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Coming clean

Antibiotics are now commonly found in many consumer cleansing products, including hand soap, body wash and dishwashing soap. In the United States in 2000, a survey showed that 45% of all consumer soaps, and more than 75% of liquid soaps, contained an antibiotic (*Am. J. Infect. Control* **30**, 257–258, 2001). Antibiotic-containing products that are used in or on humans or animals are considered drugs and are regulated by the US Food and Drug Administration (FDA). On October 20–21, the Nonprescription Drugs Advisory Committee of the FDA met to discuss the benefits and risks of consumer antiseptic products.

According to the FDA's proposed guidelines, antiseptic soap effectiveness is measured by a specified level of reduction in bacteria after hand-washing with the cleanser compared with no hand washing. However, until final requirements are established by the FDA, manufacturers are not required to comply with these guidelines, and the majority of antibiotic-containing soaps targeted to consumers have not been shown to meet these standards. In judging the efficacy of antibiotics in soaps, the most important comparison is between the reduced bacterial levels caused by washing with antibacterial soap and those resulting from normal soap. Most studies have not directly addressed this question. However, in the few studies that have, there is no evidence that the addition of antibiotics provided additional bacterial reduction over hand-washing alone.

Ultimately, people use antiseptic products at home with the idea that cleaning with these products will reduce illness and infection. Although there is clear evidence that hand-washing reduces the incidence of infection, the few well-designed studies addressing the question have not found a significant difference in infection rates between individuals who wash their hands with plain soap and those who wash with antibiotic-containing soap (*Ann. Intern. Med.* **140**, 321–329, 2004). Thus, despite their widespread use, there is no evidence so far of a benefit from soaps that contain antibiotics.

If antibiotic-containing soaps have not been shown to be effective over hand-washing alone, are there risks associated with their use? Probably the most significant potential risk is the development of resistance to the antibiotics used in these products, which could undermine the usefulness of these soaps in hospital and other health-care settings where the risks and impact of infection is clearly great. Cross-resistance with therapeutic antibiotics could pose an even greater societal problem. Unlike hand-washing, which simply washes off bacteria, antibacterials work by killing bacteria or halting their growth and, as a result, exert selective pressures based on the antibacterial's mechanism of action.

The major antibiotic used in consumer soaps is triclosan, which functions primarily against gram-positive bacteria. Triclosan works by inhibiting the enoyl-acyl carrier protein reductase step in bacterial fatty acid synthesis. There is substantial laboratory evidence that bacteria can evolve resistance to this antibiotic. Two different mechanisms of triclosan resistance have been observed. One involves the increased expression of a multidrug efflux pump, and the second involves missense mutations in the enoyl-acyl reductase protein targeted by the antibiotic. The significance of these laboratory observations is supported by an observed

increase in the triclosan minimal inhibitory concentration (MIC) for environmentally isolated bacteria (*Antimicrob. Agents Chemother.* **48**, 2973–2979, 2004). This increased resistance could pose a significant problem for the effectiveness of these soaps in health-care settings.

Even more troubling is the possibility that resistance to antibiotics used in soaps and other household products would result in resistance to clinically used antibiotics. In laboratory experiments, both mechanisms of triclosan resistance have been linked to cross-resistance to therapeutically important antibiotics (*Arch. Dermatol.* **138**,

1082–1086, 2002). It is important to note, though, that although this cross-resistance has been observed in laboratory settings, there has as yet been no evidence of it occurring in the community.

It is clear from the information presented at the FDA's October meeting (<http://www.fda.gov/ohrms/dockets/ac/cder05.html#NonprescriptionDrugs>) that additional research is needed into both the effectiveness and the safety of consumer antibacterial products. The efficacy of antibiotics in soaps for both bacterial reduction and preventing illness has been addressed in only a few studies. This has not provided enough information to make conclusions about a number of important questions, including the benefits of antibiotic-containing soap in different settings (for instance, day care facilities and schools) and for different types of infections. In addition, given the rise in antibiotic resistance, it is also critically important to gain scientific insight into the potential development of cross-resistance between the antibiotics in consumer products and therapeutic antibiotics.

In light of the rigorous standards for FDA drug approval, it is surprising that antibacterial consumer products are not currently required to meet an FDA standard prior to product release. Hopefully, the information presented at this meeting will spur the FDA to adopt final guidelines for these products and then to enforce them. However, until antibiotic-containing soaps are shown to prevent illness and not promote resistance, the sensible course of action may be to stick with old-fashioned soap. ■

