Contamination of hospital basins

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Content

Introduction

Bacteria is present and proliferating in many areas of the hospital. One area that is particularly problematic is the hospital's water source. As with any other healthcare-associated infection, occurrence of a hospital-acquired waterborne infection can erode the public's confidence in healthcare facilities. It is recommended that hospitals implement water-safety programs; the solution to the problem, however, is extensive and not always feasible. There are cost-effective ways to eliminate the exposure of vulnerable patients to the potentially lethal effect of contaminated water. One such method is to replace the use of hospital water in the very fundamental practices of patient hygiene. The elimination of the need to use tap water for performing tasks such as daily bathing and incontinence clean-up can help reduce the exposure to harmful pathogens that may be hiding in the water source, unbeknownst to the staff and patients. This method can also eliminate a common source of bacteria, the bath basin.

Water sources, biofilm, and reservoirs of bacteria

The water coming into a hospital can contain bacteria; municipal water treatment systems do not produce and provide sterile water. But bacteria that is normally not a risk for the healthy general public can be dangerous for hospital patients.

Even if the water used is clean, the pipes delivering the water are the perfect place for bacteria to proliferate. Some common bacteria form biofilms, which serve as colonies where the bacteria attach to a surface and proliferate. These water-dwelling bacteria especially like p-traps, the U-shaped bend in pipes that drain the contents of a sink.[1]

While certain waterborne bacteria, such as Legionella or pseudomonas, can accumulate in the deep recesses of water distribution sources, other bacteria, such as Gram negative bacteria and molds, tend to attach in biofilms at the distal sources of the water distribution channel (pipes and faucets).[2] Most of the time, clean, controlled water is delivered from water plants to cities.[3] The continuous flow of cold water from the plant through large-diameter pipes helps keep the water clean. This situation can change at the point where the water enters a building. Once the water is within buildings, it is no longer flowing consistently, which can lead to stagnation. The water temperature also increases as it passes through the internal complex of narrow pipes, which may contain corroded inner surfaces. "This environment provides optimal conditions for the formation of biofilm from which bacteria and other microorganisms are continuously released into the water." [3]

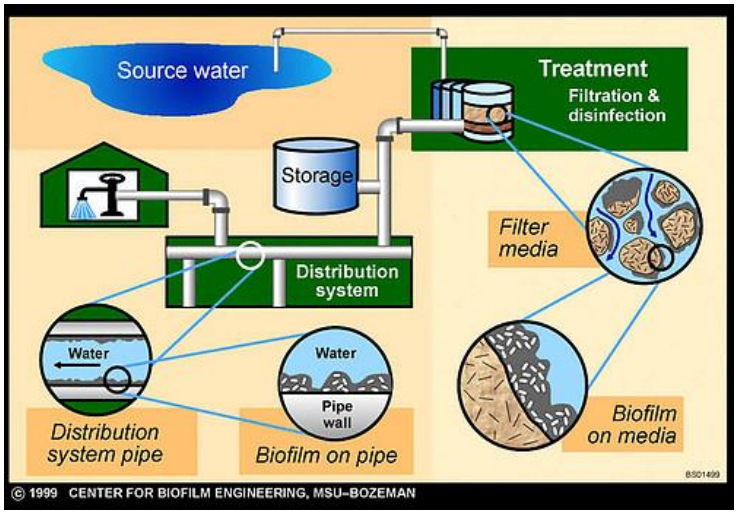


Image 1:

"Drinking water is derived from lakes, rivers or deep underground. It is purified in water plants and transported underground in large diameter pipes to cities and buildings, where it then runs through small diameter pipes, stagnates and warms up."[3]

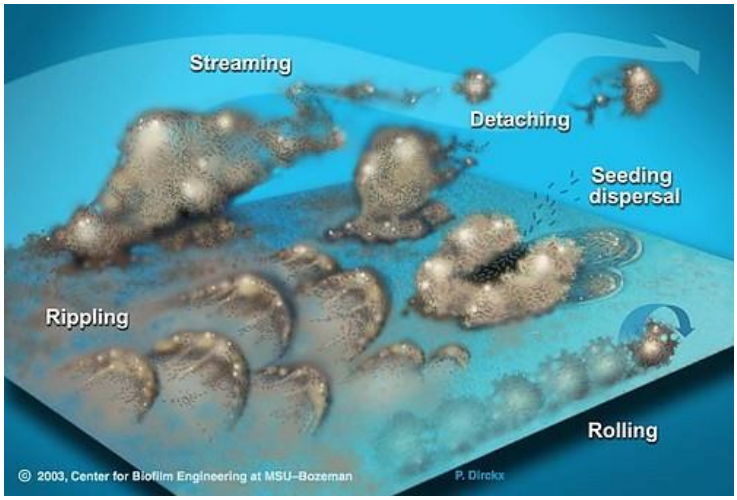


Image 2:

"Biofilm establishes in several phases over a few days. It contains microorganisms within its slimy matrix. With increasing thickness, biofilm particles containing large amounts of bacteria are released into the water stream."[3]

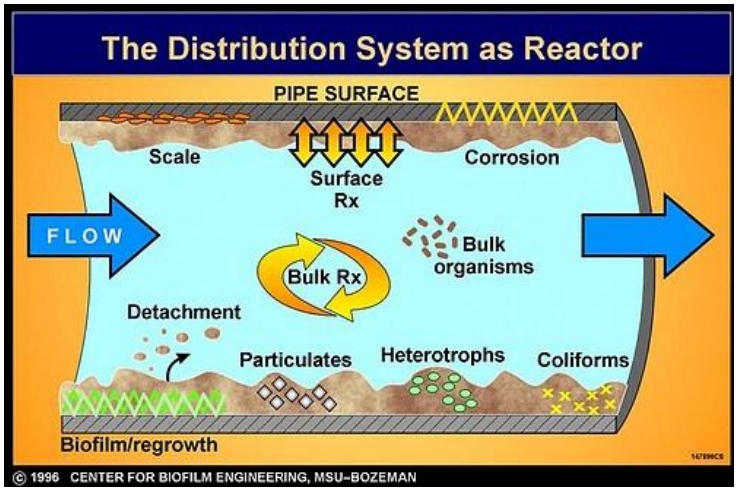


Image 3:

"When biofilm loaded with bacteria is released into the water stream, high microbial counts may be measured at the outlets. Annual testing provides only a snapshot of information, while regular testing is useful to monitor the bacterial risk of a pipe network."[3]

Why can we not rely on the water treatment plant alone?

- Domestic water is not sterile upon entry into facility.
- Building plumbing systems allow further biofilm growth and proliferation.
- Often severely immunocompromised patients contact and use water ideal for biofilm formation.

What is biofilm and how does it develop?

Just because water meets the requirements of drinking/potable water does not mean it is free of biofilm. Biofilm is known to contain bacteria, amoeba, algae, and other microorganisms. When water is freely flowing, the force of water flow causes biofilm to shear off. When water is not freely flowing, thick biofilms can form because there is no force to remove the biofilm from the surface of the pipe. The shearing off of biofilm particles allows the bacteria to travel and may lead to colonization in other parts of the water distribution channel. "External physical stress in the pipework, such as disinfection measures, can result in an increased expression of the biofilm phenotype cell which is responsible for the strong attachment of cells to a surface."[3]

Why does biofilm influence the water quality?

"With increasing thickness, biofilm better protects the microorganisms within, from chemical agents and thermal disinfection procedures. It is extremely difficult to completely eradicate the biofilm community once established. Irregular shedding from a biofilm can result in significant deviations of bacterial counts at sampling sites or points-of-use (POU). Bacteria within biofilm communities have been shown to exhibit greater resistance against antimicrobial treatments than corresponding planktonic cells."[3]

With all of this said, municipal and hospital water sources are not expected to be free of pathogens. This means that hospitals must look at ways to prevent the spread of bacteria to the vulnerable patients it is trying to protect.

Waterborne bacteria can be transmitted to patients in a variety of ways, including:[2]

- Direct transmission from water to patients: aerosol from a shower or room humidifier, cooling tower, aspiration while drinking water;
- Indirect transmission from fomites that had contact with contaminated water: bath supplies and linens; inappropriate use of nonsterile water for tasks that warrant higher measures of caution, such as oral/tracheostomy care of ventilated patents and rinsing of respiratory therapy or endoscopic equipment in tap water;
- Exposure of implanted devices to water (e.g., bathing with a central venous catheter improperly covered);
- Transmission on the hands of healthcare personnel: failure to perform hand hygiene after contact with a contaminated environment or patients colonized with waterborne organisms;

hand washing with contaminated water; splashing from contaminated sink drains.

Bath basins as a reservoir of bacteria

Marchaim and associates (2011), set out to test the theory that the hospital itself serves as a reservoir of potentially harmful pathogens and that many items commonly used for patient care tasks may help spread the pathogens onto patients and potentially lead to hospital-acquired infections. A previous smaller study sampled ninety bath basins and showed that 98% sampled were contaminated. Based on this study, Marchaim, et al decided to conduct a larger-scale study to determine whether the bath basin is a potential reservoir of bacteria.[4]

The study was designed as a prospective, multi-center trial spanning four years throughout 88 hospitals in the United States and Canada. The hospitals participating included various sizes and acuity levels, including tertiary care facilities. The team collected microbiologic samples from the first ten basins encountered on a unit. A total of 1,103 basin samples were collected from the participating hospitals.[4]

The role of bacteria in hospital-acquired infections

It is estimated that each day, one in twenty hospitalized patients will acquire an infection in the hospital, with a total healthcare cost ranging from $9.7 billion to nearly $36 billion annually.[5] It is also thought that these infections are largely preventable. Adding to the costs and quality discussion is the predominance of multi-drug resistant organism infections. According to the Centers for Disease Control, in acute care hospitals, antibiotic-resistant organisms are responsible for:

- 1 in 6 central-line-associated bloodstream infections (CLABSIs);
- 1 in 10 catheter-associated urinary tract infections (CAUTIs);
- 1 in 7 surgical site infections (SSIs).[6]

In long-term acute care (LTAC) facilities, one in four infections is caused by antibiotic-resistant organisms.

Prevention of hospital-acquired infections has become a major focus for healthcare facilities as national reporting and quality payment processes become more prevalent in healthcare economics. Most facilities have implemented process improvement plans to conduct surveillance of infection incidence rates and evidence-based interventions for prevention and treatment. Bundled care practices have been promoted by various clinical organizations as a proven method of addressing the risks associated with HAI development.

Current nursing practices for patient hygiene

One of the core principles of process improvement is the reduction of process variation.

Whenever there is a lack of standardization in practice, there is a potential impact on quality. While nursing prides itself on evidence-based practice, certain tasks have been relegated to provider preference due to the perception of the lack of significance of the practice. Patient hygiene is one of those practices perceived as a simple task with little impact on patient outcomes, therefore, the nurse decides the method and techniques for cleansing the patient.

Patient bathing and personal care is a task that has a high degree of process variation. This variation is dependent on the nurse, the available supplies, the patient's condition, staffing levels, and patient preference. The bath basin has long been a staple in this time-honored nursing practice. The basin is multifunctional in most hospitals. Not only does it serve as a reservoir of water for the daily bath and intermittent clean-ups, it is also used as a larger receptacle of emesis and a place to store personal items and other personal care items when not in use (socks, urinal, tissues, etc.). Very rarely is the basin properly sanitized between uses; instead, it is pulled from the cabinet and filled with tap water for bathing.

Nurses and other staff are not intentionally contaminating patients, but they may be unaware of the pathogens that reside in the basin. When reviewing a day in the life of a bath basin, it is easy to see why so many pathogens can be isolated from these reservoirs. Potentially contaminated water only confounds the issue. With the vast majority of pathogens sampled from bath basins being Gram negative organisms, it makes sense that these gut bugs come from gastric or bowel contents.

Another consequence, although unintended, of traditional bathing with washcloths and cleansers is the negative impact on the patient's skin. Many soaps and cleansers may contain harsh ingredients that are not pH-balanced. The skin has a built-in protective barrier, called the acid mantle that maintains the skin at a more acidic pH (4.5-6.2). This barrier provides protection against bacteria, viruses, and other contaminants.

This protection occurs because the blood pH is maintained at a slightly alkaline level (7.4) and serves as a hostile environment for any substance that penetrates the skin.[7] Many soaps and cleansers contain ingredients that fall more on the alkaline spectrum of pH and therefore, may disrupt the skin's own defense mechanism. Soap-based skin cleansers typically have a pH of 10.[7]

A study in the United Kingdom found that the repeated use of soap and water and drying with a towel disrupted the barrier function of the skin, as evidenced by an increase in trans-epidermal water loss and pH.[9] These findings were lessened when using only water and towel drying, though the rubbing effect of towel drying may damage the stratum corneum (outside layer of skin). This impact may be heightened when using abrasive wash cloths and towels.

Alternatives to traditional patient hygiene practices

Hospitals have few choices when it comes to the tasks related to patient care that require water. Bottled water for activities such as bathing would be cost prohibitive in most facilities. While there is not a long list of alternatives to basin bathing, there are a couple, such as:

- Rinse-free cleansers
- Disposable wash cloths with/without rinse-free cleansers
- Prepackaged bathing

AACN practice alert[10]

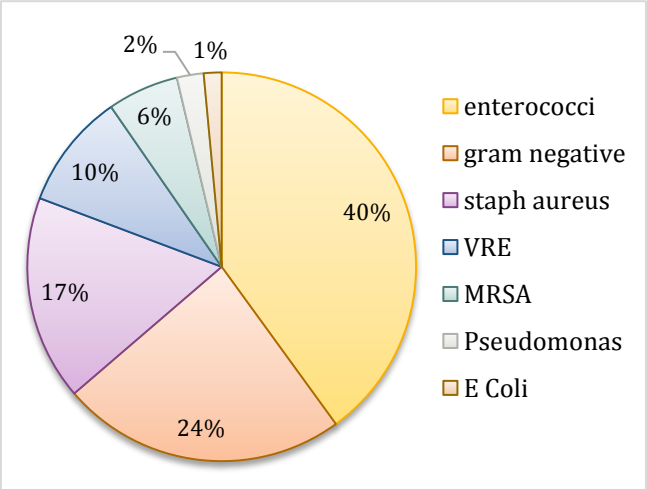
Based on the latest available evidence, the expected practice related to bathing adult patients includes:

- Provide a daily bath for bed-bound patients to improve hygiene and promote comfort. More frequent baths may be performed upon patient request or to respond to patient needs.
- Determine bath time based on patient preference and clinical stability instead of based on organizational factors.
- Use disposable basins and dispose of them after one use to reduce risk of bacterial contamination.
- Avoid use of unfiltered tap water. Alternatives include prepackaged bathing products, sterile or distilled water, or filtered water from faucets.
- Use no-rinse pH-balanced cleansers, which are superior to alkaline soaps that require wash-rinse cycles.
- Apply emollients after each non-prepackaged bath to prevent dry skin. Prepackaged bathing products include skin emollients.
- Use prepackaged bathing products to reduce process variation.

Evidence

Johnson, et al, conducted a prospective study at three acute care hospitals to identify and quantify the presence of bacteria in hospital bath basins. Ninety-two basins were tested, with 98% of the basins growing some form of bacteria.[11]

The following chart shows the results of the basin study:



After a cost-reduction initiative eliminated prepackaged bathing from their hospital, Dr. Maryann McGuckin and Arlene Shubin used the concept of Interventional Patient Hygiene (IPH) to determine the impact of prepackaged bathing on hospital infections. IPH has been defined as a comprehensive, evidence-based intervention and measurement model for reducing the bioburden of both patient and healthcare worker.

The model includes hand hygiene, oral care, skin care, and catheter site care. It is hypothesized that these evidence-based interventions can decrease the rates of healthcare-acquired infections.[12]

Key findings in the McGuckin study were:

- Lower microbial counts on patients' skin after using prepackaged bathing versus water and bath basin method;
- After sampling bath basins, microbial colony counts found in bath water were similar in number to those of urine from patients with UTIs;
- Clearly, the basin should be considered a major source of HAI;
- Additionally, what was supposed to be a cost-saving measure yielded 23 additional UTIs, 151 hospital days, and an additional $107,741 in costs.

Stone, et al, studied the impact of bath basin removal on catheter-associated urinary tract infections (CAUTI). Facility CAUTI rates were 7.5 per 1,000 catheter days, which at the time was three times the national benchmark.

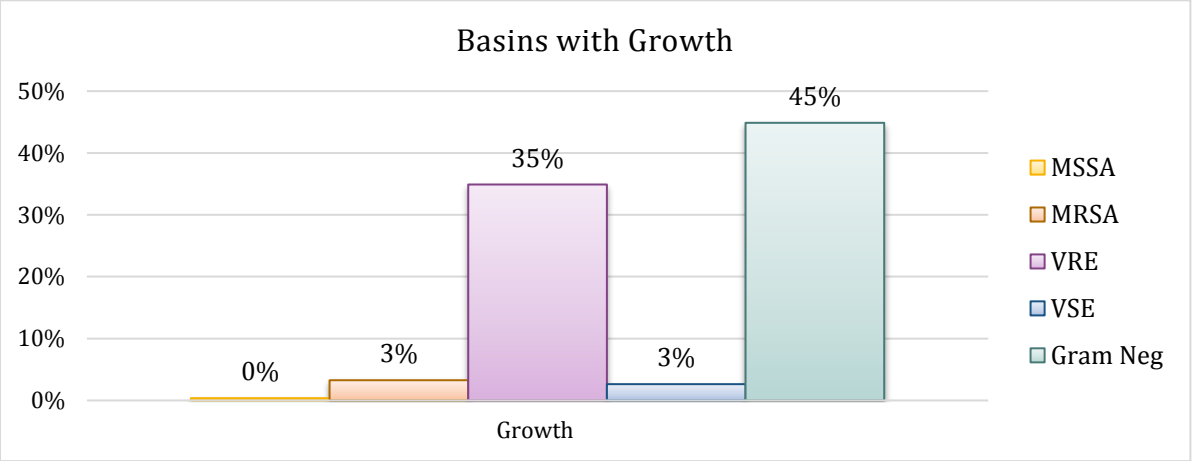
Using two medical/surgical units that were responsible for 30-40% of the indwelling catheter usage as their study units, they began a retrospective review of a six-month period. A washout period was conducted to implement prepackaged bathing and remove bath basins, followed by the study period in which the new products and protocols were implemented.[13]

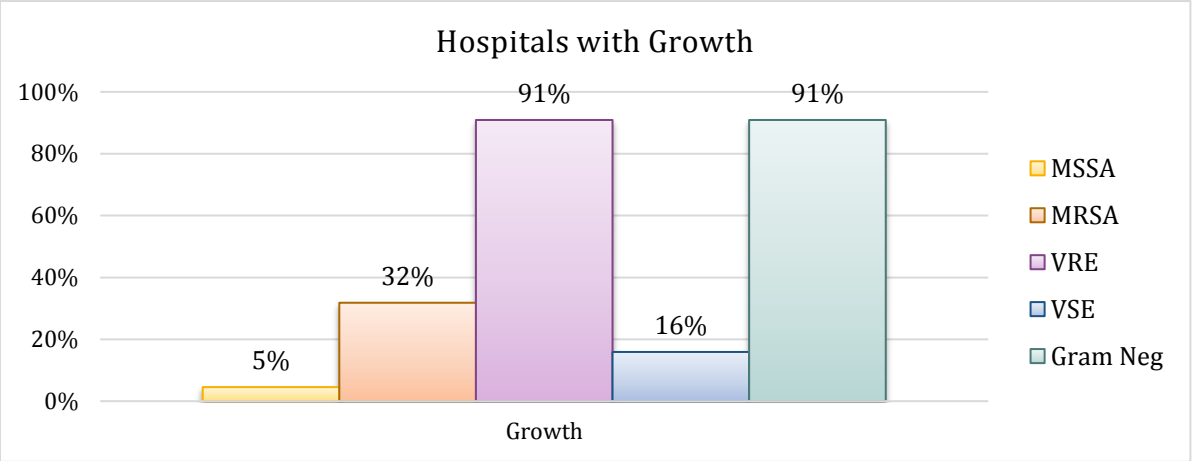
In addition to basin elimination and introduction to prepackaged bathing, the team also implemented an evidence-based comprehensive protocol surrounding insertion, care, and removal of indwelling catheters. Results of the study concluded that the CAUTI rates for the study period were positively impacted with a reduction from 4.42 to 0.46. Following the study, further data collection showed a reduction to zero CAUTIs within one month of intervention and this figure remained at zero for a nine-month period.

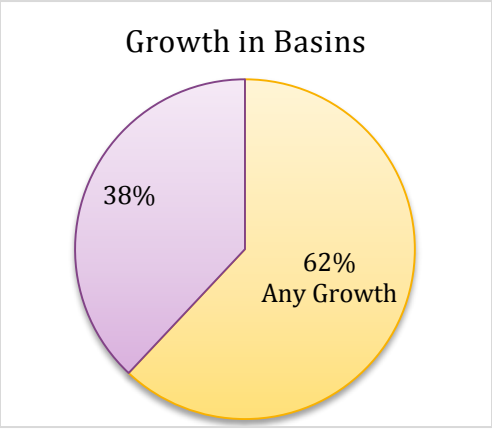
Cineas, et al, conducted a study to compare the effectiveness of two methods of patient bathing and incontinence care on overall cost and CAUTIs. The study included a retrospective review of data for comparative analysis, removal of bath basins and cleansing supplies, and institution of a new prepackaged bathing and incontinence clean-up protocol and supplies. The team was able to show a 59% reduction in CAUTI during the study period and an estimated return on investment of $33,234.[14]

Basin sampling results

Marchaim's study showed:





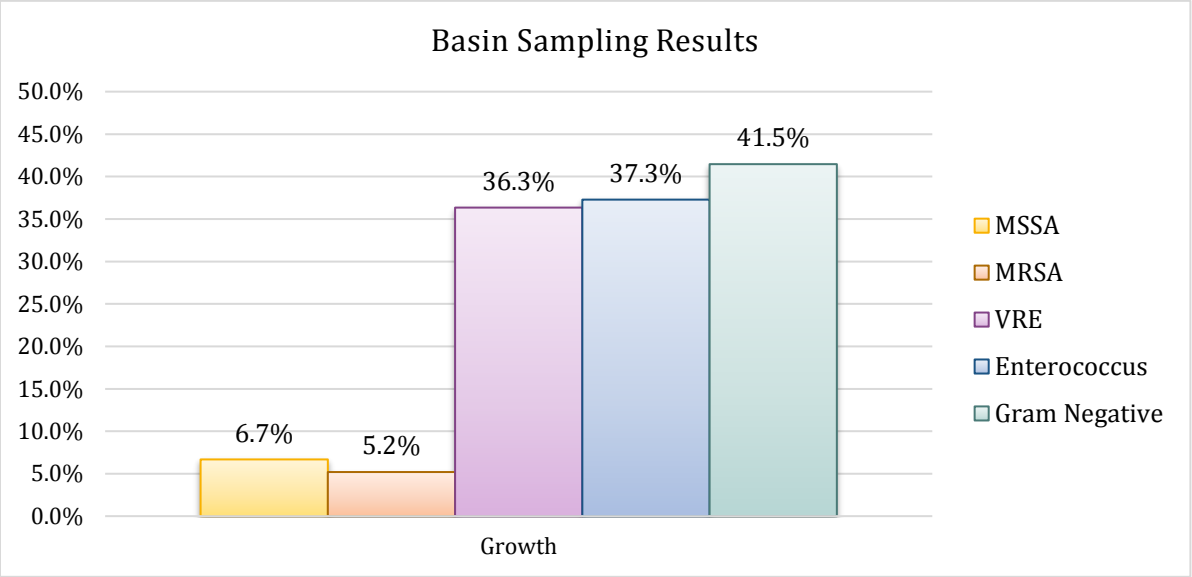


Of the basins sampled, 1,103 total, 63% tested positive for "any growth," meaning the "growth of any of the following was included: Enterococcus spp (not necessarily resistant to vancomycin), S aureus (not necessarily resistant to methicillin), or gram-negative bacilli."[4]

Similarly, 100% of the hospitals who had basins sampled tested positive for "any growth."[4]

Sage Products provides basin sampling testing services to hospitals interested in understanding the potential risk of basin contamination in their facilities. 466 individual hospitals have participated, with 6,196 basins sampled to date. Of the basins sampled, 41.5% tested positive for Gram negative bacteria. This finding is consistent with the standard uses of the bath basin, such as incontinence clean-up and emesis collection.

In all, 61% (3,782) of the basins sampled tested positive for some bacteria and 39.4% (2,440) of the basins tested positive for one bacteria PLUS a multi-drug resistant organism. Given the role of multi-drug resistant organisms in the prevalence of healthcare acquired infections, mitigating the potential risk for exposure to these organisms is paramount to infection prevention efforts. Each hospital tested had at least one positive basin.



Conclusion

Hospitals are facing unprecedented scrutiny in the form of quality and financial penalties for higher rates of healthcare-acquired infections. Simple strategies to provide basic care can equate to improved outcomes, both clinically and financially.

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