toxic but were rarely used, like drain cleaner,” says Parks. “This may be partly explained by the fact that there were not enough people using drain cleaner on a daily or weekly basis to make a strong statistical comparison to those who used it less frequently.”

Scents don't make sense

The study’s findings may prompt some families to scale back on their use of cleaning products.

“Unfortunately, we can’t tell parents which products are safe, because Canadian regulations don’t require manufacturers to disclose ingredients that account for less than 2% of the product’s total volume,” says Takaro, “and for some compounds, much smaller concentrations could still potentially cause harm.”

What to do, then?

“Whenever possible, get back to basics,” Parks advises. For simple cleaning tasks, like wiping off a countertop after you made lunch: “There’s no need to go beyond soap and water. Don’t pull out the big guns unless you really need them.”

Of course, soap and water won’t go far when it comes to cleaning a grime-coated oven. For such heavy cleaning tasks, Parks suggests that parents keep young children out of the area while cleaning, and ventilate the room during and after cleaning before letting children back in. Similarly, if a cleaning job requires more than one product “as you might expect when cleaning a bathroom, for example,” says Parks, she recommends using cleaners sequentially, rather than simultaneously. “Mixing products can create new ‘secondary’ chemicals and additional toxicity.”

Other precautions: avoid sprays and scented products whenever possible. “There’s really no reason to use air freshener: it just masks other underlying problems, like the presence of bacteria or mildew, or inadequate ventilation that should be fixed to improve indoor air quality,” Parks says. “We believe the smell of a clean home is no smell at all.”

Cleaning during COVID-19

The [Canadian Medical Association Journal](#) (CMAJ) published the study in February 2020, and the researchers received over 300 requests for interviews within a few days of publication.

“It was exciting that media in Australia and India were talking about our work,” says Parks, who co-wrote the paper while working on her master’s degree.

Then COVID-19 rolled in and hygienic practices assumed an entirely new level of importance. Suddenly, everyone was advised to clean, clean, clean: wipe down groceries, disinfect doorknobs, wash hands, and the more the better.

Recognizing the tension between the insights of their study and the demands of pandemic protocols, Takaro and Parks wrote a [follow-up letter](#) to CMAJ in which they acknowledged that the COVID-19 crisis “warrants the use of disinfectants at an increased frequency.” They encouraged parents to balance the need to prevent the spread of the virus by using disinfection practices while limiting their child’s exposure to cleaning products.

To minimize risks from the use of disinfectants, they advised parents to “first wash a surface with soap and water to remove as many pathogens as possible, then use an appropriately diluted amount of disinfectant to kill the remainder.”

For settings like schools and workplaces, and in homes of those who are frequently interacting with other members of the public, the researchers recommended using disinfectants on high-touch surfaces where virus-containing droplets could settle. “This is likely more important in areas where community transmission is evident,” adds Parks.

“We remind parents that disinfectants can be used in an appropriate context and applied in a responsible manner,” they wrote, while also championing physical distancing and other guidelines to reduce exposure, along with frequent hand washing with soap and water, and wearing masks.

“Heavy disinfection alone is not a substitute for following recommended public health measures to prevent transmission of the virus,” says Parks. “But it’s an additional precaution that can be done safely and responsibly – with our kids’ health in mind.” 