Keeping Healthcare Linen Clean

Best Practices for Laundry Sanitization

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Table of Contents

Protecting Patients and Residents: A Large Load to Carry

As part of their promise to provide high-quality long-term and short-term care, healthcare operations, like hospitals and long-term care facilities, must supply individuals with clean linens on a routine basis. Patients and residents need access to items including gowns, towels, bedsheets and blankets. As hospital admissions increase and the U.S. population ages, these facilities will require even greater volumes of clean linen.

In fact, in the United States, there are currently more than 6,000 hospitals with room for nearly 1 million patient beds[1] and 230,000 private physician practices.[2] The average patient in a hospital uses between eight and 20 pounds of linen per day[3], which adds up to an estimated total of around 5 billion pounds of linen per year.[4] Additionally, there are 15,600 nursing homes in the country that care for 1.3 million residents.[5] As the baby boomer generation ages, there may be an even greater demand for these facilities. The number of people age 65 and older is expected to nearly double to about 84 million by 2050, up from 43 million in 2012.[6]

With so much linen cycling through the healthcare system, hospitals and long-term facilities can't risk providing patients and residents with linens contaminated with infectious pathogens. Although healthcare is one of the most regulated industries in the United States, outbreaks within these types of environments can spread more easily and rapidly than in other settings. Patients and residents can be more prone to infections due to exposure, and they may have compromised immune systems due to pre-existing medical conditions. They are also at risk for Healthcare-associated Infections (HAIs), which are infections that people acquire in healthcare environments while receiving care for another condition.

Contaminated textiles can facilitate the spread of disease and increase the number of HAIs in healthcare facilities. Improperly laundered linens can contain high numbers of microorganisms from bodily substances, including blood, urine, skin, stool and other fluids. While laundering does not remove 100% of microorganisms, the combination of temperature, time, chemical and mechanical action significantly reduces the number of microorganisms to safe levels by killing or inactivating harmful pathogens like bacteria, fungi or viruses.

There are two approaches to consider when implementing an effective laundry program. Some organizations, like those in the long-term care business, have the ability to clean linens in their own on-premise laundry (OPL) facilities. Many other healthcare facilities, like hospitals,

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[1] https://www.aha.org/statistics/fast-facts-us-hospitals

[2] https://en.wikipedia.org/wiki/Group_medical_practice_in_the_United_States#cite_note-2

[3] http://www.uschemical.com/wp-content/uploads/2016/04/L000173_Laundry_Sanitation.pdf

[4] https://www.cdc.gov/infectioncontrol/guidelines/environmental/background/laundry.html

[5] https://www.cdc.gov/nchs/fastats/nursing-home-care.htm

[6] https://www.reuters.com/article/us-usa-aging-census/number-of-u-s-elderly-to-double-by-2050-reports-idUSKBN0DM1BS20140506

outsource their laundry to a trusted service provider. An average-sized laundry plant processes anywhere from 19,000 to 64,000 pounds of laundry each day.[7] The Textile Rental Services Association estimates that the commercial U.S. textile service industry processes around 15 billion pounds of laundry annually, with 3 billion of this total tied to the healthcare industry.

Given the sheer volume of linens that require cleaning and sanitization, it's important for laundry managers to understand proper linen management and how potentially harmful pathogens can spread from contaminated textiles to people. Healthcare facilities should confirm that their laundry strategy meets important standards or implement a comprehensive program to maintain control of the process.

Whether outsourced or on-site, laundry programs should re-emphasize proper sorting techniques, highlight the importance of personal protective equipment (PPE) and review their wash formulas and chemical dispensing systems to make sure the correct amount of chemical is used to remove these pathogens. Remote monitoring technology and advanced washers and dryers will help ensure that patients and guests in healthcare facilities have access to clean linens when they need them most. This technology will also provide accurate records for compliance purposes if issues do arise.

What's Hiding in your Linens?

The last thing a healthcare provider wants to do is compromise patient or resident safety by failing to adequately clean or sanitize linens. This is equally true during a global pandemic and during times when the risk of outbreaks is low. Unfortunately, improper laundering practices have been indicted as a contributor in multiple disease outbreaks. This demonstrates the very real risk of soiled linens transferring infectious agents to laundry workers, patients or residents.

To name a few examples, a study published in the journal of *Infection Control & Hospital Epidemiology* uncovered how cotton sheets on patient beds were linked to the spread of Clostridium difficile (C. diff), even after being washed.[8] C. diff can cause symptoms ranging from diarrhea to life-threatening inflammation of the colon.[9] Similarly, all laundry workers at a nursing home in Alabama were infected with a severe nonbacterial gastroenteritis outbreak as a result of incorrect laundering. The outbreak caused illness in 100 people and two of the residents died.[10]

[7] https://www.cdc.gov/infectioncontrol/guidelines/environmental/background/laundry.html

[8] https://www.modernhealthcare.com/article/20181016/NEWS/181019914/hospital-bed-linens-could-be-source-of-c-difficile-outbreaks

[9] https://www.mayoclinic.org/diseases-conditions/c-difficile/symptoms-causes/syc-20351691

[10] http://www.uschemical.com/wp-content/uploads/2016/04/L000173_Laundry_Sanitation.pdf

Furthermore, a recent study found that privacy curtains hung in patient rooms became increasingly contaminated over time. The study tracked the contamination rate of 10 freshly laundered privacy curtains in a Canadian hospital. When the curtains were first hung, they had minimal contamination. By the fourteenth day, 87.5% of the curtains tested positive for MRSA.[11] This research demonstrates the need for regular laundering, as linens in healthcare settings can become increasingly contaminated with each day.

The infections caused by soiled linens are most commonly viral, such as smallpox, hepatitis, coronavirus and norovirus. Viruses are highly infectious, often passing from person to person through respiratory droplets, and are resistant to drug therapy. Unlike bacteria, viruses are not living entities and they rely on other living cells to multiply.

Dirty linens can contribute to the spread of coronavirus disease 2019 (COVID-19). SARS-CoV-2, the virus that causes COVID-19, is an enveloped virus like influenza. These viruses can live for hours or even days on surfaces made from a variety of materials, including textiles. COVID-19 is the first known pandemic caused by a new virus and is spread through person-to-person contact, as well as indirectly from surfaces to people.[12] Recently, a nursing home in Seattle that failed to deliver clean linens to patients reported 129 coronavirus cases among residents, staff members and visitors.[13] The handling and processing of the linen in this facility was among the factors cited for the rapid spread and significant human health toll.

Because many nursing home residents already have conditions that compromise their immune system, such facilities are especially vulnerable to diseases like COVID-19. Among people who have become infected with COVID-19 in a long-term care facility, there is a sobering death rate of nearly 20%. Many doctors think that up to one-third of long-term care residents could eventually die of COVID-19-related illness if preventative actions are not taken.[14] Hospitals, which often have patients afflicted with similar immunocompromising conditions, have also suffered disproportionately during the coronavirus outbreak. Many are facing equipment and staff shortages. With COVID-19 spreading so rapidly, laundry facilities must do their part to make sure soiled linens are not further contributing to the transmission of a disease that can impact both patients and healthcare workers.

Similarly, in 2014 the World Health Organization declared the Ebola outbreak that spread to several countries a Public Health Emergency of International Concern.[15] When the Ebola virus

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[11] https://www.infectioncontroltoday.com/transmission-prevention/hospital-privacy-curtains-and-bed-sheets-soft-surface-contamination-and

[12] https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/summary.html

[13] https://www.msn.com/en-us/news/us/wash-nursing-home-faces-dollar611000-fine-over-lapses-during-fatal-coronavirus-outbreak/ar-BB1251sw?ocid=spartandhp

[14] https://www.forbes.com/sites/howardgleckman/2020/04/06/the-covid-19-nursing-home-nightmare/#504618ba60ac

[15] https://www.cdc.gov/vhf/ebola/history/2014-2016-outbreak/index.html

was classified as a Category A infectious substance, healthcare facilities were instructed to discard all linens used in the care of infected patients as medical waste.[16] In serious situations, removing linens from a laundry program, rather than laundering them, can be the best course of action to protect people during an outbreak or pandemic. At this point, linens that are suspected of being soiled with SARS-CoV-2, influenza or HIV are not being considered hazardous waste that must be incinerated. Instead, proper wash formulas and practices are effective ways to combat these pathogens.

Considerations for Properly Sanitizing Linens

The correct approach to laundering can help limit the spread of infectious outbreaks and quite literally save lives. Following procedures for linen laundering effectively sanitizes these soiled items and safely returns them to healthcare facilities, even in high-risk environments. On-premise and industrial laundering programs should consider the following components to ensure laundering reduces the rate of fungal, bacterial and viral survival on linens:

- **Wash temperature:** Higher wash temperatures kill and remove more microorganisms. Moderate temperatures can inactivate most viruses, but more resistant viruses, like hepatitis B, may require higher wash temperatures. Studies have shown that some microorganisms can survive temperatures as high as 160 degrees Fahrenheit for periods less than 25 minutes. To give you assurance that the wash process removes as many microorganisms as possible, check that your washer reaches the desired temperature for the appropriate amount of time. One chemical manufacturer's recommendations on washing temperatures is outlined below:

	Ideal Conditions (with Bleach)	**Minimum Conditions (no Bleach)**	**Minimum Conditions (with Bleach)**
Soiled Linen	150°F for 25 minutes	130°F for 25 minutes	120°F for 8-10 minutes
Contaminated Linen	160°F for 25 minutes	140°F for 25 minutes	120°F for 10-13 minutes

- **Washer mechanics:** Certain types of pathogens, like viruses, adhere less effectively to linen than bacteria. Thus, viruses are removed more easily by the mechanical action of the washer. In fact, the mechanical action of the washer does as much to remove the viruses from the linen as the temperature and chemicals do to inactivate the viruses. Not all washers are built the same. Older washers may not use enough water or operate mechanically well enough to effectively remove viruses and bacteria. For example, a continuous batch processing machine (also known as a tunnel washer), is designed to handle heavy loads of laundry and use less water than washer/extractors. If this is not properly managed, it can result in higher spore counts remaining on linen and within the

[16] https://www.cdc.gov/vhf/ebola/clinicians/cleaning/handling-waste.html

washer itself. In one specific instance documented in *Epidemiology and Infection*, a United Kingdom-based hospital using a tunnel washer had the habit of leaving partially processed linen in the tunnel overnight. This allowed B. cereus spores to subsist in the linen and spread to other items washed in the same machine.

- **Chemical concentration:** Bleach (sodium hypochlorite) is often added to the wash process to sanitize and bleach linen. When paired with high wash temperatures, bleach can quickly kill pathogens. However, not all laundries utilize sodium hypochlorite, opting instead to use hydrogen peroxide for bleaching. Peroxide is safe to use on colored fabrics, but when used at the same levels of sodium hypochlorite, does not offer antimicrobial benefits in laundry. Additionally, without proper dilution rates, detergent may not effectively remove microorganisms. A study in *Applied and Environmental Microbiology* suggests that water temperatures of 120 degrees Fahrenheit to 140 degrees Fahrenheit were as effective as temperatures of 167 degrees Fahrenheit in the presence of 50 - 250 ppm chlorine for 8 to 11 minutes.

- **pH levels:** Rapid pH shifts can kill certain microorganisms, such as fungi. When dealing with a pH-sensitive pathogen, it's important to adjust laundry pH levels accordingly. For example, soaring rapidly to a pH of 5 or below has proven effective.

- **Dryer temperature:** Drying temperatures are generally high, helping to drop bacterial counts by as much as 95%. Again, ensure that your equipment reaches the necessary temperature to inactivate germs.

- **Handling of laundry:** A laundry facility that handles linen contaminated with bodily fluids must comply with the Occupational Safety and Health Administration (OSHA) Bloodborne Pathogen Standard[17], and have a comprehensive laundry program in place that fulfills the standards accordingly. To implement this, laundry management must train employees on how to handle and sort healthcare linen and properly use laundry equipment. Employers should provide the necessary PPE, such as gloves, gowns and masks. Laundry employees should not eat, drink, smoke or bring unauthorized persons near the laundry processing area. Finally, laundries should ensure that clean laundry is properly transported and stored to avoid contamination before these linens are used again. Any item that is improperly sorted or handled post-washing needs to be rewashed according to the site's procedures.

A Smarter Way to Clean Laundry

[17] https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1030

The right balance of wash agitation, time, temperature and chemical is key to removing stains and sanitizing linens like hospital gowns, towels and blankets. Chemical dispensing systems provide the correct measurements every time and offer laundries numerous benefits, including:

- **Accuracy**: While it's important to keep linen visibly clean, it's also essential to remove microscopic pathogens that can't be seen by the naked eye but may be present on items like hospital gowns. Dispensers provide accurate doses that are necessary for achieving cleanliness when dealing with potentially contaminated linens. Some dispensers on the market even utilize a flowmeter to ensure the exact amounts are delivered, triggering an alarm if the chemical formula is not dosed properly.

- **Reliability:** Although peristaltic pumps have many advantages, including affordability and flexibility, natural deterioration from chemical contact can wear pump tubes down every three to six months. When pump tubes lose thickness and elasticity and are not regularly replaced and recalibrated, this results in less effective chemical delivery. In a pandemic environment, regular site visits may not be feasible, making low-maintenance critical. To avoid dosing and downtime issues, laundry managers should look for systems that require minimal maintenance, including those that do not require the use of squeeze tubes.

- **Compliance**: Dispensers that meter and store records of each load can be useful in compliance situations where it is critical to prove that the proper amount of chemical and wash time was achieved.

- **Safety:** Some chemicals can result in burns or skin and eye irritation. Utilizing dispensing systems eliminates employee contact with potentially hazardous chemicals. As a result, this reduces the risk of accidents and the need for medical attention. Prioritizing safety benefits employee retention and the bottom line.

- **Sustainability savings:** By precisely dosing the correct amount of chemical and water, healthcare facilities can reduce wasted resources. When dispensers dose the right amount of chemical, this helps ensure that linen emerges clean on the first wash and is not damaged. If linen is not clean and sanitized, it must be rewashed. Reducing rewash rates helps laundries save water, energy, chemical and time, while prolonging linen life. For facilities that process large volumes of laundry, even these small improvements can result in big sustainability savings over the long term.

- **Cost savings:** Chemical dispensers can also help healthcare operations cut back on certain costs. Providing more accurate and reliable chemical doses delivers the proper clean, which reduces water and energy use, and translates into long-term savings for the bottom line.

Smart dispensers provide remote access and control for critical laundry data in real-time. Managers can install smart dispensers, like Hydro Systems' EvoClean and Dositec Central Dosing Systems with Hydro Connect, that provide important data about the laundry process, such as the number of alarms that occurred during a shift and chemical usage.

Facilities can also use dispensers to run laundry programs more effectively. By providing real-time information on production, turn-times and efficiencies, dispensers provide an opportunity for continuous improvement. Implementing recommended changes helps further reduce costs and downtime so the laundry can operate as smoothly as possible.

The Right Formula for Laundry Program Success

In a world where coronavirus can rapidly spread from surfaces to people and 1.7 million people contract HAIs per year[18], it's important for healthcare facilities of all types to do everything in their power to reduce the spread of pathogens.

Clean linen is one factor that helps to create a home-away-from-home for residents in long-term care facilities. In hospitals, they are an essential element used in every patient room. Healthcare facilities must have the right procedures in place to ensure proper sanitization of linens, as contaminated linen can impact the health and well-being of healthcare patients and residents. Laundries should take key factors into account – like linen handling processes, employee training, wash temperatures, chemical formulations and the type of dispensing solution utilized in their facility, among others. Dispensing equipment that is accurate, reliable, easy-to-use and connected is also critical for achieving clean linen and preventing the spread of disease-causing organisms.

To maintain the health and safety of patients, residents and employees, it's essential to have a comprehensive laundry program in place. Chemical dispensers are a key part of a successful laundry program, as they ensure properly laundered linens and help reduce the spread of disease. By protecting the well-being of everyone and helping laundries become more cost-effective and sustainable, this equipment is a true win-win for healthcare facilities and those they serve and employ.

For more information about dispensing equipment for your laundry program, visit hydrosystemsco.com or contact 800.543.7184.

[18] https://patientcarelink.org/improving-patient-care/healthcare-acquired-infections-hais/