



SENSOR

Occupational Lung Disease Bulletin

Massachusetts Department of Public Health
Occupational Health Surveillance Program, 250 Washington Street, 6th Floor, Boston, MA 02108
Tel: (617) 624-5632 Fax: (617) 624-5696 www.mass.gov/dph/ohsp

Dear Health Care Provider,

This issue provides information about cleaning and disinfecting products, the differences between them, and the links to asthma. Cleaning and disinfecting impact work-related asthma in a number of industries—healthcare, schools and early education—as well as influence the decisions made in purchasing and using products at home.

Remember to report cases of suspect and confirmed work-related asthma to us by fax (617) 624-5696 or phone (617) 624-5632. The confidential reporting form is available on our website at www.mass.gov/dph/ohsp.

Sincerely, Elise Pechter MPH, MAT, CIH

REMINDER: To receive your Bulletin by e-mail, please send a message to occupational.asthma@state.ma.us

Disinfecting Surfaces and Asthma

Case 1

A physician reported a case of work-related asthma (WRA) to the health department. Her patient was a young woman working as a high school custodian, with responsibilities including cleaning toilets with cleaners and bleach. She was diagnosed with WRA after two years on this job, and described a coworker with similar symptoms. She was able to continue working after she was reassigned, so that bathroom cleaning was not part of her responsibilities.

Case 2

A 44-year old woman went to the ED with wheezing and shortness of breath that occurred when disinfectant cleaners were used in an office where she worked. Her asthma had begun in childhood, but was exacerbated in a previous job (1994), when ammonia and bleach were used together in a bathroom causing evacuation of a youth center where she worked. Her symptoms persisted for months after that incident. This work-aggravated exacerbation in 2011 led to increased symptoms that persisted for weeks.

Introduction—cleaning and disinfecting

Cleaning is an essential and frequently performed activity in healthcare, schools, and childcare. In healthcare, cleaning and disinfecting patient rooms and frequently touched surfaces is considered an important component of infection control that prevents patients from developing healthcare associated infections (HAIs). About 1.7 million HAIs occurred in 2002, approximately 4.5/100 admissions

Summer 2013

(Klevens 2007). The vast majority of these infections were associated with surgical sites, ventilators, and catheters—procedures & equipment not directly related to cleaning of environmental surfaces. However, “about 14,000 Americans die from *C. difficile* infection. Deaths related to *C. difficile* infection rose 400% between 2000 and 2007.”¹ These infections are transmitted from contaminated hands and surfaces. As a result, many hospitals have embraced use of disinfectants on many surfaces, without realizing the potential adverse effects.

In schools, public buildings, and childcare centers, especially during flu season, more and more disinfectants are being used in addition to, or instead of, cleaning products. Influenced by healthcare, overuse in non-healthcare settings may occur. In the vignettes above, bleach and other disinfectants were used in a youth center, office, and high school, resulting in work-related asthma (WRA) for at least two persons. These two individuals may represent numerous cases of work-related respiratory disease, often unrecognized, related to use of disinfectants in non-healthcare settings.

What are the differences?

Cleaning removes soil, organic contamination and germs by mechanical means and with use of chemical surfactants that make soil soluble, removing *most* microorganisms. Cleaning actually removes the microorganisms, rather than inactivating them. Cleaning products frequently contain surfactants, water softeners, pH adjusters, abrasives, fragrances, and other ingredients, some of which can also be hazardous, but to a lesser degree than disinfectants.

Disinfectants are used separately and/or added to cleaning products for use on environmental surfaces that require a higher level of microbial control because they will come into contact with mucous membranes. Disinfectants are antimicrobial pesticides that kill micro-organisms but not necessarily all spores, with the goal of preventing infection. These added chemicals are pesticides, registered with the EPA. In general, disinfectant ingredients are more hazardous to human health than the ingredients in products designed to clean without added pesticide properties.

What harm can disinfectants cause?

Disinfectants can cause acute and chronic health effects, including asthma; eye, nose, throat and upper respiratory tract irritation; and hypersensitivity symptoms, including dermatitis. Some disinfectants are environmental toxins

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and may contribute to the development of antibiotic resistant Staph strains and carbapenem resistant Enterobacteriaceae <http://www.cdc.gov/vitalsigns/hai/cre/>.

Over 40 articles in the scientific literature document increased incidence of asthma, chronic bronchitis, other adverse respiratory symptoms and dermatitis among janitors and other workers with regular exposure to cleaning products. Among the most compelling evidence are studies about increased respiratory disease among workers exposed to cleaning in healthcare, where disinfectant use is most prevalent. References available on request.

The prevention goal is to balance the two needs—to reduce infectious disease transmission without causing chemical-related disease. The challenges in achieving this goal are to ensure that the disinfectant products are used effectively (correct concentration and sufficient dwell time) and not used ineffectively on too many surfaces.

Are cleaning products without disinfectants hazardous?

Yes, some cleaning products are, especially if they contain hazardous ingredients such as ethanolamines (mono-, di- and tri-) which are asthmagens and 2-butoxyethanol, which can affect the blood system, and cause irritation of the eyes, nose and throat, headache and vomiting.ⁱⁱ There are 2 third party certifiers (Green Seal and Ecologo) that review cleaning products and evaluate products that meet strict criteria—environmental, occupational, and performance. <http://www.greenseal.org/> & <http://www.ecologo.org/en/>

Is disinfectant use in schools and childcare necessary?

There are many surfaces that should be routinely *cleaned* to remove soil and microorganisms in schools. Disinfectants are necessary in selected locations, such as school bathrooms, food preparation areas, and for emergency situations involving injuries. It is important to ensure that surfaces contaminated with feces, vomit or blood are cleaned *and* disinfected; guidelines recommend cleaning and disinfection for flu prevention.ⁱⁱⁱ In addition, in early education and child care settings, changing tables must be disinfected and mouthed toys must be sanitized (less concentrated disinfectant) as required by federal regulations.^{iv} All other surfaces should be cleaned—not disinfected—to avoid disinfectant overuse with unnecessary exposure to the staff and children.

Are all disinfectants hazardous?

All disinfectants are pesticides and may be hazardous to health. Therefore, they should be used with caution, in limited circumstances, as directed on the label. The two most common disinfectants are bleach and quats.

Bleach, sodium hypochlorite, is one of the most commonly used and least expensive disinfectants. Bleach is effective against bloodborne pathogens and a variety of microorganisms, and had previously been required in childcare centers, with varying dilutions for different surfaces, e.g. ¼ cup in a gallon of water for changing

tables. To disinfect, bleach must be used properly and mixed fresh daily. Bleach is now available in stronger concentrations than previously sold, 8.25% instead of 5-6%.

Bleach was recently designated an asthma-causing agent by the Association of Occupational and Environmental Clinics, based on peer-reviewed literature documenting specific inhalation challenge among occupationally exposed workers (Sastre 2011). Data on WRA from four states (1993-2006) noted 157 bleach exposures, 52% of which were associated with new-onset asthma. Childcare centers may now use any EPA-approved antimicrobial pesticide.

Quats or Quaternary ammonium compounds comprise dozens of different compounds, among which are benzalkonium chloride and lauryl dimethyl benzyl ammonium chloride. Quats, like bleach, are effective against a broad range of microorganisms. Evidence that quats cause asthma comes from case reports and case series where the affected cases had positive specific antigen broncho-provocation studies and positive skin tests. Specific quats, identified by name and Chemical Abstracts Service (CAS) number, with evidence summaries are described in Michigan's Project SENSOR News Bulletin (2008-9) <http://www.oem.msu.edu/userfiles/file/News/v20n1.pdf>

Quats are now added to many cleaning products including dishwashing liquids, hand soaps, window cleaners, “all-purpose” cleaners, floor products and baby-care products. New evidence raises concerns that use of quats may contribute to reduced efficacy of antibiotics and disinfectant cleaners (Carson 2008, Tan 2002).

Which products contain disinfectants?

Dishwashing detergents and all-purpose cleaners that claim antimicrobial activity have pesticides. Avoid quats and other antimicrobial products for dishes, walls, floors, windows, and other surfaces that do not have potential for direct contact with mouth, eyes and other mucous membranes.

Are there safer disinfectants?

EPA's Design for the Environment <http://www.epa.gov/dfe/> has begun promoting use of safer disinfectants that pose lower risks of adverse human effects and environmental degradation. To date, the active ingredients approved as safer include citric acid, lactic acid and hydrogen peroxide.

The most important guidance is to use disinfectants ONLY on designated surfaces, in the correct concentration, and applied to stay wet as long as directed on the label. These steps will ensure that the disinfectant achieves the desired dwell time to kill organisms, and is not overused.

ⁱ http://www.nlm.nih.gov/medlineplus/news/fullstory_134926.html and <http://www.cdc.gov/VitalSigns/Hai/StoppingCdifficile/>

ⁱⁱ <http://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=346&tid=61>

ⁱⁱⁱ <http://www.cdc.gov/flu/school/cleaning.htm>

^{iv} <http://nrckids.org/cfoc3/htmlversion/appendixi.pdf>