Health Care Leadership Whack-a-Mole

How mattresses can complicate patient safety initiatives

HIDING IN PLAIN SIGHT

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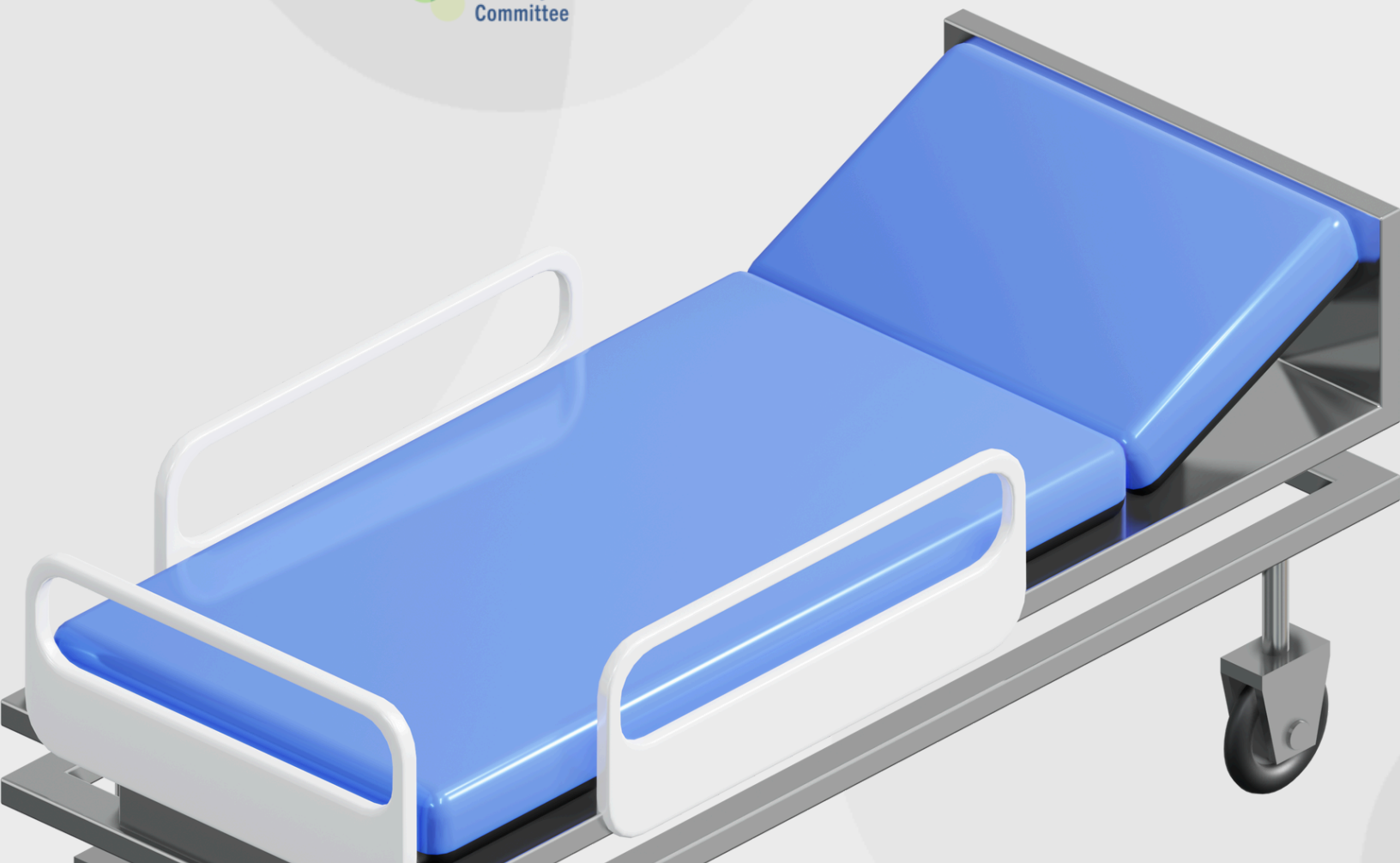


INTRODUCTION

Mattresses and beds impact all aspects of care, are the most common touchpoints for patients and move throughout a hospital. The average acute care bed supports 80 patients annually and travels through at least three rooms or units monthly.[1-3] In 2020, the Centers for Disease Control (CDC) recognized environmental surfaces, in addition to hand hygiene, as a critical area of focus for infection prevention efforts.[4]

Health care full-body support surfaces—mattresses—and their reprocessing are creating an untenable situation for health care leadership committed to patient safety and efficient resource stewardship. Since the turn of the millennium, pressure injuries have significantly decreased due to various care initiatives, including the introduction of softer, porous mattresses. However, these mattresses present greater challenges in terms of cleaning and disinfection, especially when dealing with aggressive multidrug-resistant organisms (MDROs).

Current strategies for mattress reprocessing are falling short. Despite ongoing efforts, surface covers wear out faster than expected, compromising the mattress core. When the cover is damaged, fluid can leak in and out of the mattress, becoming a source of infection transmission and a biohazard for patients. This creates another significant patient safety issue and additional expense for the health care facility.

The images below highlight the critical issue: three mattresses with compromised covers that failed inspection. In each case, the attached mattress covers failed, allowing bodily fluids to penetrate the mattress core. Naturally, fluid movement can go both ways; fluids leaking into the mattress core can also seep out onto the next patient assigned to that bed.

Image 1: Embedded stain on top of integrated mattress cover

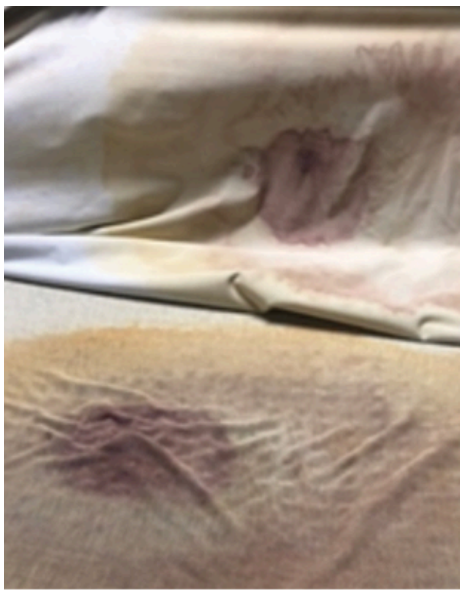
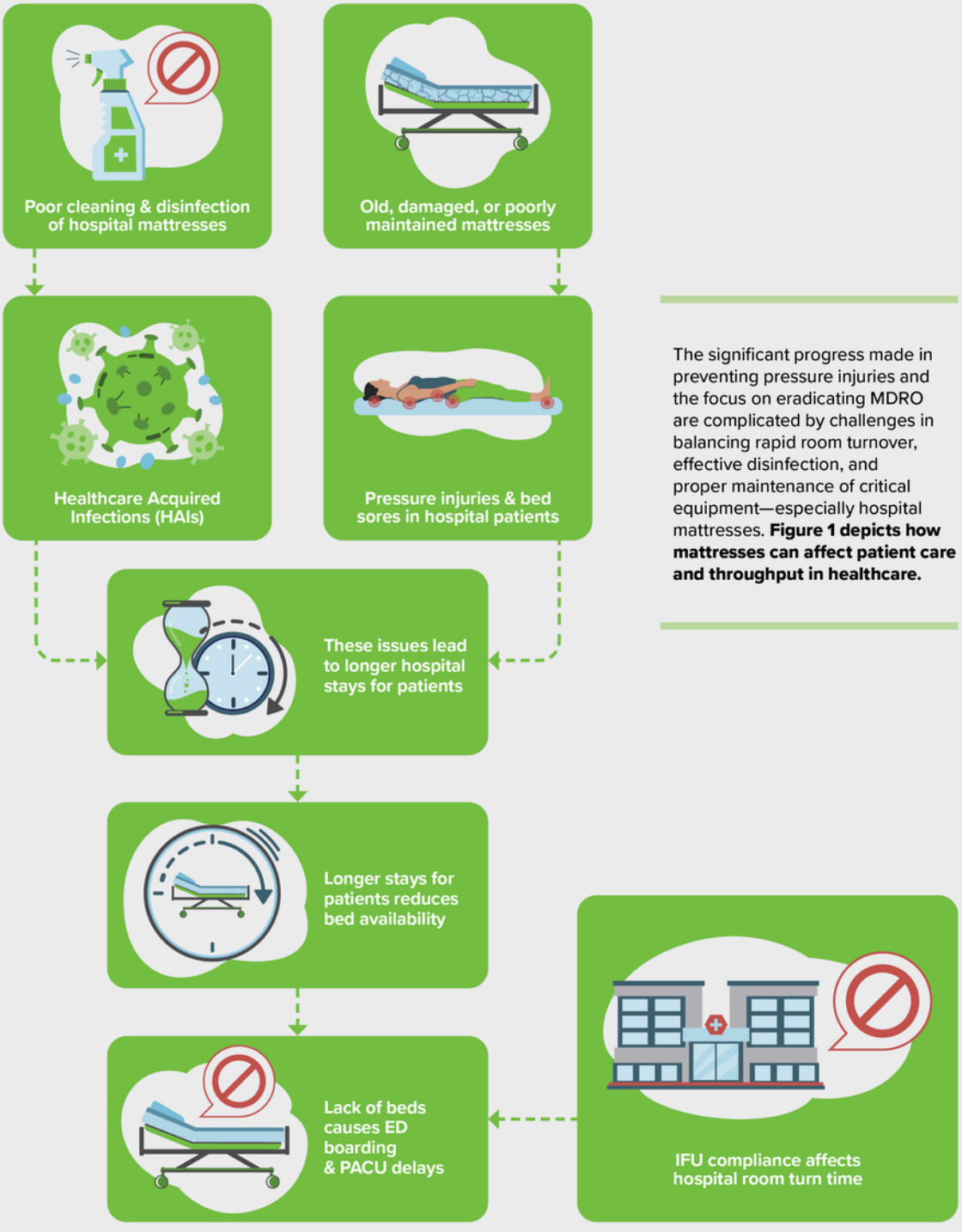


Image 2: Staining on bottom of integrated mattress cover and top of fire barrier

Image 3: Staining on bottom of integrated mattress cover and top of fire barrier

The significant progress made in preventing pressure injuries and the focus on eradicating MDROs are complicated by challenges in balancing rapid room turnover, effective disinfection and proper maintenance of critical equipment—especially hospital mattresses. *Figure 1* illustrates how mattresses can impact patient care and throughput in health care.

Figure 1: The Availability of Hospital Beds Affects Every Aspect of Patient Care



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ADDRESSING PRESSURE INJURIES WITH SOFTER MATTRESSES

In 2008, Centers for Medicare Services (CMS) designated pressure injuries in health care settings as "never events"—serious, preventable medical errors that should never occur.[5] Preventing these incidents is crucial for patient safety and directly impacts reimbursement.[6]

To help prevent pressure injuries, bed and mattress manufacturers began producing softer, air-permeable mattresses with polyurethane coatings rather than the original hard, non-porous vinyl surface. The polyurethane surface can help reduce skin maceration by allowing moisture vapor to pass through, providing a cooler patient surface. When the mattress is new, the fabric coating is fluid-proof while still allowing moisture vapor to pass through; however, that soft, porous fabric is much more delicate, as the new covers are only 1/40th of an inch thick.[7]

Although these mattresses provide significant clinical benefits, they also have certain limitations. The EPA's List K (*Table 1* in the appendix) shows that most microbicidal agents, including those aimed at *C. diff*, are specifically formulated for hard surfaces, rendering them unsuitable for modern mattresses.[8a] Using these disinfectants can damage the mattress cover, allowing fluids and moisture to seep into the mattress core, potentially resulting in damage that undermines their ability to prevent pressure injuries.[9]

In addition to the fact that **no EPA List K disinfectant is meant for soft, porous surfaces**, Thurman points out that most mattress manufacturers recommend using a disinfectant with a pH of 5-9 to avoid damaging the surface materials. Yet the recommended dilution of bleach to kill *C. diff* results in a pH of 11-13.[9] One major mattress manufacturer just recalled mattresses to reissue reprocessing instructions that limit the use of bleach to six times over the life of the mattress cover.[10]

[a]Lists provided by the EPA are not inclusive of all products that may qualify

AGGRESSIVE DISINFECTION TO ADDRESS HEALTHCARE-ACQUIRED INFECTIONS (HAIS)

HAIs are another CMS-declared “never event.”[5] Virulent MDROs such as methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant enterococci (VRE), and *C. diff* are proliferating, and biofilms that encapsulate the pathogens are making them more difficult than ever to eradicate.[11] To prevent the spread of these MDROs and the infections they cause, health care facilities have intensified their disinfection efforts. Improperly used disinfectants can erode the waterproofing of mattresses and allow for cross-contamination, putting patients at risk for a CMS “never event.”

Numerous studies link patient infections to the previous mattress occupant. Cohen et al. found that a patient is 5.83 times more likely to contract an HAI if the previous bed occupant had an infection.[12]

Health care facilities are also enhancing their disinfection efforts, recognizing the risks posed by asymptomatic *C. diff* patients, who can contaminate environments and endanger future room occupants. Witt's research showed that mattresses used by *C. diff* patients can remain a source of contagion 90 days later, even after multiple rounds of cleaning and disinfection. This has led to heightened cleaning and disinfection efforts for mattresses that facilities might otherwise regard as non-critical medical devices (which require a lower level of disinfection).[13,14]

THE PUSH FOR QUICKER ROOM TURNOVER AFTER TERMINAL DISCHARGE

Facilities face pressure to reduce the time to terminally clean rooms at discharge in order to enhance patient throughput. Many operate under the misunderstanding that a one-step, wipe-and-walk approach is adequate for disinfection. According to a 2019 survey by the Association for Professionals in Infection Control and Epidemiology (APIC), 86% of infection preventionists indicated that their hospitals employ a wipe-and-walk method for mattress reprocessing between patients.[15]

Despite mattresses being considered non-critical medical devices, they still require intermediate-level disinfection due to potential contact with blood and bodily fluids. Intermediate disinfection as defined by the CDC is a process that removes 99.9999% of vegetative bacteria and 99.9% of mycobacteria.[14] However, it is important to note that the FDA does not require the device manufacturer to validate a process for removing *C.diff* spores.[16] According to their instructions for use, hospital bed manufacturers require a 5-6 step process to achieve this level of disinfection. *Figure 2* illustrates these steps with cleaning and disinfection being distinctly different processes. Dwell time is a crucial aspect of efficacy, and rinsing mattresses with water is necessary.[15,16]

Figure 2: Steps for proper cleaning and disinfection

According to their instructions for use, hospital bed manufacturers require a 5-6 step process to achieve this level of disinfection. **Figure 2 illustrates these steps with cleaning and disinfection being distinctly different processes.** Disinfectant dwell time is a crucial aspect of efficacy, and rinsing mattresses with water is necessary[15,16]

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The wipe-and-walk approach jeopardizes sufficient disinfection because it does not clean before disinfection, does not allow adequate dwell time and does not include a rinse and dry step. This approach also contributes to mattress breakdown, which can occur in less than two years.[7] Yet, adding these steps slows turn time by approximately 20-40 minutes.

Reprocessing mattresses is complicated for Environmental Services (EVS) staff, as each manufacturer specifies different disinfectants per their MIFU. This means EVS may need to stock multiple disinfectants and change products based on the bed type. The ECRI Institute acknowledges these discrepancies and suggests informing EVS about the bed type and required disinfection level.[19]

Manufacturers caution against mixing disinfectant technologies without rinsing, as off-gassing may occur, creating a safety issue for staff. Residual disinfectants remaining on patient surfaces can lead to skin damage.[20]

This wipe-and-walk method does not guarantee proper disinfection. Numerous studies have shown that mattresses remain contaminated even after terminal cleaning.[16,21]

A prospective multicenter trial involving 23 acute care hospitals by Carling, Parry and von Beheren identified the thoroughness of terminal cleaning averaged 49% of surfaces.[13] In a separate MRSA study, Blythe et al. reported environmental contamination in the rooms of 73% of infected patients and 69% of colonized patients.[14]

Hooker collected samples from 38 hospital beds using only traditional sheets during patient use to determine the level of mattress contamination after terminal cleaning. Their results revealed an insufficient reduction in FDA-required disinfection of vegetative bacteria. Additionally, they identified several pathogens in their samples known to significantly contribute to HAIs, including MRSA and VRE. This cleaning and disinfecting failure can lead to an increased transfer of MDROs and infections to subsequent patients.[21]

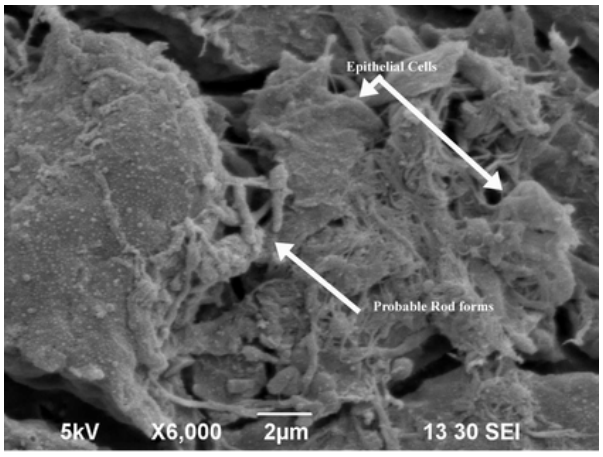

Image 4, SEM-image: *Bacteria in fissures on mattress surface caused by disinfectant damage.*

In addition, the wipe-and-walk method is not included in mattress MIFUs. CMS requires MIFU compliance as part of its Condition of Participation agreement with a hospital. The Joint Commission has also reinforced the importance of following the MIFU for mattress reprocessing in its guidelines effective 7/1/2024.[22] Details of the Joint Commission guidance and other regulatory considerations are included in *Table 2* in the appendix.

Not following the instructions for use voids the manufacturer's warranty and can negate the clinical benefit being sought by the original mattress selections due to mattress failures.[17,18] One manufacturer has stated: "If a patient is not removed from a damaged surface, this defect (leaking mattress) may also lead to patient exposure to excessive moisture and/or pressure, shear or friction of bony prominences, which may cause discomfort and increase the risk of skin breakdown or pressure ulcers." [23]

WHACK-A-MOLE: THE UNINTENED CONSEQUENCES OF DOING THE RIGHT THING

Once a mattress integrated cover has failed and fluids permeate the mattress core, the evaporative capacity is altered and the clinical benefit diminished.[24]

All the steps health care leaders take in the interest of better patient care have unintended consequences that undermine these very initiatives. Softer, more permeable mattresses and the increased use of harsh disinfectants to combat MDROs, along with pressure to decrease room turnover times, have caused mattress covers to wear out faster than they should. Damaged mattresses allow bodily fluids and bacteria to seep in and out of the mattress core, making decontamination impossible. This creates another significant patient safety issue while also compromising the clinical benefit of modern mattresses.[7]

Image 5: *Blood and bodily fluid ingress contaminating internal components.*[9]

Images 6-7: *Blood and bodily fluid ingress contaminating internal components.*[9]

A 2021 peer-reviewed study evaluated 727 mattresses across four midwestern hospitals. Researchers found 72% of mattresses were damaged. Of these, 47% needed the mattress cover replaced, and 25% required the entire mattress (cover and core) replaced. 7% of the mattresses that needed to be replaced were less than one year old.[7]

In a Medline-sponsored study, 5,121 mattresses were evaluated across 85 facilities. 59% of mattresses were red-tagged, with holes or tears, stains or fluid exudation as common issues. [25]

In a 2019 survey conducted by APIC, 52% of infection preventionists reported mattresses leaking a previous patient's bodily fluids–68% of those reporting multiple fluid leakages.[15]

In the last 24 months, organizations involved in direct patient care have brought the mattress conversation forward with evidence that this is a real-world issue.[26-28]

In November 2022, the Washington State Nurses Association (WSNA) filed a complaint with the Washington State Department of Health, citing mattresses as a possible biohazard risk for patients after nurses in a labor and delivery unit discovered blood and bodily fluids seeping from the mattress covers in patients' beds.[26] According to the news report, the hospital knew about the issue and tried to patch the damaged mattresses but ran out of patching material. Applying a patch to damaged mattresses is not an FDA-cleared solution and does not protect patients from the potentially contaminated mattress core.[26]

Image 8: *FOX 13 Seattle.*[25]

Most recently, the Veterans Health Administration (VHA) issued patient safety alert SR-46567 in April of 2024, declaring mattress fluid ingress and egress a patient safety issue. The Veterans Affairs (VA) patient safety alert specifically calls out that "mattresses can lead to hospital-associated infections, patient tissue degradation and/or patient death." [29]

PATIENTS ARE TAKING MATTERS INTO THEIR OWN HANDS

It's not just health care professionals; patients are aware of the problem and taking action. In 2024, two patients used their cell phones to record the state of their hospital mattresses and shared the videos with local news stations. As a result, these broadcasts damaged the facility's reputation. (References include links.)[30,31]

CALL FOR ACTION

Health care leaders must urgently prioritize patient safety by addressing mattress reprocessing with the same dedication given to hand hygiene, ensuring strict compliance with established standards. A critical first step toward progress is openly discussing the trade-offs between pressure injuries, HAI disinfection, room turnover time, patient throughput and mattress reprocessing or breakdowns. Leaders must also hold the industry accountable for innovation that minimizes these trade-offs and enhances patient safety.

Addressing this clear unmet need is essential to safeguard patients, health care providers and staff from damaged mattresses.

APPENDIX

Table 1: EPA's Registered Antimicrobial Products Effective Against *C. diff* Spores [List K][8]

Registration Number	Active Ingredients/s	Product Name	Company	Contact time in Minutes (time surface should remain wet)	Formulation Type	Surface Types	Use sites (Hospital, Institutional, Residential)
10324-214	Hydrogen Peroxide and Paracetic Acid	Maguard 5626	Mason Chemical Company	2	Dilutable	Hard Nonporous (HN)	Institutional; Residential
11346-2	Sodium Hypochlorite	Clorox HL	The Clorox Company	5	Dilutable	Hard Nonporous (HN)	Hospital; Institutional; Residential
11346-3	Sodium Hypochlorite	Clorox HW	The Clorox Company	5	Ready-to-use/Wipe	Hard Nonporous (HN)	Institutional
12120-4	Hydrogen Peroxide; Peroxyacetic Acid (Peracetic Acid)	SSS Sporicidal Disinfectant Cleaner	Standard Sanitation Systems, Inc.	2	Dilutable	Hard Nonporous (HN)	Hospital; Institutional; Residential
1672-65	Sodium Hypochlorite	Austin A-1 Ultra Disinfecting Bleach	James Austin Company	10	Dilutable	Hard Nonporous (HN)	Hospital; Institutional; Residential
1672-65	Sodium hypochlorite	Austin A-1 Ultra Disinfecting Bleach	James Austin Company	10	Dilutable	Hard Nonporous (HN)	Hospital; Institutional; Residential
1672-67	Sodium Hypochlorite	Austin A-1 Concentrated Bleach 8.25%	James Austin Company	10	Dilutable	Hard Nonporous (HN)	Hospital; Institutional; Residential
1677-129	Hydrogen Peroxide; Peroxyacetic Acid (Peracetic Acid)	Oxonia Active	Ecolab Inc.	5	Dilutable	Hard Nonporous (HN)	Hospital; Institutional; Residential
1677-129	Hydrogen peroxide; Peroxyacetic acid (Peracetic acid)	Oxonia Active	Ecolab Inc	5	Dilutable	Hard Nonporous (HN)	Hospital; Institutional
	Hydrogen Peroxide; Peroxyacetic						

This snapshot of the 88 entries on List K illustrates that disinfectants are not designed for soft, porous surfaces.

However, depending on the manufacturer's reprocessing IFU, disinfectants can be used. A facility may need multiple disinfectants in its supply closet because manufacturers validate specific disinfectants for different beds. Recognizing the impact of disinfectants on these soft support surfaces, manufacturers have begun to **adjust MIFUs to limit the number of times a disinfectant can be used over the life of the integrated mattress cover.**

For the complete list, visit US EPA at **https://www.epa.gov/pesticide-registration/epas-registered-antimicrobial-products-effective-against-clostridioides**.

APPENDIX

Table 2: Regulatory Considerations

NEW JOINT COMMISSION STANDARD IC.06.01.01 EP3[22]	*Undamaged hospital bed mattress covers are cleaned and disinfected according to manufacturer's instructions for use.* **Key Elements:** Damaged, worn or visibly stained hospital bed mattress or mattress covers are removed from service and cleaned, disinfected, refurbished or discarded in accordance with the manufacturer instructions and hospital procedures. **MIFU components include:** • Multi-step cleaning and disinfection process • Verification that integrated mattress cover has not exceeded expected life • External mattress inspection after each patient discharge • Periodic internal mattress inspections
JOINT COMMISSION STANDARD IC.06.01.01 EP3 / CMS STANDARD 2.D4	*Cleaners and disinfectants, including disposable wipes, are used in accordance with manufacturers' instructions (for example, dilution, storage, shelf-life, contact time).* • Use of a wipe and walk disinfection process is not in accordance with the use of a hard surface disinfectant EPA approved claims
OSHA VIOLATIONS[32]	• 1910.10030(b) Engineering controls that remove blood borne pathogens from the workplace • 1910.1310(d)(1) Precautions to prevent exposure to potentially infection materials • 1920.1030(d)(4)(ii)9A) Contaminated work surfaces shall be decontaminated with appropriate disinfectant

Relevant Joint Commission/CMS Crosswalk Standards

JOINT COMMISSION STANDARD[22]	CMS CROSSWALK[22]
IC.06.01.01 EP3	***§482.42 Condition of Participation***
The hospital implements activities for the surveillance, prevention, and control of health care-associated infections and other infectious diseases, including maintaining a clean and sanitary environment to avoid sources and transmission of infection, and addresses any infection control issues identified by public health authorities	Infection prevention and control and antibiotic stewardship

The FDA further reinforces the Joint Commission's standards and importance of following the mattress MIFU in their "Keeping Patients Safe From Contaminated Mattresses" poster found here: **https://www.fda.gov/media/109132/download**.

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