Editorial

Environmental Interventions to Control Nosocomial Infections

William A. Rutala, PhD, MPH; David J. Weber, MD, MPH

Many epidemics of nosocomial infections have stemmed from reservoirs of pathogens in the inanimate hospital environment.l However, the contribution of the environment to the acquisition and spread of endemic nosocomial infections has been thought to be insignificant.[2~3]

In this issue, Timothy E. Cooney provides experimental data on the efficacy of copper-based paints to reduce surface contamination.[4] Heavy metals have been used in clinical medicine for more than 100 years as microbicides. The use of heavy-metal-containing compounds has included topical silver nitrate to prevent ophthalmia neonatorum, topical silver sulfadiazine to treat burn wounds, and copper-8-quinolinolate to reduce fungal growth above false ceilings. More recently, heavy metals such as silver have been bonded to Foley and intravenous catheters in an attempt to reduce the incidence of urinary tract infections or intravascular line-associated bacteremia. Factors that may limit increasing use of heavy metals include concerns about toxicity and the ability of microorganisms to develop resistance to heavy metals; such resistance may be transferred on plasmids.[5]

Several criteria should be met prior to instituting an intervention to control environmental contamination of painted surfaces such as walls. First, has the environmental surface been shown to be a reservoir of nosocomial pathogens? Second, has this reservoir been linked to endemic or epidemic nosocomial infections? Third, can environmental manipulation reduce or eliminate nosocomial pathogens on this reservoir? Fourth, can the elimination of the reservoir be shown scientifically to reduce endemic or epidemic infections? Finally, assuming all of the above have been demonstrated, what is the most efficient method of eliminating the environmental source or reservoir? Scientific studies of *Legionella* and *Aspergillus* have fulfilled the above criteria for demonstrating an environmental reservoir and have led to guidelines for control of the environmental source.[6] Guidelines regarding the maintenance of the hospital ventilation system and containment of dust associated with hospital renovations have been successful in preventing *Aspergillus* infections in immunocompromised patients. Similarly, the elucidation of the water reservoirs of *Legionella* has led to guidelines on methods to eliminate *Legionella* reservoirs when epidemiologically linked to hospital-acquired infections.

The present study compares the bactericidal activity of several copper and noncopper paints in a laboratory setting. It appears that copper paints, when applied to glass coverslips, were able to achieve a 5-log to 7-log reduction of test organisms within 24 hours. The data also demonstrated that a standard latex interior paint with a microbicidal additive achieved mean reductions in test organisms of 5 logs in 24 hours and greater than 6 logs in 48 hours.

How should the data provided by Cooney be evaluated and applied? Several scientific issues bear on whether copper-based paints should be incorporated into routine infection control practices. First, a review of the literature fails to demonstrate that walls

From the Division of Infectious Diseases, University of North Carolina (UNC) School of Medicine and the Department of Hospital Epidemiology UNC Hospitals, Chapel Hill, North Carolina.

Address reprint requests to William A. Rutala, PhD, MPH, Division of Infectious Diseases, 547 Burnett-Womack CB# 7030, University of North Carolina at Chapel Hill, Chapel Hill, NC 27599-7030.

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have served as a reservoir of nosocomial pathogens linked to endemic or epidemic nosocomial infections. This may be due to one or more factors: the microbicidal activity of standard interior latex paints; significantly lower levels of contamination on hospital walls than the experimental levels used in this study; or a lack of direct contact with walls by staff and patients. Second, even if one demonstrated significant levels of potential pathogens on walls, walls would need to be shown scientifically to be linked to nosocomial infections. For example, while the microbial load of carpets is l,000-fold higher than for hard surface floors, it has not been shown that this higher level of contamination is related to increased transmission of nosocomial pathogens. Third, even if copper-based paints reduced surface contamination, other infection control strategies would continue to be needed to limit disease transmission. For example, despite the recognition of widespread environmental contamination with certain pathogens (eg, methicillin-resistant *Staphylococcus aureus,* vancomycin-resistant *Enterococcus, Clostridium difficile),* control has focused on the disinfection or sterilization of reusable medical devices, isolation of patients, barrier precautions, handwashing, and adequate procedures for the routine cleaning and disinfection of environmental surfaces.[7-9]

Several other issues should be addressed prior to adopting the use of copper-based paints. The microbicidal efficacy of copper-based paints on more porous substances, such as wall plaster and cements, should be investigated. The duration of protection afforded by copper-based paints over extended periods of time should be assessed. For example, will the mobilization of copper continue to lead to microbicidal levels over the lifetime of the paint application, or will the microbicidal levels of copper only be achieved for a period of days, weeks, or months? The toxicity of copper-based paints needs further study, especially the potential hazards of using liquid disinfectants (eg, phenolics, chlorine, quaternary ammonium compounds) on walls coated with paints containing copper supplements. Additionally, do we need to be concerned about the possibility that copper-based paints would be ingested if peeling or chipping occurred in areas with pediatric patients?

Cooney's data demonstrate a potentially feasible method of reducing environmental contamination. However, concerns regarding toxicity, costs, and duration of efficacy require further investigation. Studies using the tools of molecular biology would need to be undertaken to assess the role of contamination of walls in the incidence of nosocomial infections. Infection control interventions ideally should be introduced only after demonstrating that they are efficacious in preventing infection, that the benefits exceed the risks, and that the proposed intervention is the most efficient method of achieving the desired aim. These questions and concerns should be addressed before copper-containing paints are added to our armamentarium of infection control measures.

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