## AJCcommentaries

## Disinfection and the prevention of infectious disease: No adverse effects?

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We write in response to the publication by Cozad and Rhona<sup>1</sup> in the *American Journal of Infection Control*, which we have read with great interest.

The review was undertaken to assess what evidence there is to support disinfection as an infection control measure. The authors reach the conclusion that the use of disinfection is beneficial in preventing infectious disease and thus results in a public health benefit. However, we believe the scientific approach used in the work and, correspondingly, the authors' findings deserve comment.

The work was financed by the Consumer Specialty Product Association, a "premier trade association representing the interests of the consumer specialty products industry—a dynamic industry that provides households institutions and industrial customers with products that help provide a cleaner and healthier environment."<sup>2</sup> The association's product range includes among other things items designed to control or eliminate microbes in any environment. Moreover, both the authors are members of Scientific and Regulatory Consultants, Inc, whose staff offers "expertise gained from over 50 years of combined service to the antimicrobial industry."<sup>3</sup> Thus, the work is not without bias, takes a one-sided approach, and disregards the known adverse effects of using surface disinfection in infection control.

What do we know about the role of the hospital environment as a reservoir for infectious diseases? According to current scientific knowledge, microbial contamination of the patient's inanimate environment seems to be only a minor causative factor within the complex nature of nosocomial infection.<sup>4</sup> Maki and

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coworkers<sup>5</sup> published findings that suggest that microorganisms in the inanimate hospital environment make a negligible contribution to endemic hospital-acquired infection rates, and numerous other studies<sup>6–8</sup> have established that the use of disinfectants does not impact on the incidence of hospital-acquired infections. While some studies<sup>9,10</sup> have shown hygiene (especially hand hygiene) and targeted disinfection regimens to be useful in the eradication of antibiotic-resistant organisms in the hospital, the use of disinfectants for routine surface disinfection is not recommended by any national centers for nosocomial infection control in Europe, and, to our knowledge, not a single study has ever shown that routine use of disinfectants has prevented infections acquired in households.<sup>11</sup>

While we agree that the targeted disinfection of certain environmental surfaces is in certain instances an established component of hospital infection control, we disagree with the authors' contention that disinfectants provide an incremental public health benefit, as disinfectants may lead to the development of resistance and allergies and because they constitute an environmental load. Indiscriminate or excessive use of antibiotics has been widely blamed for the appearance of so-called superbugs.<sup>12</sup>

Disinfectants that contain biocidal agents such as quaternary ammonium compounds (quats), as well as triclosan, a widely used potent antibacterial and antifungal agent, which has so far been considered to be harmless. While it was formerly thought that triclosan killed cells only by nonspecific mechanisms, now it is known that triclosan, like antibiotics, can interact with well-defined molecular targets, thus leading to the development of resistance. Researchers warn that bacterial resistance to triclosan is a distinct possibility and that its widespread use may be unwise.<sup>13-15</sup> Overuse of biocides in an effort to produce a germ-free environment may result in lowered natural immunity to common pathogens and in increased resistance by pathogens to frequently used biocides and perhaps even to antibiotics. Chuanchuen<sup>16</sup> showed that exposure of Pseudomonas aeruginosa to triclosan can select for

multiple-drug-resistant derivatives, including, for example, high-level resistance to ciprofloxacin.

Another major consideration against the routine use of disinfectants in health care concerns users' health and environmental protection. There is evidence that the use of disinfectants may act as a trigger for allergic reaction. Skin irritation and allergies are among the most common occupational diseases in domestic staff and health care workers exposed to glutardialdehyde, formaldehyde, and glyoxal.<sup>17</sup> Triclosan is also known to trigger contact allergies.<sup>18</sup> Many surface disinfectants contain quats, phenolics, and sodium hypochlorites. Quats and hypochlorites can cause skin irritation and asthma.<sup>19,20</sup> Benzalkonium is one of the leading allergens affecting health care personnel, and of 15,751 health care workers, 1.6% were already sensitized to benzalkonium.<sup>21</sup>

Almost all surface disinfectants pollute the environment. The potential harm increased use of biocides may cause to the environment is a serious consideration. Biocides find their way into the soil, rivers, and sea and, if they do not break down, can build up to levels that could have a significant impact on the environment. Triclosan has long persistence in the environment, and it is known that chlorophenol is a source of dioxin, while chlorine-containing cleaning agents place a load on wastewater through increased absorbable organohalogen value. Quats are unsafe for the environment both during manufacture and when they are discharged into the waste stream. They are not readily biodegradable. Swisher<sup>22</sup> reported dialkyldimethyl quaternary compound levels ranging from 0.04 to 0.08 ppm for the Ohio River and 0.01 to 0.04 ppm in other United States rivers. The manufacturing process of quats and phenolics releases carcinogens such as benzene and other volatile organic chemicals.

Finally, some of the citations presented do not corroborate the authors' findings. From the study by Roberts,<sup>23</sup> it can be deduced that surfaces in fact played only a subordinate role in outbreaks of food poisoning in the period under observation, and nowhere in the study cited by Thomas and Tillet<sup>24</sup> is it mentioned that only environmental disinfection with phenolic was needed to halt the outbreaks in day care facilities. The authors of the review disregard information on other important measures such as isolation and introduction of general toilet hygiene measures. The study by Scott<sup>25</sup> does not encompass any

The study by Scott<sup>25</sup> does not encompass any occurrence of disease or transmission, although more than 200 homes were monitored microbiologically. On the contrary, the study includes an example of ineffective nappy bucket disinfection.

To embody the requisite validity, a state-of-thescience article should be systematic and should cover all aspects of current scientific knowledge, including the evidence for both the advantages and the disadvantages of surface disinfection.

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