Cleaning Products Drive Antimicrobial Resistance

BY JEFF EVANS
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BETHESDA, MD. — Use of household cleaning products that contain benzalkonium chloride may decrease the susceptibility of bacteria to other antimicrobial ingredients in cleaning products and increase their resistance to antibiotics, according to the results of a randomized, double-blind study.

The study is the first randomized intervention study to assess the relationship between the use of two biocidal ingredients found in household cleaning products—benzalkonium chloride (BZK) and triclosan—and antibiotic resistance in the household setting, Allison E. Aiello, Ph.D., reported at an annual conference on antimicrobial resistance sponsored by the National Foundation for Infectious Diseases.

Consumer antiseptics and disinfectants are products that can prevent infections by killing or inhibiting the growth of microorganisms. Biocidal ingredients in these products often are quaternary ammonium compounds (such as BZK) and triclosan.

Some studies have found triclosan in more than 75% of liquid hand-washing soaps sold in the United States. Triclosan has been used ubiquitously since the 1960s and can be found in some toothpaste and embedded in products such as cutting boards and baby diapers. Triclosan also is known to remain in treated sewage that is recycled for use in agriculture, according to Dr. Aiello, an epidemiologist at the University of Michigan, Ann Arbor.

In 2000, Dr. Aiello and her coinvestigators provided 238 households with either antibacterial products (floor cleaner with 0.08% BZK, surface cleaner with 2.7% BZK, and liquid hand-washing soap with 0.2% triclosan) or the same products without antibacterial ingredients. They cultured the hands of household members before the study started and then after 1 year. Isolates of bacteria from the cultures were tested to determine the minimum inhibitory concentrations (MICs) of BZK and triclosan on which bacteria can grow.

The investigators defined MICs that were above the median for each biocide as "high" and those equal to or less than the median as "low." The investigators analyzed the general trends and changes over time in all bacterial species combined because they could not compare the same isolates at baseline and at the end of 1 year.

At 1 year, isolates from households that used antibacterial products had more than double the likelihood of developing resistance to antibiotics.

In isolates from all bacterial species combined, there were no differences between the groups in susceptibility to BZK at baseline or 1 year.

Dr. Aiello and her colleagues then analyzed isolates of bacteria from all species with a high MIC for BZK. At baseline, these isolates from either group of households had similar rates of antibiotic resistance or high MICs for triclosan. But, after 1 year, the isolates that came from households using antibacterial cleaning products had more than twice the odds of developing a high MIC for triclosan than did isolates from households that did not use products with antibacterial ingredients. At 1 year, isolates from households that used antibacterial products also had more than double the likelihood of developing resistance to antibiotics. A subanalysis showed that gram-negative bacterial isolates from households using antibacterial products had nearly fourfold higher odds of developing antibiotic resistance, compared with gram-negative isolates from households that did not use products with antibacterial ingredients.

"Potential selective pressure may result in coselection of resistance genes for other biocides and antibiotics," she concluded.

Dr. Aiello and her associates tested all gram-negative bacteria against gentamicin, imipenem, and ciprofloxacin. Certain bacterial species were tested against other types of antibiotics.

No covariates—such as use of a product before enrollment, child day care attendance, or antibiotic use—were associated with susceptibility to BZK or with households that used products containing antibacterial ingredients.

Dr. Aiello had no conflicts of interest to disclose. ■

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