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Making the Case for Textiles with a Dual Mechanism of Action

To the Editor—The paper titled "A Randomized Crossover Trial to Decrease Bacterial Contamination on Hospital Scrubs"[1] by Mallory Boutin et al published in November's issue is an important contribution to the body of evidence needed for the use of technical or engineered textiles as an innovative approach to healthcare-system–based infection prevention. I applaud the authors for making such an important step forward for us as a scientific community as we explore new technologies that hold promise for positive impact not only for patients and healthcare workers but also for public health.

In Ms. Boutin's discussion section, it appears that she and her colleagues have inaccurately interpreted the available published research. She states in her discussion, as it relates to her research, that "(o)ther recent studies testing antimicrobial scrubs but using different products have shown similar ineffectiveness." On the contrary, the study of reference (Bearman 2012[2]) concluded that the technology they studied *was* effective.

In short, Bearman et al conducted a randomized clinical trial (RCT) to determine the effectiveness of a breathable, antimicrobial, fluid barrier scrub fabric for reducing the bacterial burden on hands and scrub attire worn by healthcare workers (HCWs) in an intensive care unit (ICU) setting. The technology Bearman et al studied was an active barrier textile, one with a dual mechanism of action of both fluid repellency and antimicrobial attributes. All study participants (N = 31 HCWs) were required to wear an assigned set of scrub attire during a clinical shift. Each HCW underwent unannounced weekly garment and hand cultures. Cultures (N = 3,324) taken at the beginning and end of the shifts included garment cultures taken from the abdominal and leg pockets of the scrub attire.

The researchers found a highly significant statistical ($P = .0002, .0056$) 4–7 mean log reduction in the overall number of methicillin-resistant *Staphylococcus aureus* (MRSA) CFUs on study scrub attire compared with traditional nonprotective scrub attire worn by HCWs on both the leg and the abdomen. The reduction persisted from the beginning to the end of work shifts.

As Ms. Boutin correctly summarizes, there were no differences in the number of CFUs for vancomycin-resistant *Enterococcus* (VRE) and Gram-negative rods—not because the study scrubs were not effective, but because the baseline measurements at their facility were too small to measure a statistically significant change. The researchers concluded that "When bundled with known infection prevention strategies such as hand hygiene, antimicrobial impregnated apparel may limit the bacterial burden of the inanimate environment. For settings with high rates of hospital-acquired infections with drug-resistant pathogens such as MRSA, the use of antimicrobial apparel may be a useful adjunct to other infection prevention measures."

It is also important to note that Bearman's findings in the clinical setting were validated in the laboratory findings of Hardwick et al.[3] Dr. Hardwick and colleagues described the dual mechanism of action of breathable, antimicrobial, fluid barrier fabrics in their published laboratory "Fabric Challenge" test method. Hardwick noted that the combination of an organosilane antimicrobial agent and a hydrophobic barrier chemistry provides an additive effect when combined and results in a higher reduction of MRSA on the fabric than does either the antimicrobial or the fluid barrier alone. The role of the fluid barrier in this dual mechanism is consistent with the *CDC/HICPAC Guideline for Disinfection and Sterilization in Healthcare Facilities* (2008), which states that organic matter in the form of serum, blood, pus, or fecal or lubricant material can interfere with the antimicrobial activity of disinfectants. The bioburden reduction results of Hardwick's study strongly correlate with the findings of Bearman and colleagues.

To Ms. Boutin's credit, she is correct regarding textiles with an antimicrobial alone. This was supported in a study conducted by Burden et al[4] in which the extent of bacterial contamination of scrub attire and skin were compared when HCWs wore 2 different types of antimicrobial scrub attire compared to traditional nonprotective scrub attire (N = 105). One type of antimicrobial scrub attire was made from a polyester microfiber embedded with an antimicrobial chemical. The second type of antimicrobial scrub attire was made from a polyester/cotton blend

that included two proprietary chemicals and silver embedded into the fabric. Cultures of the pocket, sleeve cuff, thigh, and wrist were taken before the scrub attire was donned and at the end of the day after patient care. The researchers found that, at the end of an 8-hour work day, wearing the antimicrobial scrub attire *did not* decrease bacterial or antibiotic-resistant microbial contamination of the HCWs' scrub attire.

In another study of silver impregnated scrubs versus standard scrubs, Gross et al[5] conducted a study in the emergency medical setting to compare the contamination rates of newly developed silver thread-hybrid clothing with that of standard textile clothing. Samples were taken from jackets and pants of 10 emergency workers at day 0 (preservice), day 3 after use, and day 7 after use over a divided 4-week period to test this hypothesis. No significant difference in the extent of microbial contamination was detected between these 2 materials.

These studies suggest that the presence of a fluid barrier, the type of fabric, the active antimicrobial ingredient, the onset of action, kill time, and nonleaching characteristics of the fabric and technology should be carefully assessed to ensure effectiveness and safety. This is, as Ms. Boutin points out, definitely an issue that warrants further research.

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Mobile Phone Microbial Contamination Among Neonatal Unit Healthcare Workers

To the Editor—Mobile phones are reservoirs for pathogenic bacteria, and their frequent use by healthcare workers (HCWs) makes them a perfect vehicle for nosocomial transmission.[1–6] Because no study has concentrated on microbial contamination of HCW mobile phones in neonatal units, we investigated this contamination source in this specific environment.

The study was carried out at the neonatal unit of the teaching hospital Umberto I in Rome, Italy. The study participants, healthcare workers and students in this unit, were asked to anonymously answer a 13-item questionnaire including age, sex, job profession, mobile phone type, and cleaning activity, after which culture samples were obtained from their mobile telephones.

Sterile swabs moistened with sterile demineralized water were rotated over the phone's surface and immediately plated onto blood and MacConkey agars using standard microbiological procedures. Isolates were identified using the bioMerieux API system (bioMerieux, Durham, NC).

Statistical analyses were performed using SPSS software (version 14.0 for Windows, Chicago, IL). When observed frequencies were >5, χ^2 with Yates correction was used to compare the proportions observed in the 2 groups. When frequencies were ≤5, Fisher's exact test was used.

A total of 50 mobile phones were sampled from 22 doctors, 19 nurses, and 9 medical students (7 males, 43 females). The average age of the participants was 38.3 ± 12.7 years, (median 37.5 years; range, 20–61 years), and self-reported use in the preceding 24 hours was 14.5 ± 10.9 times (median 10 times; range, 2–40 times). The average duration of mobile phone ownership was 17.6 ± 19.7 months, and 17 HCWs (34%) declared mobile phones "very important for their work."

Overall, 43 mobile phones (86.0%) demonstrated evidence of some bacterial contamination, and 66 different strains were isolated (1 bacterial species on 26 mobile phones, 2 on 14 mobile phones, and ≥3 on 3 mobile phones). In particular, 10 mobile phones (20.0%) grew bacteria known to cause healthcare infection (Table 1).

Only 26 HCWs (52.0%) indicated that they cleaned their mobile phones in the following ways: dump cloth (27.0%), dry cloth (23.1%), spectacles detergent (15.4%), alcohol (11.5%),