



NOSOCOMIAL INFECTION

Dirty Soap? The Overlooked Risk in Hospital Hygiene

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Keywords

Antiseptics • Antimicrobial • Hand Hygiene • Intrinsic Contamination • Soap

Dear Editor,

Handwashing with soap and water is a well-established and effective measure for reducing the transmission of potentially pathogenic microorganisms [1]. According to the CDC's *Guideline for Hand Hygiene in Health-Care Settings*, washing with plain or antibacterial soap is preferred over alcohol-based hand rubs when hands are visibly soiled, contaminated with proteinaceous material, blood, or other body fluids, after toilet use, or following contact with patients suspected or confirmed to have *Clostridioides difficile* [2].

Plain soaps are detergents that lack antimicrobial agents, although they may contain preservatives, whereas antimicrobial soaps incorporate specific antiseptic compounds. Notably, all types of soap, including those with antimicrobial properties, may become contaminated with bacteria, thereby posing a recognized risk to health, particularly in healthcare settings [3]. A 2023 systematic review on bacterial contamination of antiseptics (AS), disinfectants (DI), and hand hygiene (HH) products reported that since 1977, in healthcare settings in low- and middle-income countries, liquid soap accounted for 31% (4/13) of documented outbreaks and 18.4% (12/65) of contaminated products identified across 25 cross-sectional studies [4]. Comparable analyses from high-income countries over the past 70 years identified soap contamination in 16% (11/68) of outbreaks and 39% (13/33) of cross-sectional surveys [5].

Gram-negative bacteria represent the principal contaminants of soap, comprising more than 90% of reported isolates. Within this group, non-fermentative species predominate, particularly *Pseudomonas aeruginosa* and *Burkholderia cepacia*, while *Acinetobacter baumannii*, *Chryseobacterium indologenes*, and *Achromobacter xylosoxidans* are less frequently identified. Among the Enterobacterales, *Klebsiella oxytoca* and *Serratia marcescens* are most commonly reported, followed by *Enterobacter cloacae*, *Escherichia coli*, and *Citrobacter freundii*. In contrast, Gram-positive organisms are infrequently implicated (<10%), with Gram-positive bacilli predominating, followed by coagulase-negative staphylococci and *Staphylococcus aureus* [4-6]. Yeast contamination, while exceedingly rare compared with bacterial contamination, has been reported only in soap, with no evidence in other hand hygiene products or disinfectants [4]. A plausible explanation is the limited

antifungal efficacy of quaternary ammonium compounds (QUATs), commonly used in antimicrobial soaps, against *Candida* spp., including *Candida auris* [7].

In literature common risk factors associated with soap contamination were related to bacterial characteristics, preparation, containers, and handling practices. These included natural resistance of bacteria (*Burkholderia cepacia*, *Pseudomonas aeruginosa* are intrinsically resistant to QUATs, chlorhexidine), use of non-sterile or contaminated water, incorrect dilution, and preparation in unsuitable environments. Issues related to container and dispenser involved reuse or improper reprocessing, and biofilm formation. Risky practices mainly included topping up of containers and extended use beyond expiry [4, 5]. The contamination of soap can be either intrinsic; present at the time of manufacture or extrinsic, arising during handling, storage or in use [5].

In March 2026, we incidentally identified intrinsic contamination of *Enterobacter cloacae* in liquid antibacterial soap available in our hospital as part of an outbreak investigation in neonatal ICU due to another micro-organism. No healthcare-associated infections or outbreaks due to *E. cloacae* were reported during that period. Immediate administrative and operational measures were implemented to mitigate risk, and the manufacturer was notified to initiate the product recall. Leveraging this finding, the following recommendations for hand soap use in the healthcare settings are proposed to guide stakeholders from purchase to protection, ensuring soap quality to reduce infection risks.

A. Selection of soap

1. Liquid soaps are preferred over bar soaps in healthcare settings, as bar soaps have 4-to-20-fold higher propensity to get contaminated in comparison to liquid formulation. Notably, high-income countries have phased out the use of bar soaps in hospitals since the 1980s [8].
2. The selection of antimicrobial over plain soap is not specified in either WHO or CDC guidelines; however, few earlier studies have indicated that antimicrobial soaps may be more effective than plain soap [1, 2, 9, 10]. However, while selecting antimicrobial soaps, it is essential to ensure that they

contain effective concentrations of antiseptic agents. According to WHO, appropriate concentrations are: 0.5-4% chlorhexidine, 0.5-4% chloroxylenol, 0.5-10% iodophors, 0.1-2% triclosan, and QUATs (0.5-0.55% benzalkonium chloride, 0.5-2% cetrimide) [1]. Notably, triclosan has been banned by the US FDA since 2016 due to safety and efficacy concerns [11].

3. It is suggested to procure ready-to-use soap solutions rather concentrated form and then diluting in house. Dilution of liquid soap at any level is strongly discouraged as over dilution leads to decreased efficacy and also contamination from non-sterile tap water is a frequent factor resulting in extrinsic contamination [12].

B. Procurement of the product

1. To minimize the risk of intrinsic contamination, soaps should be sourced from area-specific, reputable manufacturers with stringent quality control, avoiding products from informal markets where water and raw materials may be chemically or microbiologically uncontrolled [13].
2. Apart from legal licenses, under regulatory compliance, following certificate or document should be verified by the manufacturer [5].
 - a. Good Manufacturing Practices (GMP) certificate under ISO 22716 an international standard for cosmetics, provides guidelines for production, control, storage and shipment.
 - b. European norm (EN) 1499, a standard that specifies the requirements and test method for the hygienic handwash efficacy of handwashing products, including soaps.
 - c. United States Pharmacopeia (USP) 1072 which provides structured guidance on how to select, validate, and implement disinfectants and antiseptics in pharmaceutical manufacturing, by the manufacturer related to product integrity.

Additionally, manufacturers can be asked to provide microbiological testing reports issued by an accredited laboratory, certifying the sterility of the respective batch.

C. Best practices / recommendations for containers and dispenser use

1. Preferably use original and disposable containers, limit use of reprocessed containers. Containers are bottles or reservoirs for product storage should preferably be disposable and of small volume. Prolonged use of liquid soap products may lead to degradation of preservatives, thereby promoting biofilm formation in the containers. This can facilitate contamination with opportunistic pathogens such as *Pseudomonas aeruginosa*, *Stenotrophomonas maltophilia*. [4, 5].
2. Dispensers combine a container with a dispensing mechanism (e.g., a wrist-operated pump) used in working area. The best recommended practice is use

of disposable dispenser with single use pump system for liquid soap also like alcohol-based hand rubs and refilling is discouraged. However, in resource-limited settings, cost considerations may necessitate the reuse of dispensers after appropriate reprocessing. The dispenser along with the pump should be cleaned and air dried before refilling. And every time date of refilling should be labelled on the dispenser [4, 5].

3. In view of absence of any guidelines on frequency of refilling or “topping up,” the healthcare institutions should develop their own policies based on resource availability and the level of risk in different clinical areas. These policies should aim to standardize practices and reduce the risk of contamination.

D. Role of Infection Prevention and Control Committee (IPCC)

1. It is recommended for IPCC to supervise and monitor and quality of soap products throughout their lifecycle – from selection and procurement to storage, use, and disposal. As per Joint Commission and International Standards hospital leadership should approve resources required for the infection prevention and control program which includes AS, DI and HH products used in the hospital before procurement [4, 14].
2. CDC does not recommend microbiological testing of in-use hand hygiene products or soaps as a routine part of surveillance and is only considered during outbreak investigation [2, 5]. Nevertheless, individual institutions may develop and implement context-specific guidelines based on local risk assessments and resource availability.
3. Based on our experience, we initiated the policy on randomly checking a sample of fresh batch for microbiological analysis which is done by using combined method of direct plating method and enrichment broth.
4. It is recommended that the infection control team closely monitor dispensers during routine rounds, paying attention to overuse or visible changes such as turbidity or bulging [4]. While outbreaks may not always occur, contaminated dispensers may lead to sporadic infections especially in high-risk patients whose source of infection might otherwise go unrecognized.

E. Training and sensitization of stakeholders

1. It is recommended that training programs for healthcare workers be expanded to include all stakeholders involved in the procurement, storage, and distribution of hand hygiene products, with emphasis on intrinsic and extrinsic risks of contamination [5].
2. Training should address the misconception that antiseptic products are inherently safe, highlighting their susceptibility to microbial contamination when improperly handled or stored [5].

3. Trainers should be the infection control team (ICT) and training should be tailored as per the stakeholders. Special attention should be paid on training the housekeeping staff on re-processing and refilling of container [15]. Evidence indicates that inadequate IPC training is associated with poor recognition of contamination risks, whereas trained personnel demonstrate significantly greater awareness of such risk factors [15].

Eventually, the identification of intrinsic contamination of antimicrobial soap used in our institute serves as an eye-opener. The incident act as an important wake-up call, highlighting the necessity for continuous vigilance in maintaining quality standards and preventing adverse events such as outbreaks, the suspicion and detection of which are often complex and challenging. It also underscores the active involvement of ICT in filling the gaps in awareness from procurement till end-user practices that can facilitate product contamination.

Acknowledgement

None.

Conflict of interest statement

The author have no conflicts of interest to declare.

Authors' contribution

SG: Concept design, data curation, literature search and manuscript writing.

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Received on May 20, 2026. Accepted on May 28, 2026.

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How to cite this article: Gupta S. Dirty Soap? The Overlooked Risk in Hospital Hygiene. *J Prev Med Hyg* 2026;67:E235-E237. <https://doi.org/10.82082/2421-4248/jpmh2026.67.2.3960>

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