

## Comments on Quaternary Ammonium Compounds and Work-related Asthma

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#### Background

The Work-related Asthma Prevention Program (WRAPP) within the Occupational Health Branch of CDPH has conducted tracking and prevention of Work-related Asthma (WRA) since 1993. WRAPP is funded by the Centers for Disease Control/National Institute for Occupational Safety and Health (CDC/NIOSH) to conduct ongoing statewide surveillance, to investigate exposures of interest targeted by surveillance findings, and to develop prevention strategies based on results. California is one of five states funded to do this work. Since 1993, WRAPP has confirmed over 10,000 cases of WRA in California. Once a potential case is identified, public health follow-up through medical record review and telephone interview are used to confirm the case and collect additional detail about work history, exposures, and other risk factors.

The Association of Occupational and Environmental Clinics (AOEC) has created a standardized numeric coding scheme for exposure (<http://www.aoecdata.org/ExpCodeLookup.aspx>). The origin of the codes was as a tool for member clinics to be able to report case exposures for any occupational illness or injury to the AOEC in a standardized way. In addition, the scheme includes a few specialized designations, including an indicator of whether a substance is an asthmagen, or capable of initiating new asthma in a person who did not previously have it. The AOEC list is an active web site which is regularly updated, that assigns substances an "A" designation if they meet specified criteria for causing work related asthma by sensitization or acute irritant-induced asthma (<https://pubmed.ncbi.nlm.nih.gov/25863522-web-based-listing-of-agents-associated-with-new-onset-work-related-asthma/>). Substances are systematically evaluated using peer-reviewed medical literature and published criteria to determine their asthmagen designation. This AOEC asthmagen list is widely considered as the most comprehensive and standardized list of asthmagens available. WRAPP, NIOSH, and the other states conducting work-related asthma surveillance rely on the AOEC asthmagen list for our work.

Criteria for AOEC asthmagen designation are fairly strict: there must be peer-reviewed, published literature in English; the exposures in the study must be occupational; and specific clinical tests must have been performed on the test subjects. The absence of an "A" can mean published studies about the substance have been reviewed and the criteria to classify it as an asthmagen are not met, or it can mean that there just is no literature published on the topic and it hasn't been reviewed. Often, the reason why a reviewed substance is not designated an asthmagen is because the researchers publishing the study have not conducted the exact types of clinical assessments that the AOEC criteria requires for the "A" designation.

The quaternary ammonium compounds (QACs) that are widely found in consumer and commercial cleaning and disinfecting products are benzalkonium chlorides (also known as BACs and alkyl dimethyl benzyl ammonium chlorides). The AOEC designates BACs as known sensitizer asthmagens. "Quaternary ammonium compounds, not otherwise specified (NOS)" does not have an "A" designation in the asthmagen column because there is currently not published literature about the other QACs that are not BACs. However, because there have been multiple articles in the medical literature about different BACs

meeting the AOEC asthma criteria, the category “benzalkonium chlorides, NOS” has received an “A” designation.

#### WRAPP surveillance data (1993-present)

Exposure information is primarily based on self-report from telephone interviews with patients. Often, patients do not know the specific chemicals or even the brand or formulation of products to which they are exposed. For this reason, often case exposures are categorized as “cleaning materials, NOS” or “cleaners, disinfectant, NOS” but some unknown proportion of these exposures may include QACs.

Surveillance findings:

- 39 confirmed cases involving AOEC codes within 322.32 (any kind of QAC, including 19 where BACs were specified).
- 49% of QAC cases were in the health care industry, 10% in education, 8% in corrections
- 36% of QAC cases were in health care workers, 23% cleaners, 10% food workers or inspectors, 8% admin
- 23% of QAC cases involved saturated disposable wipes
- 94 cases could not be coded more specifically than “cleaner, disinfectant, NOS” which likely includes some QAC cases
- 1,042 cases included any kind of cleaning agent exposure, including 497 that could only be coded “cleaning materials, NOS”

#### Case Reports

Case reports are generated from information and descriptions provided by patients in telephone interviews. We include these examples because they provide insight into the human health and social impact of work-related asthma that numbers alone can't show.

*A 63-year-old woman worked as a nurse practitioner in a prison for 7 years. She had no prior history of asthma. They use a QAC product to clean and disinfect everything (floors, etc) in her work area. The product was "written up by UCSF and other agencies as possibly hazardous and is not supposed to be used in an enclosed area." The SDS shows it contains alkyl dimethyl benzyl ammonium chloride and dodecyl dimethyl ammonium chloride. She developed breathing problems over many years, while hating the smell of the product all along. Her breathing problems came on gradually and are still happening, as the product is still used at work, although not quite as much in her immediate area or when she's at work. She says she knows 6 others with similar breathing problems to hers. She now takes 3 different medications. She is a former smoker (12 years, 5 cigarettes per week, quit 30+ years prior). She filed a Workers' Compensation claim, which was accepted and she was deemed 50% disabled due to the respiratory issues from exposure to that chemical.*

*A 50-year-old man with no previous history of asthma worked as a physician within the state prison system at two different Southern California prisons. His primary duties were treating and diagnosing inmates for medical problems. He had been working there for 3 years. A product containing QACs used in the prisons is sold undiluted and the prisoners have to mix it with water to get it the proper strength. The patient suspects that, due to inadequate training, the inmates might not have been mixing the cleaner correctly and it was incorrectly concentrated. The patient began experiencing symptoms of asthma, including shortness of breath, chest tightness, and a dry cough, about 5-6 months after he first started*

*working at the prison. He is certain that this disinfectant product caused his breathing problems; an inmate initially observed that the patient began coughing whenever inmates were nearby using the product. The product contains QACs, including dodecyl dimethyl ammonium chloride and benzyl-C12-16-alkyldimethyl ammonium chloride. The patient reports that inmates are required to do daily cleaning with this product. The patient still works in the prisons but he got an accommodation so that the product is not supposed to be used in his work area within 3 hours of his arrival to that area. In addition, he does his best to avoid exposure, but he is not always successful.*

*A 43-year-old lab assistant at a large hospital had worked there for 19 years. She had childhood asthma until age 7, but grew out of it and had not had symptoms since that time. When she transferred from a different hospital facility to the current location (2 years earlier), she began reacting to a cleaner that the lab used for the counters and for spills. The cleaning product contained QACs and other, unknown, disinfectant ingredients. Whenever the cleaner was used and she was in the vicinity, her eyelids swelled and her chest became tight with shortness of breath. She never smoked. She still works there and now leaves the area whenever the chemical is going to be used. She estimates they use the chemical 10 times during each shift. This product was not used at the other hospital facilities where she worked. They gave her a paper charcoal mask to use and the doctor wrote in her records that they 'may want to consider other cleansers.'*

*A 57-year-old woman worked as a receptionist and medical records clerk in a medical clinic. She had no history of asthma and never smoked. There were 2 people who rotated working as receptionist. One day while waiting to take over so the other receptionist could go to lunch, she witnessed the other person wiping down the computer keyboard, desk and phones with QAC wipes (alkyl dimethyl benzyl ammonium chloride and dimethyl ethyl benzyl ammonium chloride). After the other receptionist left, the phone rang and the patient answered it. She immediately developed a reaction and was put on oxygen. Over a six-month period, the other receptionist used the wipes on office surfaces repeatedly, despite being instructed not to use them there, and the case's breathing symptoms kept getting worse. If the use of wipes was necessary elsewhere in the clinic, she was instructed to leave the building. Two years later she changed buildings, but near her desk was a small room where they cleaned instruments using the same QACs that sensitized her. She went to the ER twice during this period, including once after a large cleaning and disinfecting job had to be done post an accident in the waiting room. She stopped work three years after her initial incident per medical advice. She still has breathing problems and takes many new medications. She is now sensitive to many different things, including other people's use of personal care products, and it has greatly affected her life. She feels she lost her job and many friends because of her work-related exposures.*

*A 48-year-old woman worked as an office clerk at a residential training center for youth. She had developed asthma in her twenties. Another worker in her office sprayed a cleaning product that contained BACs to clean a counter in the reception area near the office clerk's desk. She immediately began having very severe asthma symptoms and had to be transported to the hospital by ambulance, where she nearly died. In order to prevent another reaction, the office staff replaced the BAC cleaning product with a strong disinfectant, a glutaraldehyde wipe, to do general cleaning on surfaces in the office, which sent the clerk to the emergency room again with a severe asthma episode. The office has now adopted cleaning products that are safer for the clerk's asthma.*

In general, WRAPP has encouraged employers to eliminate the overuse of disinfectants and to only disinfect areas that need it. Cleaning without disinfecting is often enough for many surfaces, like desktops, walls, and floors. Where disinfectants are needed, WRAPP urges employers to avoid products that contain AOEC designated asthmagens such as sodium hypochlorite, benzalkonium chlorides, and glutaraldehyde and to use safe work practices.