Designing for Infection Control in Healthcare Settings

Understanding Your Door Solution Options

ASSA ABLOY
Entrance Systems

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INTRODUCTION

Infection control awareness in the design and construction community has significantly increased on the back of the COVID-19 pandemic. The issue is critical in healthcare facilities, where the risk of hospital-acquired infections (HAIs) is high, and the impact on immunocompromised patients and healthcare workers can be severe.

The threat of HAIs goes beyond COVID-19. There are many types of pathogens that can spread quickly throughout a hospital, many of which are life threatening. Add to this the growth of superbugs that are resistant to medical treatment and thrive in hospital settings. Research indicates that drug-resistant bacterial infections directly caused 1.27 million deaths worldwide in 2019 and can be associated with another 4.95 million deaths.[1]

These factors have created new challenges around how healthcare buildings are designed and operated. One requirement in reducing the incidence of HAIs is implementing architectural design solutions that address the common ways infections are spread. There are multiple doors solutions that can assist with infection control via surface contamination reduction, while others are also designed to prevent air contamination in high risk areas. The key is knowing what type of door is needed and when.

This whitepaper will examine how infections are spread in healthcare settings and what door solutions should be specified to minimise such risks. We also take a look at the primary design considerations when specifying door solutions for healthcare applications.

HOW ARE INFECTIONS SPREAD IN A HEALTHCARE SETTING?

For an infection to spread, there must be a source of infection, persons who are susceptible to infection and transmission.

- The **source of infection** is usually a person or a surface contaminated with infectious pathogens.
- **Susceptible persons** are those who are not immune to the infection, or who have a weakened immune system that allows the infection to enter and spread in the body.
- **Transmission** refers to ways in which germs, viruses or bacteria can move to a susceptible person. The common modes of transmission are direct or indirect contact, inhalation of infectious droplets, or via food and water.

Hospital settings have many potential sources of infection – from patients, healthcare staff and visitors to medical equipment, shared bathrooms and other high-touch surfaces. The presence of immunocompromised patients, patients recovering from surgery, terminally ill patients and so on provide many susceptible persons in close proximity.

Lastly, there are plenty of opportunities for transmission to occur with patients and staff frequently coming into contact with contaminated surfaces, and constant interaction between staff, patients and visitors.

Surfaces contaminated with infectious pathogens are one the main ways in which infections are spread, particularly high-touch surfaces such as door handles. In one study of two busy intensive care units and one high dependency unit, a significant correlation was found between the frequency of movements through a door and the degree to which it was contaminated.[2] Contaminated surfaces lead to contamination of the hands or clothing of healthcare personnel or patients, then transmission to other patients.

Transmission through inhalation of airborne particles and droplets is a known route of infection, most notably of COVID-19 and other respiratory diseases. This commonly occurs when an infected person expels virus-laden droplets when they talk, cough, sneeze, or even exhale, which are then inhaled by a person in close proximity.

LEVELS OF INFECTION RISK

In general, infection control measures need to be commensurate to the infection risk of a particular area. For example, office areas occupied by staff only are generally low risk, whereas patient rooms and emergency rooms are significantly higher risk. Operating theatres and intensive care units (ICUs) require the strictest controls as they are areas in which treatment is being provided to people who are vulnerable to serious infection and/or are very ill.

Isolation rooms require special consideration. These are rooms in which you will find patients requiring transmission-based precautions, or for patients who require protection from external sources. Under the Australasian Health Facility Guidelines there are four types of isolation rooms:[3]

- **Class S – Standard:** This room is used for patients who require isolation to minimise the potential for infections being transmitted by contact or droplets to other patients and staff.
- **Class P – Positive pressure:** Positive pressure rooms maintain a higher pressure within the treated area than the surrounding environment. This allows air that contains any airborne particles or germs to be filtered out of the room, while preventing any contaminants in surrounding environments from entering the room. This type of room keeps patients safe from infections and disease.
- **Class N – Negative pressure:** A negative pressure room uses lower air pressure and allows air from outside into the segregated environment, but traps any harmful particles within. This type of room is used to protect those outside from exposure.
- **Class Q – Quarantine:** Usually reserved for those suffering from highly infectious pathogens, this room is for patients who require a further level of containment over and above the standard negative pressure isolation room.

In recent years, more hospitals are implementing cleanrooms to control contamination and the spread of disease. Cleanrooms are controlled environments where air and surface contamination are constantly monitored and strictly controlled. Cleanrooms follow ISO 14644-1:2015 “Cleanrooms and associated controlled environments — Part 1: Classification of air cleanliness by particle concentration”, which is the international standard that determines the concentration levels of particles within a cleanroom.

CHOOSING THE RIGHT DOOR SOLUTION

Touchless automatic doors for all areas

As many communicable diseases are spread via hand-based transmission, touchless automatic doors are no longer a suggestion for healthcare environments, they are now a minimum requirement. Doors that can be activated using sensors or touchless wave plates are proven ways to reduce the transmission of germs and bacteria. Automatic doors can be programmed to minimise air leakage (e.g. by opening at a specified distance when staff enter) or to preferred room requirements.

The latest technology in this category allows automatic doors to be integrated with access control and locking systems, and interface with BMS (Building Management Systems) for extra security and monitoring capabilities.

Patient rooms

Door solutions for patient rooms should limit airflow during opening and closing. Automated sliding doors, with contactless operation, are recommended. Door openings should be wide enough to manoeuvre beds and other equipment through. Acoustic and visual privacy for patients should also be considered.

Isolation rooms

The risk of infection is particularly high in isolation rooms or quarantine spaces. Air lock, perimeter seals, airtight doors, self-closing and contactless operating systems are recommended. You must ensure that the door solution has been tested to meet the negative, positive or combination pressure requirements of the room.

ICUs

It is important for ICUs to be sufficiently closed off and sealed to maintain a hygienic, protected closed-loop environment. Airtight doors, ventilation and filtration are necessary to reduce the risk of contamination. The door system should be independently tested and rated to ensure it can control air leakage and help maintain a negative pressure environment. Glazing options that can switch from clear to opaque will help provide patient privacy while allowing the staff to monitor critically-ill patients constantly.

Operating theatres

An airtight seal is very important when minimising infection risks and to meet the standard positive pressure requirements of operating rooms. Hermetic door systems are designed to create airtight seals that prevent decreases of pressure. Advanced door solutions can be integrated with an access control system to record how long and how often the door is left open or closed during an operation, which is useful for monitoring the risk of contamination.

Cleanrooms

Cleanroom doors should have an airtight seal to minimise pressure drop and protect the interior environment from drafts, humidity, dust and dirt. Fast opening and closing speeds control air exchange, which reduces the amount of contaminants that can enter the room. The door itself should have minimal collection points and seams for ease of cleaning, and should be made with corrosion-resistant and chemical-resistant materials. Ensure the selected door system is tested and rated to the international cleanroom standard (see ISO 14644-1:2015).

HEALTHCARE DOOR DESIGN CONSIDERATIONS

As we have outlined above, door solutions can vary within a healthcare setting. Nevertheless, there are several features that are common in high-quality door solutions that are effective for infection control and prevention. We briefly look at these features below for easy reference:

- **Durability.** Some areas of a hospital, such as emergency rooms, are subject to heavy, high speed traffic all day and night. Doors need to be able to open quickly to ensure a smooth flow of personnel, patients and equipment, and also be able to withstand repeated impacts.
- **Ease of maintenance.** The manufacturer should be able to provide prompt and effective support, with all necessary accessories and parts readily available. This will prevent having to replace the door at a significantly higher cost in the future. More importantly, you need to be able to respond quickly to door-related problems that compromise the safety of controlled environments.
- **Hygienic door materials.** Hospital doors should be carefully selected to ensure they are constructed using an inorganic hygienic material that is easily cleanable, non-porous and fluid resistant. Door construction should minimise seams, textures, voids and any other spaces that can harbour bacteria. Anti-bacterial surfaces may be considered.
- **Speed of opening and closing.** Higher opening and closing speeds helps control air exchange and reduces contaminants. Whether a door is sliding or hinged can also impact air exchange through the doorway.[4]
- **Airtight seals.** An airtight perimeter seal around the door is essential in maintaining a hygienic environment. Ensure that the door has been tested for air leakage by a NATA-approved laboratory and meets the requirements for the intended application.
- **Privacy.** Acoustic-rated doors can play a positive role in healthcare environments by supporting patient wellness and privacy. There are also models available with a variety of configuration and vision panel options to support visual privacy needs.

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ASSA ABLOY ENTRANCE SYSTEMS

Healthcare doors for all your needs

A global leader in healthcare access solutions, ASSA ABLOY help create sterile, safe and secure settings for any healthcare building with anti-bacterial door surfaces, sealed environments and touchless entrances. With many years of experience in the hospital sector, you can trust ASSA ABLOY to provide the best entrance solutions for all areas of your healthcare facility.

ASSA ABLOY offer the industry's most complete, flexible service solutions, including regulatory compliance checks and upgrades. Their local trained and qualified technicians respond quickly to issues to ensure that your doors, no matter the brand, are fully operational, and downtime is kept to a minimum.

SL Hygienic ICU 521 – NATA-tested ICU door system

ASSA ABLOY has recently launched the SL Hygienic ICU door platform, a touchless automatic sliding door solution capable of maintaining desired air pressure, privacy and acoustics.

Carefully engineered for the future of healthcare, SL Hygienic ICU 521 has been designed to control air leakage in a negative pressure environment, assisting in the prevention and spread of infectious contaminants. SL Hygienic is an ideal solution for the health and medical industries for superior infection control, or those industries requiring highly efficient room sealing.

ASSA ABLOY Entrance Systems offers its SL Hygienic doors with one of the industry's largest door openings, with a 33% wider opening than traditional two-panel door designs. The telescopic functionality features an internal transmission, eliminating noise and delivers a smooth, simple opening and closing.

SL Hygienic helps to minimise external noise, with the option of double or triple insulated glass with a Sound Transmission Class (STC) glazing rating of up to 42. With the SL Hygienic 'Switch' option, the door glass will be able to instantly switch from clear to opaque, eliminating the need for curtains, whilst maximising space and privacy.

In addition, users have the ability to program the automatic door to open at any specified distance to minimise air leakage when medical staff enter or program to preferred room requirements.

The SL Hygienic ICU door system can also be utilised as a connected IoT door system to enable the collection and exchange of data.

References

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All information provided correct as of June 2022.

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