Studies of Health Impacts Associated with Cleaning Products

The following is an annotated literature review in chronological order, summarizing key findings of numerous scientific studies documenting the health effects associated with various cleaning products.

*Toxicology and Applied Pharmacology 1984*—Musk Ambrette, a commonly used fragrance ingredient, has been found to cause serious brain damage in laboratory animals.


*Clinical and Experimental Allergy 1997*—Asthma prevalence in schools has been associated with higher relative air humidity, higher concentrations of volatile organic compounds, and mold or bacteria.


*Eighth International Conference on Indoor Air Quality and Climate 1999*—Floor cleaning products were found to be a cause of occupational asthma.


*New Scientist 1999*—Frequent use of air fresheners and aerosol sprays in the home contributed to 25 percent more headaches and 19 percent more incidence of depression in mothers and 30 percent more ear infections and 22 percent greater incidence of diarrhea in infants less than six months of age.


*European Respiratory Journal 2000*—Acute short-term exposure to common cleaning chemicals was found to cause a severe asthmatic attack and adult respiratory distress syndrome in an asthmatic subject.


*American Journal of Industrial Medicine 2001*—Janitors and cleaners (625/million) and firefighters (300/million) in California had the highest reported rates of work-related asthma. Half of all work-related asthma cases were associated with agents not known to be allergens.

Scandinavian Journal of Workers Environmental Health 2001—Asthma prevalence in cleaners of private homes was 1.7 times higher than that of a control group. This incidence was related to kitchen cleaning and furniture polishing.


European Respiratory Journal 2002—A 22-year comparative study of cleaning women and administrative workers found that cleaners had an increased risk of developing persistent adult-onset asthma.


Journal of Occupational and Environmental Medicine 2003—A study of confirmed cases of work-related asthma in four states found that 12 percent were associated with exposure to cleaning chemicals. Of these, 80 percent were new onset cases and 20 percent were work-aggravated cases.


Thorax 2003—Asthma was found to be more prevalent in women previously or currently employed as domestic cleaners as compared to women who had never worked in the cleaning industry. Domestic cleaning work may have a serious public health impact that affects professional cleaners and people cleaning their own homes.


Atmospheric Environment 2004—Toxic air contaminants emitted by cleaning products and air fresheners are found to combine with other indoor air components to form secondary pollutants.


Environmental Health Perspectives 2004—Children exposed to phthalates had a higher incidence of being diagnosed with asthma, rhinitis, or eczema. Phthalates were measured in house dust from bedrooms and a dose-response relationship was confirmed. Phthalates are found in PVC (polyvinyl chloride) or VCT (vinyl composite tile) flooring, plastics, adhesives and many other products. Dust from bedrooms with PVC or VCT flooring was more likely to have higher concentrations of phthalates.

The Plain Facts

**Thorax 2004**—Children living in homes with higher levels of volatile organic compounds (VOCs) showed a marked increase in their risk of asthma. VOCs are emitted by cleaning products, air fresheners, and building products.


**15th Annual Congress of the European Respiratory Society 2005**—The authors presented the results of a study that linked household sprays and new onset asthma. 4,200 subjects who cleaned their own homes took part in the study, with 3,500 participants initially being asthma free. After nine years, the data showed that the incidence of asthma was greater in participants who used sprays more frequently. “Between 11 percent and 18 percent of new asthma cases can be attributed to frequent use of household aerosols.” The most hazardous of the sprays used were room, furniture, and window sprays. Using ammonia, bleach, or dye solvents was also found to put people at risk for developing asthma.


**Environmental Health Perspectives 2005**—85 mothers and sons were tested for phthalates in their urine. The mothers with the highest levels of phthalates in their urine late in their pregnancies produced babies with genital abnormalities. This same effect has been seen in rats, but this is the first evidence that phthalates are causing a similar effect in humans. In rats, “phthalate syndrome” causes a decrease in testosterone levels, lower sperm counts, infertility, and testicular abnormalities in the mature animal.


**Occupational and Environmental Medicine 2005**—Asthma symptoms in domestic cleaning women are associated with exposure to bleach and possibly other irritant agents. The public health impact of using cleaning products that contain irritants could be widespread because the use of these products is common in the workplace and at home.


**Thorax 2005**—Prenatal exposure to the use of disinfectants, bleach, carpet cleaner, window cleaner, air fresheners, paints, dry cleaning fluid, aerosols, and pesticides increased the risk that the young child would have persistent wheezing. Scientists determined that the more frequently the chemicals were used, the greater the risk of persistent wheezing, which can be a precursor to asthma.

Indoor Air Chemistry: Cleaning Agents, Ozone and Toxic Air Contaminants 2006—The “research focused on two common classes of ingredients in cleaning products and air fresheners: ethylene-based glycol ethers, which are classified as toxic air contaminants, and terpenes, which react rapidly with ozone.” The researchers measured exposures from several different scenarios and found:

- Users of products with high levels of ethylene-based glycol ethers or terpenes should make sure the areas being cleaned are properly ventilated during and after cleaning.
- Some products should be used in a dilution rather than full strength.
- Cleaning supplies should be promptly removed from occupied spaces.
- Using ozone generators or ionizing air cleaners should be avoided, especially where cleaning products that contain terpenes or air fresheners are used.


American Journal of Industrial Medicine 2007 – 2,995 cases of work related asthma from four states were examined. Teachers or teacher’s aids made up 54% of the cases.

“Conclusions - Asthma within the educational services industry is an occupational health problem. The health of school employees should also be considered when initiatives addressing asthma among schoolchildren are instituted. The identification, elimination, and/or control of respiratory hazards are important factors for the protection of staff and students alike.”


American Journal of Respiratory and Critical Care Medicine 2007 – “The use of cleaning sprays at least weekly was associated with the incidence of asthma symptoms or medication and wheeze. The incidence of physician-diagnosed asthma was higher among those using sprays at least 4 days per week. Risks were predominantly found for the commonly used glass-cleaning, furniture, and air-refreshing sprays.” A similar correlation was not found with products not applied in spray form.

**European Respiratory Journal 2008** – “Increased use of domestic chemical based products was associated with persistent wheezing during early childhood. These findings suggest that frequent use of chemical based products in the prenatal period is associated with persistent wheezing in young children.”  


**Occupational Medicine 2008** – Twelve focus group session participants were asked about their job tasks, type of products they use to clean, bodily symptoms, job training and work environment. Three general themes emerged regarding cleaning professionals' work experiences: (i) job training, (ii) chemical exposure and use and (iii) competence. “Domestic cleaners demonstrated significant skills deficit across each of these three themes as compared to industrial cleaners. Domestic cleaners reported more frequent exposure to respiratory irritants and sensitizers and also reported adverse respiratory symptoms as compared to industrial cleaners. CONCLUSIONS: The results from this qualitative study are consistent with earlier findings from quantitative studies placing domestic cleaners at risk of exposure to chemicals that are respiratory irritants and/or sensitizers.”


**Environmental Working Group 2009** – Cleaning supplies used in 13 large California school districts release an airborne brew of 457 chemicals, including a number that have been linked to asthma or cancer by state and federal health authorities. Tests of 21 cleaners from these schools conducted for the Environmental Working Group found that when used as directed, the products released 6 chemicals known to cause asthma, 11 contaminants that are known, probable, or possible cancer-causing substances in humans, and hundreds of other compounds for which there is little or no hazard information.

R. Sutton. Greener School Cleaning Supplies = Fresh Air + Healthier Kids
New Research Links School Air Quality to School Cleaning Supplies. Environmental Working Group, (November 2009.)

**American Journal of Industrial Medicine 2009** – Female cleaners have more asthma symptoms worse at work than controls. Work-related asthma symptoms among male cleaners were associated with a number of specific cleaning tasks. Findings suggest the need for school cleaners to have reduced exposure to cleaning chemicals and need for protective strategies during performance of tasks expected to exacerbate asthma, such as wax stripping.

Environmental Health: a Global Access Science Source 2009 - Cleaning products used for common cleaning tasks were mixtures of many chemicals, including respiratory and dermal irritants and sensitizers. Examples of ingredients of concern include quaternary ammonium compounds, 2-butoxyethanol, and ethanolamines. Cleaning workers are at risk of acute and chronic inhalation exposures to volatile organic compounds (VOC) vapors and aerosols generated from product spraying, and dermal exposures mostly through hands.


Environmental Health 2010 - Women who regularly use household cleaners and air fresheners are at double the risk of developing breast cancer than those who never use the products. The study of more than 1,500 women found that solid slow-release air fresheners and anti-mold products had the biggest effect.

“The antimicrobials, phthalates and alkylphenolic surfactants often found in mold and mildew products are associated with various health and environmental issues. The antimicrobial triclosan for example, can cause skin irritation, allergy susceptibility, bacterial and compounded antibiotic resistance, and dioxin that jeopardizes fragile aquatic ecosystems. The study highlights methylene chloride (in some fabric cleaners), nitrobenzene (soaps, polishes), perfluorinated compounds (stain resistant, waterproof coatings), phthalates (surfactants), alkylphenols (solvents), parabens (preservatives), triclosan, and polycyclic musks (fragrance) as ingredients of concern.”


Environmental Health Perspectives 2010 – Pre-natal exposure to phthalates found in pesticides, scented products and personal care products is associated with a greater risk the child will develop disruptive behavior disorders. Children whose mothers had higher levels of a certain type of phthalates in their blood during the third trimester of pregnancy had a higher risk of developing conduct, aggression and attention deficits in later childhood. Some of the effects of these chemicals appeared to be greater in boys than girls – especially aggression, attention problems and hyperactivity.

**Allergy and Clinical Immunology 2010** - Recent studies have strengthened the evidence of asthma and other adverse respiratory effects in cleaning workers. Similar effects are seen in other settings in which cleaning products are used such as healthcare professionals and homemakers. Both new-onset asthma and work-exacerbated asthma due to cleaning exposures may play a role. Exposure to cleaning sprays, chlorine bleach and other disinfectants may be particularly relevant.

Jan-Paul Zock; David Vizcaya; Nicole Le Moual “Update on Allergy and Cleaners” *Allergy and Clinical Immunology*. 10(2):114–120, APR 2010. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3125175/

**Journal of Investigational Allergology and Clinical Immunology 2010** - Although cleaners represent a significant part of the working population worldwide, they remain a relatively understudied occupational group. Epidemiological studies have shown an association between cleaning work and asthma, but the risk factors are uncertain. Cleaning workers are exposed to a large variety of cleaning products containing both irritants and sensitizers, as well as to common indoor allergens and pollutants. Thus, the onset or aggravation of asthma in this group could be related to an irritant-induced mechanism or to specific sensitization. The main sensitizers contained in cleaning products are disinfectants, quaternary ammonium compounds (such as benzalkonium chloride), amine compounds, and fragrances. The strongest airway irritants in cleaning products are bleach (sodium hypochlorite), hydrochloric acid, and alkaline agents (ammonia and sodium hydroxide), which are commonly mixed together. Exposure to the ingredients of cleaning products may give rise to both new-onset asthma, with or without a latency period, and work-exacerbated asthma. High-level exposure to irritants may induce reactive airways dysfunction syndrome. Cleaning workers may also have a greater relative risk of developing asthma due to prolonged low-to-moderate exposure to respiratory irritants. In addition, asthma-like symptoms without confirmed asthma are also common after exposure to cleaning agents. In many cleaners, airway symptoms induced by chemicals and odors cannot be explained by allergic or asthmatic reactions. These patients may have increased sensitivity to inhaled capsaicin, which is known to reflect sensory reactivity, and this condition is termed airway sensory hyper-reactivity.


**Microbiology 2010** – Antibiotic resistant bacteria such as MRSA and pseudomonas aeruginosa are becoming more prevalent. When a disinfectant containing benzalkonium chloride was applied to lab cultures of pseudomonas aeruginosa, the microbe adapted to survive not only the disinfectant but also a common antibiotic.

"In principle this means that residue from incorrectly diluted disinfectants left on hospital surfaces could promote the growth of antibiotic-resistant bacteria," said lead researcher Gerard Fleming of the National University of Ireland in Galway. "What is more worrying is that bacteria seem to be able to adapt to resist antibiotics without even being exposed to them."

**Occupational and Environmental Medicine 2010** – “In a survey of mothers of children with birth defects, those who were janitors or scientists were more likely to have children with certain conditions, Michele Herdt-Losavio, PhD, of the New York State Department of Health, and colleagues reported online in Occupational & Environmental Medicine.

They found that women working as janitors had a significantly increased risk of giving birth to a child with seven specific defects: ear, eye, musculoskeletal, gastrointestinal, and oral clefts, among others, Herdt-Losavio said. These included amniotic bands, anotia/microtia, anorectal atresia, anophthalmia/microphthalmia, glaucoma, and bladder extrophy. Janitorial occupations had previously been associated with neural tube defects, spina bifida, and oral clefts, the researchers said.”


**Occupational and Environmental Medicine 2011** - Cleaning work in places with high demand for disinfection, high cleaning standards and use of cleaning products containing respiratory irritants is associated with higher risk of asthma symptoms. This suggests irritants have an important role in cleaning-related asthma.


**International Journal of Public Health 2012** - Infants of mothers who used household chemicals such as solvents, cleaning sprays, air fresheners or degreasing products during pregnancy were more likely to have respiratory symptoms and/or infections during the first year of life.


**Thorax 2013** – 9,488 people born in Britain in 1958 were tracked for 15 years in order to examine the association of adult onset asthma with lifetime exposure to occupations and occupational exposures. Researchers were able to identify which jobs were linked with an increased risk of developing asthma as an adult. Eighteen jobs were linked to an increased risk of asthma. Four of the eighteen were cleaning jobs and a three more were likely to involve exposure to cleaning products.

**British Medical Journal Open 2013** – These data indicate that a substantial proportion of workers who experience asthma symptoms related to cleaning materials show a pattern of bronchial reaction consistent with sensitizer-induced occupational asthma. The results also suggest that quaternary ammonium compounds are the principal cause of sensitizer-induced occupational asthma among cleaners.

Olivier Vandenplas, Vinciane D’Alpaos, Geneviève Evrard, Jacques Jamart, Joel Thimpont, François Huaux, Jean-Christophe Renauld. “Asthma related to cleaning agents: a clinical insight.” *British Medical Journal Open*, September 2013 Available at: [http://bmjopen.bmj.com/content/3/9/e003568.full?sid=e2e75ce0-58ff-4e13-b51d-75a73f839193](http://bmjopen.bmj.com/content/3/9/e003568.full?sid=e2e75ce0-58ff-4e13-b51d-75a73f839193)

**Environmental Science and Technology 2013** - Long-term exposure to benzalkonium chloride disinfectants (BACs) results in change of microbial community structure and increased antimicrobial resistance. Findings indicate that exposure of a microbial community to BACs results in increased antibiotic resistance, which has important implications for both human and environmental health.


**European Journal of Allergy and Clinical Immunology 2013** - Professional and domestic cleaning is associated with work-related asthma (WRA). This position paper reviews the literature linking exposure to cleaning products and the risk of asthma and focuses on prevention. Increased risk of asthma has been shown in many epidemiological and surveillance studies, and several case reports describe the relationship between exposure to one or more cleaning agents and WRA. Cleaning sprays, bleach, ammonia, disinfectants, mixing products, and specific job tasks have been identified as specific causes and/or triggers of asthma. Because research conclusions and policy suggestions have remained unheeded by manufactures, vendors, and commercial cleaning companies, it is time for a multifaceted intervention. Possible preventive measures encompass the following: substitution of cleaning sprays, bleach, and ammonia; minimizing the use of disinfectants; avoidance of mixing products; use of respiratory protective devices; and worker education. Moreover, we suggest the education of unions, consumer, and public interest groups to encourage safer products.

**Occupational & Environmental Medicine 2015** – (Reuters Health) Fumes from cleaning products used at work can make existing asthma worse, according to a new study of professional cleaning service employees. Products such as bleach, glass cleaner, detergents and air fresheners exacerbated asthma-related symptoms for the women, and their reduced lung function lasted until the morning after exposure, in some cases getting worse with time.

"These results support the importance of developing workplace health and safety practices designed to limit exposures to irritant chemicals in cleaning products," the study team wrote online April 23 in Occupational and Environmental Medicine.


**European Urology 2015** - (Environmental Health News, Brian Bienkowski) “Genital defect in baby boys linked to moms’ chemical exposure. Mothers around a lot of endocrine disrupting chemicals at home or in jobs such as cleaners, hairdressers and laboratory workers during pregnancy are more likely to have baby boys with a genital defect, according to a new study in the south of France.”

“Some of the endocrine disrupting chemicals linked to the professions involved in the study were bisphenol-A (BPA), phthalates, polychlorinated compounds, alkylphenolic compounds and organic solvents. Most exposures—78 percent—occurred in the window of development when babies’ genitals are forming.”

“We found that fetal exposure to [endocrine disrupting chemicals] was a significant risk factor for hypospadias in our series. The types of substance having an impact on the phenotype were heterogeneous, but detergents, pesticides, and cosmetics accounted for 75 percent of the cases.”


**Journal of Asthma 2017** - Surveillance data show that fragrance use in the workplace is associated with work-related asthma (WRA). Prevention methods include employee education, enforced fragrance-free policies, well-designed ventilation systems, and good building maintenance.

American Journal of Infection Control 2018 - “A clear rationale is needed to establish policies for determining preferable disinfection products for use in child care settings, based on efficacy against relevant pathogens, toxicity, ease of use, and cost. When other factors are equal, the use of peroxide-based disinfectant products is recommended to minimize inhalational toxicity.”


European Respiratory Journal 2017 – “Disinfectant use has been associated with adverse respiratory effects among healthcare workers. However, the specific harmful agents have not been elucidated. We examined the association between occupational exposure to disinfectants and asthma control in the Nurses’ Health Study II, a large cohort of female nurses.”

Orianne Dumas, Aleta S. Wiley, Catherine Quinot, Raphaëlle Varraso, Jan-Paul Zock, Paul K. Henneberger, Frank E. Speizer, Nicole Le Moual, Carlos A. Camargo Jr
https://www.ncbi.nlm.nih.gov/pubmed/28982772

Canadian Medical Association Journal 2018 – “Emerging links between household cleaning products and childhood overweight may involve the gut microbiome. We determined mediating effects of infant gut microbiota on associations between home use of cleaning products and future overweight.”