

Infection Prevention & Control

Designing Flooring Solutions
for Healthcare Environments



Introduction

The COVID-19 pandemic has brought infection prevention and control to the front of mind of design professionals. Healthcare settings have been a focus due to the increased risk of immunocompromised patients in hospitals, and the potential exposure of healthcare workers putting a strain on hospital resources.

To combat the spread of infection in health and aged care facilities, an emphasis has been placed on environmental cleaning. This has led to the increased use of disinfectants for surface cleaning and specification of antimicrobial materials to help maintain sanitary indoor environments.

However, the risks associated with the overuse of disinfectants and antimicrobial materials is easily overlooked. COVID-19 is not the only threat as other types of pathogens can spread throughout the hospital, many of which are serious or life threatening. Not only is there no evidence to suggest that antimicrobial and biocidal products contribute to healthier populations, but they may actually contribute to the development of superbugs that are resistant to standard antibiotics.

When selecting flooring solutions, designers must take a step back and consider what properties in a floor can contribute to healthier environments. It is time to look beyond antimicrobial and biocidal products, and assess how a floor will perform in the chosen environment. Selecting the right materials and implementing proper cleaning regimes are the prerequisite of a healthier long-term product that is less dependent on chemicals and disinfectants.

In this whitepaper, we examine the critical role of flooring in creating safe hospital environments and the design considerations when specifying flooring solutions for such applications.

Infection risks in healthcare settings

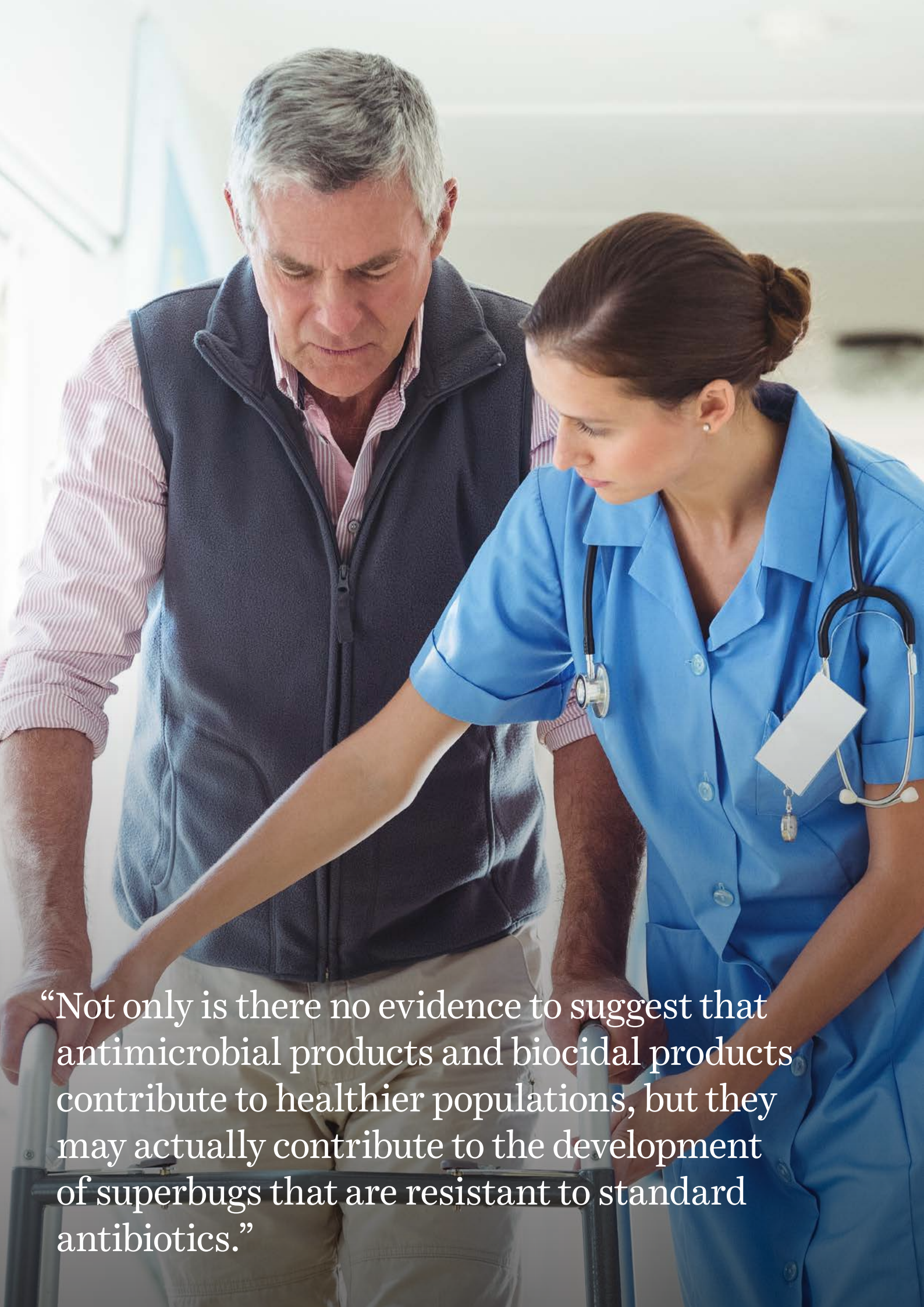
When designing healthcare environments, solutions that prevent healthcare-associated infections (HAI) and avoid the increase of antimicrobial resistance (AMR) are among the highest priorities. HAIs are infections acquired by patients during their stay at a hospital. The most common types of HAIs include infections affecting the bloodstream, urinary tract and open wounds, and lung infections (i.e. pneumonia).¹

In Australian health facilities, HAIs are the most common complications affecting patients with around 165,000 infections occurring each year.² The government reports that HAIs account for an estimated two million hospital bed days in Australia per annum.³

Closely related to the prevalence of HAIs, AMR refers to the ability of microorganisms to become resistant to antimicrobial agents such as antibiotics and biocides.

Bacteria and fungi can change over time and develop the ability to defeat the antibiotics designed to kill them. This evolution can be spurred on in hospital environments where patients are exposed to antibiotics and receive lots of hands-on care. Common treatment-resistant strains include methicillin-resistant *Staphylococcus aureus* (also known as 'golden staph' or MRSA), vancomycin-resistant *Enterococcus* (VRE) and carbapenemase-producing *Enterobacteriaceae* (CPE).

The rise of these so-called 'superbugs' has become a worldwide problem. Research indicates that treatment-resistant bacterial infections directly caused 1.27 million deaths worldwide in 2019 and were associated with an additional 4.95 million deaths.⁴ According to the World Health Organization, AMR-attributed deaths could reach 10 million per year in 2050.⁵



“Not only is there no evidence to suggest that antimicrobial products and biocidal products contribute to healthier populations, but they may actually contribute to the development of superbugs that are resistant to standard antibiotics.”

How do hospital floors spread infections?

Hospitals create several factors that increase the risk of infections and AMR, including the presence of microorganisms, contamination between staff and among patients, and the presence of vulnerable patients with weakened immune systems. Surfaces in hospitals are frequently contaminated with harmful microbes, hence the focus on daily cleaning procedures and design solutions that limit bacterial growth, such as antimicrobial surface materials.

Floors are an often overlooked bacteria source that highlights the need to improve infection control. Researchers with the Northeast Ohio VA Healthcare System found that the floors

of hospitals can be easily contaminated with bacteria within hours of patient admission, allowing bacteria to move to patients' socks, bedding, and nearby surfaces.⁶

A 2017 study published in the American Journal of Infection Control supports this finding, reporting that, as items in the patient's room may touch the floor, pathogens on hospital floors can rapidly move to the hands and high-touch surfaces throughout a hospital room.⁷ There is also some evidence that pathogens on the floor can be resuspended in the air with the potential of inhalation, swallowing or contamination of surfaces or hands.⁸



“As items in the patient’s room may touch the floor, pathogens on hospital floors can rapidly move to the hands and high-touch surfaces throughout a hospital room.”

Designing hygienic flooring

KEY CONSIDERATIONS

UNDERSTANDING RISK LEVEL

Hospitals are comprised of many different areas, each with its own risk profile. Entrances, office areas and service areas, for example, are considered low risk, and floor and wall coverings are considered to have less impact on infection control. In medium risk areas where the risk of contamination and exposure increases, such as in clinical areas and patient rooms, the requirements for hygienic flooring and cleaning become more demanding.

In serious or very high risk areas – such as emergency rooms, operating theatres, medical laboratories and cleanrooms – floors must meet the highest hygiene standards to ensure infection control and air cleanliness.

REQUIREMENTS FOR HEALTHCARE FLOORING

The Australasian Health Facility Guidelines (AHFG) provides the key requirements for flooring in hospital areas, which are discussed below.

Smooth and non-porous

In Section 04.01 of Part D, the AHFG provides that all surfaces in patient care areas should be smooth and impervious, and easily cleanable.

Easy to clean and repair

Section 04.03 requires floor coverings to be easy to clean and repair. Easily-repairable flooring materials should be considered so that they can be fixed or resealed without changing the whole floor.

In addition, installing products with surface restoration properties that easily remove micro-scratching through dry buffing technology allows for the surface to be restored to the smooth factory finish. This capability allows for ease of maintenance, decontamination and microbial control. For example, the surface restoration process for Tarkett's iQ range, is achieved without the need for waxes or polishes. The dry buffing process combined with the iQ ranges high PVC content allows for surface restoration without the need to shutdown areas, which is needed when waxes and polishes are required.

Area appropriate

Section 04.03 further adds that flooring should be area appropriate. Carpet may be used in selected areas within clinical zones such as interview rooms and office areas. In areas subject to frequent wet cleaning, floor materials must

be able to tolerate use of disinfectants. Food preparation and assembly areas require flooring that is non-slip, water resistant and greaseproof to comply with the relevant standards. Floors in sterilising services areas should be non-slip and have smooth surfaces for cleaning.

Watertight installation

Section 04.04 emphasises that good design and detailing of joints, and sealing of any gaps, are important to infection prevention and control. A watertight installation is important in all areas of hospitals or health facilities as these installations ensure there are no voids or gaps, which create issues for infection control. Section 04.05 adds that skirtings, floor and wall joins should be made integral with the floor, tightly sealed against the wall, and constructed without voids (coved).

Hot welded joints add durability. The European Standard EN 684:1995 "Resilient Floor Coverings" specifies a method for determining the strength of the seams of resilient floor covering when welded in accordance with the manufacturer's instructions.

A system such as Tarkett's CodeMark-certified wetroom installation method means you can comply with the requirements of the National Construction Code for waterproofing with the added benefit of being able to test the watertightness of the product and welds once installed. This is very important as waterproofing is one of the biggest issues in the building industry.

EFFECTIVE CLEANING PROCEDURES

Effective methods of cleaning are key components of infection control. Once the appropriate flooring materials are selected, they have to be cleaned and maintained to ensure high levels of hygiene. The appropriate cleaning method should consist of either dust mopping to remove dust and debris, or damp mopping with a detergent for a thorough clean as required.

To mitigate the risk of AMRs, avoid specifying flooring materials that contain antimicrobial agents, and use disinfectants only where and when required. Normally, disinfectant is not necessary and should be reserved for areas where the risk of infection is high. Disinfection without cleaning is not recommended as most disinfectants lose their effectiveness rapidly in the presence of organic matter.

HIGH RISK AREAS (CLEANROOM) CONSIDERATIONS

Hospital cleanrooms are controlled environments where air and surface contamination are constantly monitored and strictly controlled. These types of rooms are essential for sensitive tasks such as invasive surgery to protect patients with compromised immune systems.

Within a cleanroom, environmental factors such as airflow, temperature and humidity are carefully regulated to minimise infection or contamination. Integrated solutions for floors and walls that meet or exceed stringent cleanroom standards need to be specified.

When specifying floors, ensure the manufacturer has an integrated solution for the floor and walls which meet or exceed the ISO 5 Clean Room Classification as per ISO 14644-1:2015. The solution will also need to resist chemicals (as per the testing procedure specified in ISO 26987:2008). Static-controlled solutions may be required depending on the equipment being used within the room.

For compliance purposes and to achieve the required level of cleanliness, all cleanroom surfaces should have the following properties:

- thermal welded;
- smooth and non-porous;
- the surface shall not generate its own contamination (e.g. by creating dust, peeling, flaking, corroding or providing a place for microorganisms to proliferate);
- easy to clean and accessible, without any ledges or recesses;
- rigid and robust so that it will not crease, crack, shatter or dent easily; and
- no gaps.

CHOOSING THE RIGHT FLOORING SOLUTION

In general, homogeneous vinyl rolls stand out as having the required properties for hospital flooring, especially for serious risk or very high risk areas. See below table comparing the suitability of different flooring materials for various healthcare applications.

	Seamless and smooth	Coving	Welded Joints resistance	Chemical resistance	Low Risk Area	Medium Risk Area	Serious Risk Area	Very high Risk Area
Homogeneous Vinyl (sheet)	***	***	***	***	✓✓✓	✓✓✓	✓✓✓	✓✓✓
Heterogeneous Vinyl (sheet)	***	***	**	***	✓✓✓	✓✓✓	×	×
Linoleum (sheet)	**	*	*	***	✓✓	✓	×	×
Rubber (sheet)	*	*	*	**	✓✓	✓✓	×	×
LVT	-	-	-	***	✓✓	×	×	×
Carpet	-	-	-	-	✓✓	×	×	×
Wood	-	-	-	-	✓✓	×	×	×
Ceramic	-	-	-	***	✓✓	×	×	×

*** Excellent ** Good * Poor - Bad ✓✓✓ Highly recommended ✓✓ Recommended ✓ Suitable × Not suitable



Tarkett iQ

VINYL FLOORING SOLUTIONS FOR HEALTHCARE ENVIRONMENTS

Tarkett is the world leader in the design, manufacture and distribution of commercial and residential floor coverings. Designed to meet the demanding requirements of healthcare, Tarkett iQ homogeneous vinyl flooring with its unique surface restoration properties, is renowned for delivering consistent long-term performance without compromising on design.

Suitable for any hospital environment, Tarkett iQ is the only homogeneous vinyl flooring to provide consistent long-term performance without compromising on design. Its ease of installation, outstanding durability, lowest life-cycle cost and treatment with unique dry-buffing surface properties restoration mean iQ outperforms everything else on the market. Factor in a colour palette covering the full spectrum plus designs ranging from classic to contemporary, and you will see why iQ is the perfect choice. Tarkett iQ homogeneous flooring is not afraid of time and with the proper care and maintenance, it will look the same even after decades of use.

The iQ ranges of homogeneous vinyl rolls are the best flooring solutions for demanding healthcare environments. The key benefits are summarised below:

- **Excellent cleanability.** The smooth surface ensures the highest levels of hygiene, proven by the Fraunhofer Institute.
- **Perfect watertightness.** Unmatchable flexibility allowing perfect coving, hot welding and easy repair.

- **Durable joints.** Outstanding seam strength (three times above standard) preventing split joints.
- **High chemical resistance.** Withstands the strongest disinfectants (quaternary ammonium, alcohol, bleach, hydrogen peroxide etc.). Best in class resistance to common healthcare chemicals such as betadine and iodine.
- **Comprehensive solution for floors and walls.** Easy to match and heat-weld (ProtectWall and Wallgard) for a fully watertight system.
- **Cleanroom solutions.** Options that meet the highest hygiene standards to ensure infection control and air cleanliness, with electrostatic control.

Tarkett has identified the use of biocides as a major risk to health and the environment and have therefore stopped adding antimicrobials in their flooring production since 2013, and actively promote the importance of appropriate cleaning methods.

REFERENCES

- ¹ Victorian Government. "Preventing healthcare associated infection (HAI)." Better Health Channel. <https://www.betterhealth.vic.gov.au/health/conditionsandtreatments/infections-in-hospital-reduce-the-risk#types-of-healthcare-associated-infection> (accessed 4 March 2022).
- ² New South Wales Government. "Healthcare Associated Infections." Clinical Health Commission. <https://www.cec.health.nsw.gov.au/keep-patients-safe/infection-prevention-and-control/healthcare-associated-infections> (accessed 4 March 2022).
- ³ Ibid.
- ⁴ Deutsche Welle. "Antibiotic-resistant superbugs kill more people than AIDS or malaria: study." DW. <https://www.dw.com/en/antibiotic-resistant-superbugs-kill-more-people-than-aids-or-malaria-study/a-60494599> (accessed 4 March 2022).
- ⁵ World Health Organization. "New report calls for urgent action to avert antimicrobial resistance crisis." WHO. <https://www.who.int/news/item/29-04-2019-new-report-calls-for-urgent-action-to-avert-antimicrobial-resistance-crisis> (accessed 4 March 2022).
- ⁶ ScienceDaily. "Hospital floors are hotspot for bacteria, creating route of transfer to patients." ScienceDaily. <https://www.sciencedaily.com/releases/2020/10/201030081545.htm> (accessed 4 March 2022).
- ⁷ ScienceDaily. "Hospital floors may pose a larger health risk than previously thought." ScienceDaily. <https://www.sciencedaily.com/releases/2017/02/170228185332.htm> (accessed 4 March 2022).
- ⁸ Teska, Pete. "Pathogens Underfoot Can Floor Patients, Health Care Workers." Infection Control Today. <https://www.infectioncontroltoday.com/view/pathogens-underfoot-can-floor-patients-health-care-workers> (accessed 4 March 2022).

All information provided correct as of March 2022.

