US Healthcare Mattress Integrity

White Paper

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The Problem Statement

US healthcare providers are putting patients at risk by not effectively managing the condition of mattresses. The impact of this mismanagement is not only a decrease in patient confidence, but an increase in healthcare-associated infections, avoidable patient morbidity and mortality, and associated costs.

Soft-surface (upholstered) assets — which we refer to in general as mattresses — are found on patient beds and stretchers, upholstered pads on procedure and examination tables, and upholstered seats on clinical furniture and wheelchairs in hospitals, long-term care centers, outpatient clinics, general practitioners' offices and emergency medical services vehicles. Because mattresses are rarely seen (exposed) by patients, visitors or clinical personnel, and, in the case of stretchers and wheelchairs, move about the facility continuously, they are erroneously considered a low-risk point of organism transmission and may be overlooked in the assessment of environmental risks during environment of care inspections.

This misperception leads to lax management practices and, consequently, a buildup of deficient mattresses. While national statistics are not available for the US, some UK healthcare providers report the accumulated deficiency problem to be as high as 27% of all mattresses in circulation (Stevens, 2012).

Environmental Services, clinicians and senior healthcare leaders are complicit in the perpetuation of the problem through their reluctance to act. Reporting a deficient mattress means extra work for Environmental Services personnel; dealing with the replacement mattress may in turn cause extra work for staff and slow down clinical activity, such as patient admissions or surgical cases, and the personnel required to make the change may not be readily available. Also, staff may be unclear about whom they should inform about a deficient mattress. A "don't ask, don't tell" approach means that senior management remain unaware of the magnitude of, and can therefore avoid dealing with, this unfunded problem.

Why Mattresses Become Compromised

Mattress surfaces are generally made of vinyl or polyurethane surfaces with some nylon. The integrity of a mattress surface can be compromised for a variety of reasons, including accidental damage, inappropriate clinical practice, frequent cleaning with incompatible surface disinfectants and wear from routine use. Common mattress surfaces are incompatible with a number of EPA-registered cleaner-disinfectants. For example, a mattress manufacturer may indicate rinsing a mattress surface with water after cleaning, which is inconsistent with the contact-time requirements of cleaner-disinfectants. A number of professional practice resources also recommend avoid the common practice of using the mattress as temporary hold (pincushion) for sharps.

Why Deficient Mattresses Are a Big Deal

Hospital bed surfaces are considered high-touch surfaces (Reynolds, n.d.). Mattresses are a potential reservoir of pathogenic organisms and can facilitate the transmission of infection (Creamer & Humphreys, 2008). Indeed, a mattress may act as a reservoir if the surface impermeability is compromised (Van der Mee-Marquet et.al, 2006). Cracks, holes and tears in the mattress allow blood and body fluids to penetrate and stain the inner lining or foam core; consequently, a mattress surface may act as a fomite (Reynolds, n.d.). Moist mattress padding and leaks in mattress covers are common findings during outbreaks (Hota, 2004) — one hospital in France reported an end to an outbreak when contaminated mattresses and covers were discarded (Van der Mee-Marquet et.al, 2006).

Damaged mattress surfaces may at times be visible to patients and visitors who observe the changeover of spaces. This may set a negative impression in the minds of patients or visitors as to the overall quality of care. The concern is that apathy toward dealing with damaged mattresses may promote acceptance of other unacceptable facility conditions and tolerance for sub-optimal clinical practices.

The FDA is aware of the mattress deficiency problem. Responding to over 458 reports associated with medical bed mattress covers failing to prevent blood and body fluids from leaking into mattresses (fluid ingress), it stated:

> *"The FDA is concerned that fluid ingress from worn or damaged medical bed mattress covers may be widespread and largely under-recognized by health care providers, health care facility staff, and caregivers" (US FDA, 2013).*

What the Regulators Say

According to The Joint Commission (Joint Comission, 2014), standards governing a facility's infection prevention and control plan require hospitals to use evidence-based national guidelines or, in the absence of such guidelines, expect consensus (Standard IC.01.05.01). The element of performance expectation is that a hospital "reduces the risk of infections associated with medical equipment, devices, and supplies" (Standard IC.02.02.01). Environment of care performance elements require the hospital to identify "safety and security risks with the environment of care that could affect patients, staff, and other people coming to the hospital's facilities" (Standard EC.02.01.01, A 1).

While avoiding prescriptive statements, Joint Commission standards extend to the care and maintenance of mattresses and include measures for cleaning and performing low-level disinfection of medical equipment, devices and supplies, actions to minimize or eliminate identified safety and security risks in the physical environment, and maintenance of all grounds and equipment.

Various US professional practice regulators have identified mattress integrity as a concern and highlight the importance of mattress integrity as a component of patient safety. For example, mattress integrity is an evaluation point in the perioperative environment (AORN, 2013).

The cleanliness and condition of mattresses in healthcare facilities is addressed by the Centers for Disease Control and Prevention (CDC). Their 2003 "Guidelines for Environmental Infection Control in Health-Care Facilities" includes specifc references to the importance of mattress surface integrity. CDC guidance is "supported by certain experimental, clinical, or epidemiologic studies and a strong theoretic rationale" and "is suggested for implementation and supported by suggestive clinical or epidemiologic studies, or a theoretic rationale" (Sehulster and Chinn, 2003).

According to the FDA, "Fluid ingress may occur if mattress covers become worn or damaged from small holes or rips in the fabric or from incorrect cleaning, disinfecting and laundering procedures. The zipper on the cover may also allow fluid to penetrate the mattress. Some reports indicate that if blood and body fluids from one patient penetrate a mattress, they can later leak out from the mattress when another patient is placed on the bed. Patients are at risk for infection if they come into contact with blood and body fluids from other patients. Medical literature shows that damaged and wet (soiled) mattresses can be a source of contamination during infection outbreaks" (US FDA, 2013).

According to the US Department of Health and Human Services, the FDA has classified a hospital (therapeutic) mattress as a class I medical device. As such, a healthcare facility bears the responsibility, through practice and documentation, of ensuring that mattresses are functioning as designed by the manufacturer and will not place patients or employees at risk. Insurance providers will expect healthcare providers to establish appropriate controls. Policy must guide practice to ensure regular inspection of mattresses and appropriate corrective actions for deficient surfaces.

The US Centers for Medicare and Medicaid Services (CMS) indirectly comment on the condition of hospital mattresses by requiring a hospital to ensure its overall environment "is developed and maintained in a manner that provides an acceptable level of safety and well-being of patients, staff and visitors.…[I]n order to ensure an acceptable level of safety and quality, the hospital must identify the equipment required to

> *"meet its patients' needs…the hospital must make adequate provision to ensure the availability and reliability of equipment needed for its operations and services" (US DHHS, 2014).*

CMS goes on to define medical equipment and discuss requirements for inspection, record keeping, documented process and responsibility.

Damaged mattresses may also increase employee exposure to pathogenic organisms. The Occupational Health and Safety Administration (OSHA) requires an employer to provide a work environment "free from recognized hazards that are causing or are likely to cause death or serious physical harm" (US Department of Labor, 1970).

How Big the Problem Really Is (The US National Mattress Deficit)

There is no published data to support the scale of the national US mattress deficit. Some facilities replace all mattresses as soon as the warranty expires (i.e., every seven years). Two UK studies have suggested

the proportion of problem mattresses in the National Health Service to be between 10% and 27% of all its mattresses. However, there is no evidence to suggest these outcomes are transferable to the US healthcare system. For illustrative purposes, if US hospitals replace mattresses according to warranty cycle, this frequency of replacement suggests the magnitude of the problem to be 14%. The number of soft-surface units in US healthcare can conservatively be estimated at over six million units , which translates into more than 850,000 damaged units in circulation. Replacement costs for mattresses and wheelchair seats vary; however, an average estimated cost of $500 per unit means that the national mattress deficiency is a more than $550 million problem.

Compounding the cost impact is the degree to which damaged mattresses are contributing to healthcare-associated infections (HAIs). According to a report published by the CDC, HAIs cost the US healthcare system between $28 billion and $45 billion annually (Scott, 2009).

Current Approach to Managing the Problem

A bed mattress is rarely exposed without linens, except during patient changeover and surface cleaning. While practice varies, Environmental Services personnel are typically responsible for terminal cleaning of clinical spaces and are consequently well aware of the condition of this asset across the facility.

While some facilities plan for mattress replacement (i.e., based on warranty cycles), mattress replacement funding is inconsistent and commonly a last-minute initiative at the end of the fiscal year. There are no national practices when it comes to the management of these assets, and proactive life-cycle management is rare. Mattress replacement can be coordinated by a number of departments, such as Environmental Services, Facility Maintenance, Materials Management or Nursing.

Healthcare facilities generally inventory all assets, including beds, stretchers, examination tables etc. In many cases, however, mattresses are not identified for tracking and will be relocated to different beds as part of normal practices of care and environmental administration.

In view of the fact that there are no published standards for managing this risk potential, we propose a "Protocol for Managing Mattress Integrity" and adoption of new generation solutions.

Condition Assessment

Critical to building an effective strategy that addresses a healthcare facility's mattress deficiency is knowing the overall condition-deficit. Mattresses in all areas of the facility should be inspected before establishing a plan to address the problem. Damage will occur continuously; therefore, inspections should take place at regular intervals (Audit & Effectiveness Assistant / Clinical Governance Facilitator, 2010), and procedures should be in place for the reporting of damaged mattresses to appropriate personnel. Turning mattresses will prolong the life of the asset and provide an excellent opportunity for thorough visible inspection.

Inspecting mattresses should encompass a variety of damage-assessment criteria, such as surface integrity and condition (cracks, tears, punctures and stains), permanent odors, properly operating zippers or closures, exposure of the inner lining and contamination of the foam core. The size and number of damage points should also be assessed (for example, one small cut vs. several tears or fractures). Visible observation of the presenting surfaces is the

most common method of assessment. However, secondary inspection of inner liners and the foam core may necessitate the removal of the surface cover (Aziz, 2012).

Finally, the appropriate course of remedial corrective action will be informed by the overall mattress condition. Beyond the degree of damage, general factors such as age, general wear and color deterioration, integrity of the foam core (permanent depressions or bottoming out), and surface impermeability (fluid penetration) and texture (smooth, no bunching of the liner) should be considered.

Solution Options

Repair the Mattress

There are three primary methods of mattress repair: taping, patching or re-upholstering/replacing damaged surfaces. Ensuring that replacement surfaces meet the same standards of condition as the original surface will mitigate risk and ensure a viable value solution, so taping (i.e., repairing the surface with duct tape) is ineffective and contrary to regulatory objectives. Mattress repair is a viable solution when the general asset condition is acceptable and the longer-term use of the mattress is probable.

On-site repair methods such as patching will optimize the utilization of the mattress and reduce downtime. The relatively low cost of repair will provide for an attractive return on investment and a cost-avoidance opportunity. This option is suitable for smaller points of surface damage. On-site repair achieves the goal of surface integrity, but because patching is a relatively new solution, regulatory guidance for mattress integrity predates the availability of newer products. As with other aspects of environmental hygiene, technological innovations outpace the regulators' ability to respond.

Off-site repair (re-upholstering) extends the life cycle of the mattress, albeit at a higher cost. More suited for larger points of surface damage, this solution involves removing the mattress from circulation (for off-site repair) and therefore may be a viable solution only for higher-cost, therapeutic mattresses.

Apply a Removable Cover

Some healthcare providers may consider covering a damaged mattress with an after-market cover as an alternative to mattress repair or replacement. A variety of fitted covers exist. In order to optimize the mattress life cycle, a high-quality cover with an appropriate surface material and closure mechanism (i.e., a zipper) is paramount to reestablishing and maintaining surface integrity. According to the FDA, "A medical bed mattress cover provides outer protection to a medical bed mattress by preventing blood and body fluids from entering the inside (inner core) of the mattress.… [A] medical bed mattress covers may be coated with or contain a substance that kills germs (viruses or bacteria) or prevents bacterial growth. There are multiple terms used to describe medical bed mattress covers: water-resistant (keeps liquid away from the material), water-proof (prevents liquid from entering inside the material), or water-repellent (keeps liquid away from the material and prevents liquid from entering inside

the material). Medical bed mattress covers, whether water-resistant, water-proof, or water-repellent, may lose their effectiveness over time. The duration of time that a medical bed mattress cover is expected to last (expected life) varies from manufacturer to manufacturer. In addition, the expected life of a medical bed cover may differ from that of the mattress itself. For example, a medical bed mattress may have a longer expected life than the mattress cover" (US FDA, 2013).

Discard the Mattress

Disposal of hospital mattresses is a routine occurrence in healthcare. Generally, if not donated, hospital mattresses are directed to local landfills. Only one state has legislated requirements for recycling mattresses (Keating, 2013). Disposal is the best option when the degree of surface damage is too severe for repair; when due to age the mattress has signs of wear, surface bunching and deterioration of foam integrity that cannot be corrected by a surface cover; or when the inner liner or foam core has been compromised (i.e., with blood, body fluids or parasites).

In order to minimize clinical disruption, damaged mattresses should be removed and replaced immediately. Materials-handling staff must be on-hand (at the time of identification) and have access to replacement units; replacement will be required outside of business hours, such as during nights and weekends. Environmental Services personnel may feel pressure to overlook damaged units because, as noted above, reporting a problem will result in extra work and may cause delays in patient treatment.

Deferring mattress change-outs (i.e., reporting the damage for later replacement when staff are on hand to perform the replacement) decreases the likelihood of replacement; given that some mattresses travel throughout the facility, the damaged mattress may be difficult to locate.

The advantage of replacement is that the clinical surface will return to optimal functionality and provide patients with a best-performing soft surface. However, the cost associated with replacement will be most acute, and replacing mattresses prematurely (i.e., before warranty expiration) requires administrative time to file a claim. Mattresses are not commonly included in general waste pickup services, nor can they be accommodated in compactors; therefore, the cost of specialized disposal services will need to be considered. On-site storage of discarded and replacement mattresses may also present a challenge for some hospitals. Typically, hospitals do not budget adequately for mattress replacement, and on-hand replacement inventory levels may include a variety of general-purpose and therapeutic replacement units.

Summary

Healthcare reform is fueling a greater focus on the clinical and economic impact of healthcare-associated infections. Evidence exists linking the condition of hospital mattresses to the transmission of infection. There is no US data on the order of magnitude of the problem, but a comparison of domestic practices with international studies suggests that the US mattress deficiency could be valued at over half a billion dollars. Regulators such as the FDA are increasingly concerned about the condition of hospital mattresses. Inside the hospital, mattress management practices vary, and barriers may exist that discourage awareness of the problem and actions to deal with specific damage conditions. Conventional solutions have been ineffective and cost prohibitive; however, new technologies have entered the marketplace that achieve the desired safety outcome at a fraction of the cost of mattress replacement. There is no longer any excuse for healthcare organizations to avoid the problem: proactive management of mattress integrity will help improve patient safety, avoid cost and streamline clinical activity.

References

American Ambulance Association. N.d. Ambulance Facts. Accessed March 02, 2013. *http://www.the-aaa.org/media/ambulance_facts.html.*

American Hospital Association. 2014. Fast Facts on US Hospitals .Accessed March 02, 2014. *http://www.aha.org/research/rc/stat-studies/fast-facts.shtml.*

Arias, K.M. 2010. "Contamination and Cross Contamination on Hospital Surfaces and Medical Equipment." Initiatives in Safe Patient Care. Accessed March 02, 2014. *http://www.initiatives-patientsafety.org./assets/initiatives43.pdf.*

Association of periOperative Registered Nurses (AORN). 2013. "Recommended Practice: Environmental Cleaning, Recommendation II." In Perioperative Standards and Recommended Practices. Denver: Association of periOperative Registered Nurses.

Audit & Effectiveness Assistant / Clinical Governance Facilitator. 2010. Audit Report — Mattress Audit. Report to Infection Control Committee, Dudley. West Midlands, UK: Dudley and Walsh, NHS.

Aziz, A-M. 2012. "Mattress Cleanliness: The Role of Monitoring and Maintenance." British Journal of Nursing, Vol. 21, no. 3: 152-157.

Centers for Disease Control and Prevention. 2009. Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008. December 29. Accessed March 02, 2014. *http://www.cdc.gov/hicpac/disinfection_sterilization/3_4surfacedisinfection.html.*

—. 2013. Nursing Home Care. May 30. Accessed March 02, 2014. *http://www.cdc.gov/nchs/fastats/nursingh.htm.*

Creamer, E.A.C. Shore, E.C. Deasy, et al. 2013. "Air and Surface Contamination Patterns of Methicillin-Resistant Staphylococcus aureus on Eight Hospital Wards." (Accepted Manuscript) Journal of Hospital Infection.

Creamer, E., and H. Humphreys. 2008. "The Contribution of Beds to Healthcare-associated Infection: The Importance of Adequate Decontamination." Journal of Hospital Infection, Vol. 69: 8-23.

Department of Health & Human Services (DHHS). 2014. "Details for title: 100-07 , State Operations Manual." Centers for Medicare and Medicaid Services. Accessed March 09, 2014. *http://www.cms.gov/Regulations-and-Guidance/Guidance/Manuals/Internet-Only-Manuals-IOMs-Items/CMS1201984.html.*

Forester, A.J., K. Wilson, and C. van Walraven. 2011. Predicting Clostridium Difficle-Associated Diarrhea Risk andIimpact. Edmonton: Canadian Patient Safety Institute.

Healthcare Facilities Today. 2013. Perception of Hospital Cleanliness Can Impact Patient Satisfaction. May 03. *http://www.healthcarefacilitiestoday.com/posts/Perception-of-hospital-cleanliness-can-impact-patient-satisfaction-Environmental-Services--943.*

Hooker, Edmond A., S. Allen, L. Gray, and C. Kaufman. 2012. A Randomized Trial to Evaluate a Launderable Bed Protection System for Hospital Beds. July 26. Accessed March 02, 2014. *http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3441859/.*

Hooker, Edmond A., and Kristen Jones. 2012 "Cleaning Practices for Hospital Mattresses in Top US Adult Hospitals."American Journal of Infection Control, Vol. 40, no. 5: 00-00.

Hota, Bala. 2004. "Contamination,Disinfection, and Cross-Colonization: Are Hospital Surfaces Reservoirs for Nosocomial Infection?" Healthcare Epediemiology, Vol. 39, no. 8: 1182-1189.

Joint Commission, The. 2014. Hospital Accreditation Standards (abridged version) . Oakbrook Terrace, IL: The Joint Commission.

Keating, C. 2013. "House Passes Nation's First Mattress Recycling Program," The Hartford Courant, May 02. Accessed March 03, 2014. *http://articles.courant.com/2013-05-02/news/hc-house-passes-nations-first-mattress-recycling-program-20130502_1_new-mattress-cities-and-towns-state-rep.*

Reynolds, K.A. N.d. "New Trends in Environmental Hygiene: Decontaminating Soft Surfaces." Infection Control Today. Accessed February 27, 2014. *www.infectioncontroltoday.com.*

Scott, R. Douglas II. 2009. The Direct Medical Costs of Healthcare-Associated Infections in US Hospitals and the Benefits of Prevention. Atlanta: The Centers for Disease Control and Prevention.

Sehulster, L., and R.Y.W. Chinn. 2003. "Guidelines for Environmental Infection Control in Health-Care Facilities." CDC: Morbidity & Mortality Weekly Report (MMWR). June 06. Accessed March 05, 2014. *http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5210a1.htm.*

Stevens, L. 2012. The Clinical and Cost-efficacy of Strikethrough Resistant Technology (TM). Sponsored White Paper. Gloucestershire: Wound Care Today.

US Department of Labor. 1970. General Duties Clause (Section 05, a, 1) OSHA Act. Accessed March 09, 2013. *https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=OSHACT&p_id=3359.*

US Department of Health and Human Services (DHHS). 2003. Guidelines for Environmental Infection Control in Health-Care Facilities. Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC), Altanta: US Department of Health and Human Services, Centers for Disease Control and Prevention.

—. 2013. FDA US Food and Drug Administration. March 03. Accessed March 08, 2014. *http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfPCD/classification.cfm.*

US Food and Drug Administration (FDA). 2013. "FDA Safety Communication: Damaged or Worn Covers for Medical Bed Mattresses Pose Risk of Contamination and Patient Infection." US Food and Drug Administration. April 19. Accessed March 03, 2014. *http://www.fda.gov/medicaldevices/safety/alertsandnotices/ucm348016.htm.*

van der Mee-Marquet, N., S. Girard, F. Lagarrigue, et al. 2006. "Miltiresistant Enterobacter Cloacae Outbreak in an Intensive Care Unit Associated with Therapeutic Beds." ccform. Accessed March 11, 2014. *http://ccforum.com/content/10/1/405.*

Weinstein, R. A. 2004. Contamination, Disinfection, and Cross-Colonization: Are Hospital Surfaces Reservoirs for Nosocomial Infection? July 02. Accessed March 02, 2014. *http://cid.oxfordjournals.org/content/39/8/1182.full.*

Wheelchair Statistics: How Many Wheelchair Users Are There? N.d. Disability News–Wheelchair. Accessed March 02, 2014. *http://www.newdisability.com/wheelchairstatistics.htm.*

About the Authors

Mark Heller is a consultant to healthcare providers and hygiene technology industries. He also leads an organization providing environmental hygiene performance coaching improvement solutions.

He has pioneered a number of industry firsts, including the integration of North America's largest publicly operated environmental services enterprise.

Heller is a member of Association for Professionals in Infection Control and Epidemiology (APIC), Association for the Healthcare Environment (AHE), Healthcare Financial Management Association (HFMA), and The Society for Healthcare Epidemiology of America (SHEA).

Today, he helps leading business and healthcare providers across North America achieve their financial, quality and transformation objectives. He is a sought-after presenter and subject-matter expert on environmental infection prevention and control, hygiene technology and services, multi-facility environmental services and healthcare support services.

Darrel Hicks is the director of environmental services at a 500-bed, award-winning hospital in the United States. He started his career in the management of housekeeping services in 1981.

Hicks was President of the IEHA-Uniting Facility Managers Worldwide during the term 2006-2008 and holds the title of Registered Executive Housekeeper (REH).

He is an active member in AHE (the Association for the Healthcare Environment) and holds the designation of CHESP (Certified Healthcare Environmental Services Professional) through that great organization as well.

Today, Hicks is nationally recognized as one of the industry experts in infection prevention and control as it relates to cleaning. He has written and published numerous articles in professional and healthcare-related journals as part of his commitment to providing a cleaner, safer and healthier indoor environment.