

## **Perception of Faucets Role in Healthcare Infection Control Strategy**

*A careful examination of what the latest studies are suggesting*

A recent study, conducted by Johns Hopkins University (reference 1) has raised the question whether electronic faucets elevate the risk of Legionella and other waterborne bacteria in a healthcare facility's bacteria protection strategy.

In summary, this research which has not been peer reviewed, found that 50 percent of cultures of water from 20 electronic, infrared-activated faucets revealed the presence of Legionella spp. In comparison, 15 percent of the cultures from 20 manual faucets tested positive for Legionella. Water from the electronic fittings also had a higher proportion of other bacteria—26 percent as compared to 13 percent for the manual fixtures—but this is not a statistically significant difference.

It was suggested that the complexity of an electronic faucet and the lower dynamic water flow through the faucet were the main reasons for the higher level of Legionella and other waterborne bacteria.

An investigation of select faucets in a healthcare facility was launched after a disruption of the municipal water supply, which typically harbors greater than normal levels of bacterial contamination. Plus, the study acknowledges that dynamic flow of water will bring levels of bacteria back down to normal background concentration.

Just as some of the energy-efficient measures adopted in the 1970s were a catalyst for indoor air quality issues, water-saving measures that incur stagnation may exacerbate problems with Legionella and other waterborne pathogens. The report indicts the internal components in the faucets such as check valves and filter screens as contact points for contamination. There is some truth to this position, but the real culprit is the stagnant water resulting from low or limited use that creates the ideal conditions for bacterial growth.

Because there appears to be a conflict relative to the use of electronic faucets in the healthcare market, this paper will provide a more comprehensive explanation of the relevant issues and hopefully clarify the role of electronic faucets in a healthcare facility's bacteria protection strategy.

## **Legionella background**

There are four primary factors to consider when it comes to infection; the robustness of a person's immune system (healthy versus compromised), the number of bacteria (inoculum), how pathogenic or aggressive the bacteria, and the root of the infection.

Serious infections of the lung (pneumonia) and blood (bacteremia) can be caused by a host of bacteria, such as Legionella, Pseudomonas, and fungi, such as Aspergillus. Although these microorganisms are "normal" inhabitants of water systems and do not harm healthy individuals,

they can be especially dangerous to patients with compromised immune systems. This includes people with cancer, HIV/AIDS, transplantation and burns, as well as the elderly and newborns.

These microorganisms can further contaminate faucets, taps and showers in hospitals. The plumbing system materials also play a role: Elastomers are a great food source for *Legionella* but are found in more than electronic faucets. Biofilms can develop inside the copper pipes, for example, and contribute to bacterial growth.

*Legionella* is not transmitted from person to person; it is always acquired from the environment. Almost all outbreaks of Legionnaires' disease for which an environmental source has been identified were due to inhalation of contaminated aerosolized water. Because people can contract Legionnaires' disease from showers when water coming from the shower containing the *Legionella* bacteria becomes aerosolized, nosocomial infections are increasingly recognized as a primary threat to public health in the U.S. According to the Centers for Disease Control & Prevention (CDC), of the nearly 2 million patients who acquire an infection while in a hospital, about 90,000 die. About one-third of these cases are preventable, the CDC reports. The CDC also notes that 23 percent of all Legionnaires' disease reported in the U.S. during the 1980s was acquired in hospitals, and of these cases, 40 percent died, which is nearly twice the rate for infections acquired outside the hospital. Most hospitals require the use of non-aerated spray heads on faucets, in part, because of the concerns over airborne contaminants.

## **Research discussion**

It's important to note that the most obvious benefit of touch-free electronic faucets is improved sanitation. The absence of handles removes a touch point for spreading dirt or harmful bacteria from one user to the next. Hands-free operation also makes the faucets usable by virtually anyone, regardless of age or physical ability. Another plus is water conservation. Sensor-activated faucets eliminate wasted water by discharging only what the user needs.

The researchers who conducted the latest study said that it appears that standard hospital water disinfection methods, which complement treatments by public utilities, did not work well on disinfecting the complex components within the newer, electronic faucets. They suspect, but have not concluded, that the valves simply offer additional surfaces for bacteria to become trapped and grow.

Because this is such a complex issue, the answers from any single study or collection of studies do not offer clear solutions to controlling this organism—only creating additional questions that require further research.

For example, the American Society for Healthcare Engineering (ASHE) and the Association for Professionals in Infection Control & Epidemiology (APIC) have offered input on the new research findings. In a joint statement they said, "Previous investigations of electronic controlled faucets have raised the issue of infection control and prevention." As a means to offer some perspective ASHE and APIC supplied the following observations:

*1) APIC and ASHE endorse and support the use of the Infection Control Risk Assessment (ICRA) – a multidisciplinary, documented assessment process intended to proactively identify and mitigate risks from infection that could occur during design and construction activities. A key element of an ICRA is identifying the design and location of hand-washing stations. Excerpts of the 2010 Guidelines that address this element are provided in the Appendix. The Guidelines document has been adopted by authorities having jurisdiction (AHJs) that approve plans for design and construction of health care facilities in many states and is used as a reference standard in other states. The 2010 edition does permit electronic (sensor-activated) faucets as this design is consistent with “hands-free” operation. It is recommended that health care facilities implement an ICRA early in the planning phase of a construction or renovation project, when it serves as the forum for assessing risks and implementing design elements aimed at preventing of infection.*

*2) Several studies have found that manual, handle-operated faucets were the source of bacterial infections in patients, including Legionella. **This demonstrates there is no single design feature that can mitigate all risk of cross transmission.** In fact, the findings from one of these studies were incorporated into the 2010 Guidelines (see Appendix).*

*3) Another study of electronic faucets did not find these fixtures to be a source of bacteria. In fact, a sample from a manual, handle-operated faucet was the only one that detected bacteria. Electronic faucets do help with water conservation, which is important as hospitals are an industry noted for high use of water. The hands-free feature of electronic faucets also lessens risk of recontamination of hands after washing as there is no need to manually turn off the water supply after use.*

*4) Why do some studies find a higher likelihood of recovery of bacteria from electronic faucets? This is a complex question, but some feel this is due to the reduced water flow in electronic faucets which makes the flushing effect less pronounced than in a manual, handle-operated faucet. One strategy to minimize risk of contaminants inside the faucet is to ensure the length of the pipes connecting the valve and water outlet is as short as possible. Also, the frequency of use is important. Faucets, whether electronic or manual, that are not used on a regular basis will have stagnant water and low levels of bacteria will increase over time. There may also be some unique aspects to electronic faucets as they have more parts, including a magnetic valve made of rubber, plastic, and polyvinylchloride. These materials are more likely to develop a biofilm, which protects bacteria in the film from disinfectants that have been added to the water.*

In order to address the stagnant water issue, some advanced electronic faucets have the capability to program the control module with the Line Purge function, an automatic, pre-set command to initiate water flow from the faucet every 12 hours since last use for a determined duration. In itself, it is not the solution. If used, however, with an environmental surveillance strategy for Legionella, electronic faucets can help facilities deal with this pathogen where it lives: in the water distribution system.

5) Sydnor ERM, et al. Abstract, SHEA 2011 Scientific Meeting:

*a) This study was presented in an oral session at a scientific meeting. It has not been published in a peer-reviewed, scientific journal. As such it is an interesting study, but any major changes in policy or actions by others should await publication. More details will be revealed in the published article, and peer review always improves the context and significance of findings. This study also needs to be considered in the context of other published studies and evidence-based guidelines.*

*b) This was an in vitro investigation, in which cultures of water were obtained and studied. There were no infections seen in patients with the same bacteria, including Legionella spp., identified at the institution where this study took place. Tap water is not sterile and in most facilities contains low levels of bacteria; these bacteria are a possible source of infection to patients, but actual infections from this source are relatively infrequent in most facilities. Findings similar to those of this study are present in the literature; however, many of these are in vitro investigations that were not associated with infections in patients.*

*c) The trigger for this investigation was a disruption of the water supply from the municipal system that supplies this facility. Disruptions frequently result in disturbance of bacteria present in the pipes, often in a biofilm, that deliver water throughout a facility. This is usually a temporary situation. Restoration and dynamic flow of water will bring levels of bacteria back down to normal background concentration.*

*d) Cultures of water in this study were “first draw,” meaning samples were obtained at the point when the sink water flow was initially activated. The concentration of microorganisms in these samples often is higher as the samples are pulled from water that has been stagnant in the neck of the faucet. Other studies have found that electronic faucets can be programmed to flush this water out each day and the levels of bacteria drop significantly with this step (personal communication, A. Streifel).*

*e) The state in which this facility is located has published recommendations for control of Legionella spp. for water systems in health care facilities through routine cultures of water and periodic disinfection if the bacteria is identified. Other states do not have such guidance, nor does the Centers for Disease Control & Prevention (CDC) recommend routine testing of water for Legionella spp.*

While the recent findings, as well as previous reports, are a cause for concern, more research is needed to validate the risk-benefit ratio of using sensor-activated faucets.

It is conceptually possible that electronic faucets have more internal areas that can hold stagnant water, thus promoting the growth and amplification of microorganisms inside faucet. However, it is well known that Legionella is formed throughout the water supply system of a hospital, and

the removal of faucets may not have a significant impact on colonization by waterborne pathogens.

"It would be helpful to have more research before any widespread recommendations are made about the use of electronic eye faucets," said John Boyce, MD, chief of the infectious disease section at the Hospital of Saint Raphael's Hospital in New Haven, Connecticut, who chaired the session at which the Johns Hopkins study was presented.

"The study was well done, and it's an issue that warrants further investigation," he said. Dr. Boyce noted that because electronic faucets reduce water usage, they have clear benefits. Yet if they also increase contamination of the water supply, the risk of possible increased infection rates might be a concern. "What we really need is documentation of whether increased contamination of electronic faucets leads to increased infection rates," he said.

From an infection control point of view, the lack of electronic faucets does not reduce the concentration of *Legionella* species in the water supply. Thus, removal of or routine cleaning of contaminated faucets may not prevent hospital-acquired infections if the hospital's water supply has been systematically colonized by *Legionella* species.

*For additional information or assistance please contact Sloan at 1.800.982.5839 or [marketing@sloan.com](mailto:marketing@sloan.com) and reference this paper.*

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## References

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## APPENDIX

Excerpts from the FGI *Guidelines for Design and Construction of Health Care Facilities*, 2010 edition (additional details available at: <http://www.fgiguideelines.org>):

### **“\*2.1-7.2.2.8 Hand-washing stations**

#### (1) General

- (a) Hand sanitation dispensers shall be provided in addition to hand-washing stations.
- (b) The number and placement of both hand-washing stations and hand sanitation dispensers [A unit that contains alcohol-based hand-washing rub (ABHR) or other FDA-approved solutions used for hand hygiene] shall be determined by the ICRA.

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#### (4) Fittings

- (a) General hand-washing stations used by medical and nursing staff, patients, and food handlers shall be trimmed with valves that can be operated without hands.
  - (i) Single-lever or wrist blade devices shall be permitted.
  - (ii) Blade handles used for this purpose shall be at least 4 inches (10.2 centimeters) in length.
  - (iii) Care shall be taken in location and arrangement of fittings to provide the clearance required for operation of blade-type handles.
- (b) Sensor-regulated water fixtures shall meet user need for temperature and length of time the water flows. Electronic faucets shall be capable of functioning during loss of normal power.
- (c) Sensor-regulated faucets with manual temperature control shall be permitted...

### **\*2.1-8.4.3.2 Hand-washing stations**

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#### (2) Sinks

- \*(a) Sinks in hand-washing stations shall be designed with deep basins to prevent splashing to areas where direct patient care is provided, particularly those surfaces where sterile procedures are performed and medications are prepared.
- (b) The area of the basin shall not be less than 144 square inches (365.76 square millimeters), with a minimum 9-inch (22.86-mm) width or length.
- (c) Hand-washing basins/countertops shall be made of porcelain, stainless steel, or solid surface materials. Basins shall be permitted to be set into plastic laminate countertops if, at a minimum, the substrate is marine-grade plywood (or equivalent) with an impervious seal.
- (d) Sinks shall have well-fitted and sealed basins to prevent water leaks onto or into cabinetry and wall spaces.
- (e) The discharge point of hand-washing sinks shall be at least 10 inches (25.40 centimeters) above the bottom of the basin.
- (f) The water pressure at the fixture shall be regulated.
- (g) Design of sinks shall not permit storage beneath the sink basin.”