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**ID 013 - Effective elimination of Staphylococcal contamination from hospital surfaces by a bacteriophage-probiotic sanitation strategy.**

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**Introduction.** Persistent contamination of hospital surfaces and antimicrobial resistance (AMR) are recognized major causes of healthcare-associated infections (HAI). The control of pathogen contamination has been approached so far by conventional chemical-based sanitation, which however does not prevent recontamination, has a high environmental impact and can favor the selection of resistant strains. In the search for effective methods, we recently showed that a probiotic-based sanitation (PCHS) can stably decrease surface pathogens, significantly reducing also AMR and HAI incidence. However, PCHS action is slow and non-specific. By contrast, bacteriophages have been proposed as a decontamination method due to their ability to kill bacterial targets very rapidly and specifically, but their routine application has never been tested. We thus analyzed the feasibility and effectiveness of phage addition to PCHS sanitation, aiming to obtain a both rapid and stable abatement of specific pathogens in the hospital environment.

**Materials and Methods.** The study was performed in a private hospital located in Ferrara (Italy), after approval by local Ethics Committee. Phage decontamination potential was tested in 8 bathrooms of the General Medicine wards, against *Staphylococcus* spp., being bathrooms the most contaminated areas and Staphylococci the most prevalent bacteria in such settings, as detected by preliminary tests. Four rooms were treated with PCHS alone (controls) and 4 rooms with phage nebulization combined with PCHS. Sanitation procedures were applied daily, and Staphylococcal contamination was analyzed by culture-based methods and molecular real-time PCR analyses.

**Results.** The characterization of Staphylococcal contamination showed the presence of four prevalent species, namely *S. epidermidis*, *S. haemolyticus*, *S. cohnii*, *S. simulans*. A daily phage application by nebulization was associated with a rapid and significant decrease of *Staphylococcus* spp. load on treated surfaces, up to 97% more than PCHS alone ( $p < 0.001$ ). The bacterial decrease was paralleled by an increase of phage load on treated surfaces, as detected by specific real-time PCR. No variations were observed in other bacterial genera, confirming a specific action of phages.

**Discussion and Conclusions.** Collected data suggest that the use of a probiotic-phage sanitation system is associated with a stable and specific decontamination, that would be highly desirable in the hospital environment, as it would prevent infections associated to the persistence of specific pathogens on hospital surfaces. Such system might be thus considered as a part of infection prevention and control strategies, to counteract outbreaks of specific pathogens and prevent associated infections.