Infection Control & Hospital Epidemiology (2023), **44**, 342–344
doi:10.1017/ice.2021.433

SHEA

Concise Communication

Assessing compliance of infection prevention mitigation strategies in hospital construction and renovation

Mark O. Buchanan BS, BSN, RN, RN-BC[1], Emily E. Sickbert-Bennett PhD, MS, CIC[1,2,3], Lauren M. DiBiase MS, CIC[1,3] and David J. Weber MD, MPH[1,2,3]

[1]Department of Infection Prevention, University of North Carolina Medical Center, Chapel Hill, North Carolina, [2]Division of Infectious Diseases, UNC School of Medicine, Chapel Hill, North Carolina and [3]Gillings School of Global Public Health, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina

Abstract

Hospital-associated fungal infections from construction and renovation activities can be mitigated using an infection control risk assessment (ICRA) and implementation of infection prevention measures. The effectiveness of these measures depends on proper installation and maintenance. Consistent infection prevention construction rounding with feedback is key to ongoing compliance.

(Received 9 July 2021; accepted 19 September 2021; electronically published 19 October 2021)

Environmental disturbances in healthcare facilities that generate dust such as construction, renovations, remediation, repair, and demolition have been associated with a large number of fungal outbreaks.[1–4] These outbreaks have most commonly involved patients with hematologic malignancies and other immunocompromising conditions.[1,2] The causative pathogens of these outbreaks were usually *Aspergillus* spp, but Zygomycetes and other fungi have occasionally been reported.[1] Importantly, the overall mortality of construction–renovation-associated fungal infection was ∼50%.[1]

Because of the frequency and high mortality of construction–renovation-associated fungal infections, proactive strategies for preventing such infections have been developed.[1–3,5,6] An infection control risk assessment (ICRA) conducted before initiating repairs, demolition, construction, or renovation activities can identify potential exposures of susceptible patients to dust and moisture, and can determine the need for dust and moisture containment measures.[5,6] This assessment centers on the type and extent of the construction or repairs in the work area but may also need to include adjacent patient-care areas, supply storage, and areas on levels above and below the proposed project. Developing an ICRA requires a multidisciplinary team approach to coordinate the various stages of construction activities (eg, project inception, project implementation, final walk-through, and completion).[5] Infection prevention staff along with staff from plant engineering facilities maintenance, environmental services, environmental health and safety, as well as stakeholders occupying areas adjacent to the construction–renovation space (eg, nursing, radiology, etc) must be represented in construction planning and design meetings.[5]

Although the association of construction–renovation with fungal infections and developing and implementing an ICRA have been well described in the literature, the utility of routine "construction–renovation" rounds by infection prevention staff has not been previously assessed. Our facility has conducted infection prevention construction–renovation rounding for many years, but a formalized, multidisciplinary team rounding approach with a standardized checklist began in 2014. We performed this retrospective analysis of such rounds at our large academic hospital.

Methods

This study was conducted at a 951-bed academic medical center with 9 intensive care units, 4 intensive care step-down units, and 3 units dedicated exclusively to oncology care. The infection prevention department has 20 full-time employees. An ICRA is developed for all construction and renovation projects; an infection prevention staff member collaborates on the development and completion of the ICRA. Once construction starts, an infection preventionist (IP) leads fortnightly rounds in conjunction with life safety officers from plant engineering (PE) and environmental health and safety until the project is completed. Unannounced fortnightly rounding occurs on varying days and times to deter contractors from only effecting repairs when rounds are anticipated. The IP assesses up to 16 specific elements that reflect the implementation of appropriate infection prevention strategies. Construction projects (n = 140) were inspected multiple times (n = 1,085) since standardized rounding with a discrete rounding compliance tool was initiated in August 2014.

Here, we have summarized the overall compliance with each of these elements. In addition, the priority level of the finding is scored as low (eg, walk off mats not clean), medium (eg, debris cart covered during removal), high (eg, lack of negative pressure on unit housing immunocompromised patients) as well as whether the finding is a repeat event. The findings are shared in the form of

Author for correspondence: Mark O. Buchanan, E-mail: mark.buchanan@unchealth.unc.edu

Cite this article: Buchanan MO, *et al.* (2023). Assessing compliance of infection prevention mitigation strategies in hospital construction and renovation. *Infection Control & Hospital Epidemiology*, 44: 342–344, https://doi.org/10.1017/ice.2021.433

Table 1. Compliance of Construction/Renovation Infection Prevention Measures from 2014 to 2021

Infection Prevention Inspection Item	Repair Priority	% Compliance (n = 1,085)
Is the walk off mat clean and changed frequently to prevent dust outside of the site?	Low	77.4
Are barriers appropriate and properly sealed?	High	82.2
Is construction area under negative pressure?	High	86.1
Are HEPA filters being properly utilized?	High	92.2
Is construction sign posted?	Low	95.0
Construction area doors are closed, gaskets and hardware are intact?	Medium	95.7
Is egress path free of dust?	Low	96.2
Are patient care items protected from contamination (eg, covers and drapes)?	Medium	98.1
Are the windows closed?	Medium	98.2
Are ceiling tiles replaced when space not being accessed?	Medium	98.7
Is the construction site clean and free of debris?	Medium	99.7
Are contractors and personnel free of dust when leaving the area?	Medium	99.7
Do workers demonstrate compliance with traffic patterns?	Low	99.7
Are return air vents covered and/or is return air shut off?	High	99.8
Is debris removed in a proper, covered container?	Medium	99.8
Is there an absence of water leakage signs?	Medium	99.9

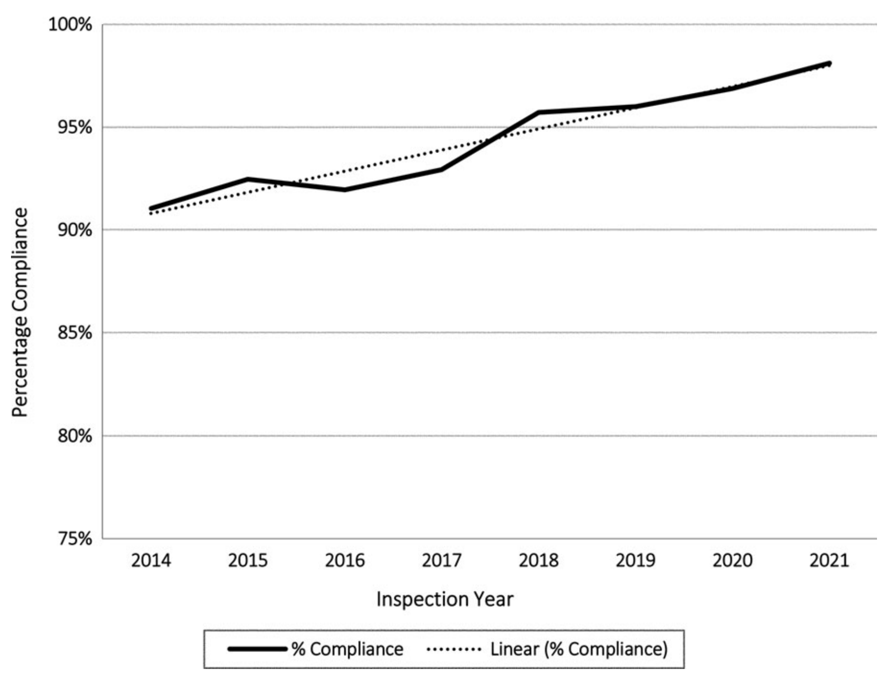

Fig. 1. Mean compliance of infection prevention measures by year.

real-time verbal feedback to the contractor's site supervisor and are shared in writing with the plant engineering project manager and PE leadership. Any follow-up actions and dates are documented accordingly. Hospital-acquired fungal infection rates were reviewed from 2014 to June 2021. The data analysis was performed using Microsoft Excel software (Microsoft, Redmond WA).

Results

The compliance rates of the 16 infection prevention mitigation elements ranged from 77.4% to 99.9% (Table 1). The elements with the lowest compliance rates (<90%) were "Is the walk off mat clean and changed frequently?" at 77.4%, "Are barriers appropriate and properly sealed?" at 82.2%, and "Is the construction site under negative pressure?" at 86.1%. Hospital-acquired fungal infections did not statistically differ over time and ranged from 0.01 to 0.025 per 1,000 patient days.

Discussion

The 2 elements with the lowest compliance (ie, walk off mats and barriers sealed) are items that require ongoing inspection and daily

https://doi.org/10.1017/ice.2021.433 Published online by Cambridge University Press

maintenance. The other lowest performing element (ie, site under negative pressure) can require more premeditated planning and coordination to achieve. This particular element is deemed a high priority for repair if found deficient especially if the work is in an area housing immunocompromised patients. Regardless of repair priority if deficient, all of these 16 infection prevention measures are key elements to containing any potential fungal pathogens. Microbes can escape on shoes and wheels, through barrier gaps, and through the air as personnel enter and exit a site that is not under negative pressure (−0.01 mmHg). Over 7 years of construction rounding, we have observed marked improvements in compliance (Fig. 1), but this requires ongoing collaboration and education. Key strategies to proactively obtain compliance are PE staff and contractor education about the risk to patients, real-time feedback regarding deficiencies, management engagement, use of PE project coordinators to assist project managers with deficiency follow up, and construction specific policies that clearly address IP and safety expectations. Our facility has very low hospital-acquired fungal infections rates and no additional improvement was noted during the study period. The formalized rounding process was not started because of an outbreak but as a proactive, quality improvement–based infection prevention measure to protect our many immunocompromised patients.

This study had several limitations. Repair priority is not well described and is determined subjectively by the rounding IP. There were 2 rounding IPs for construction during the 7 years of data collection (rounding IP no. 1 2014–2018; IP no. 2 2018–present). COVID-19 prevented rounding as a multidisciplinary team for of the majority of the year 2020. During that time, rounding was conducted individually, and findings were reported via e-mail.

In conclusion, the use of infection prevention measures to reduce the risk of hospital-acquired fungal infections has been well described; however, ongoing inspection and maintenance of these measures are required for optimal effectiveness. Given the association between fungal infections and construction–renovation in the hospital setting, a routine rounding and feedback tool, like we describe, is critical to ensuring appropriate and consistent implementation and operational effectiveness of the infection control risk assessment measures.

Acknowledgments.

Financial support. No financial support was provided relevant to this article.

Conflicts of interest. All authors report no conflicts of interest relevant to this article.

References

1. Kanamori H, Rutala WA, Sickbert-Bennett EE, Weber DJ. Review of fungal outbreaks and infection prevention in healthcare settings during construction and renovation. *Clin Infect Dis* 2015;61:433–444.
2. Weber DJ, Peppercorn A, Miller MB, Sickbert-Benett E, Rutala WA. Preventing healthcare-associated *Aspergillu*s infections: review of recent CDC/HICPAC recommendations. *Med Mycol* 2009;47 suppl 1: S199–S209.
3. Haiduven D. Nosocomial aspergillosis and building construction. *Med Mycol* 2009;47 suppl 1:S210S216.
4. VandenBergh MF, Verweij PE, Voss A. Epidemiology of nosocomial fungal infections: invasive aspergillosis and the environment. *Diagn Microbiol Infect Dis* 1999;34:221–227.
5. Guidelines for environmental infection control in healthcare facilities: recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC), 2003. Centers for Disease Control and Prevention website. https://www.cdc.gov/infectioncontrol/pdf/guidelines/environmental-guidelines-P.pdf. Updated July 2019. Accessed April 12, 2021.
6. Olmsted RN. Prevention by design: construction and renovation of healthcare facilities for patient safety and infection prevention. *Infect Dis Clin N Am* 2016;30:713–728.