eBook

Healthier Workplaces and Schools

Mitigating Airborne Infectious Disease Transmission in Workplaces and Communities

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Different approaches to help mitigate the risk of spreading airborne infectious diseases depending on your workplace setting.

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This publication was developed by experts with background, training, and experience in industrial hygiene (IH), occupational and environmental health and safety (OEHS), and the built environment, working with information available at the time of publication. AIHA, as the publisher, and the authors have been diligent in ensuring that the material and methods addressed in this book reflect prevailing multidisciplinary practices. It is possible, however, that certain policies or procedures discussed may require modification due to changing federal, state, local, or international guidance or regulations.

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PART ONE

Introduction

The COVID-19 pandemic taught important lessons about the importance of preventing the spread of airborne infectious diseases, like COVID-19, respiratory syncytial virus (RSV), and influenza (flu), in indoor settings. Many people have become more conscious of illnesses that can be spread through fomite or surface contact, such as norovirus and Staphylococcus aureus, as well.

For example, if your workplace is a traditional office setting, you must address the risks associated with large numbers of people working separately and at shared desks in cubicles, open floor plans, and conference rooms. Office workers spend an extended amount of time indoors with their coworkers, management, or visitors, increasing their risk of becoming ill. Or, if your workplace is in the service sector, you must limit disease transmission among workers and management doing their tasks indoors and at close quarters, even as the flow of customers in and out of the workplace adds uncertainty to your environment.

Nonetheless, you can take simple, effective steps to help keep people in your workplace or community safe from whichever infectious disease you're most concerned about. Your first step is to check global (World Health Organization or WHO), federal (Centers for Disease Control and Prevention or CDC), state, and local guidance for disinfection strategies, recommended worker protections, and other risk management practices for contagious diseases. Remember to check these sources frequently for updates. Then, read this ebook to learn about approaches and foundational concepts that may help mitigate the risk of infectious diseases in your workplace or community. You should use the suggestions in this ebook alongside official recommendations.

The information supplied in Part One of this ebook applies to workplaces in general. It provides a solid foundation from which to build an infectious disease control plan. If your workplace is an office or commercial establishment, the information provided in Part One may be adequate for your purposes. In Part Two, we provide guidance tailored to workplaces and community settings that have more specific needs: healthcare facilities, childcare and educational facilities, manufacturing facilities and warehouses, cultural and entertainment spaces, outdoor event locations, and transit systems. However, because there are many different types and sizes of buildings and establishments, some of the guidelines presented in this ebook might not apply to your workplace or community setting. Try to implement as many as possible, rather than applying them all. A multi-layered approach to preventing disease transmission will help keep your buildings and the people inside them safer and healthier.

How to Limit Disease Transmission?

Bacteria and viruses can remain airborne for hours and can travel up to 20 to 30 feet from their source. Think of airborne bacteria or viruses like water in a stream: they will take the easiest path as they flow from one point to the next. If the stream is partially blocked by a rock, log, or other obstacle, the flow of the stream will slow as water is dammed up. Likewise, to slow the spread of disease, you should create as many obstacles to the flow of airborne particles as possible. In occupational and environmental health and safety, these obstacles are known as engineering controls. They may include enhanced ventilation systems, ultraviolet light, and filtration. Engineering controls may be used with administrative controls—workplace practices and policies that reduce people's risks of infection—such as staggered access to workplace or community spaces, distancing measures, cleaning or disinfection protocols, and masking.

The ability to assess the risk of a person being exposed to infectious particles, becoming infected, and spreading the illness further is your most important skill for keeping yourself and others healthy and safe. Being exposed to bacteria or viruses does not mean you will be infected. Infection requires an adequate dose of bacteria or viruses to enter the body of an exposed individual. The number of bacteria or viruses that makes an "adequate dose" varies from person to person, depending on the strength of their immune system. We typically don't know how much of a pathogen will make us ill, how bad the illness could be, and often what type of virus we've caught until we start feeling sick.

But we do know how infectious diseases spread and how we can reduce people's potential for exposure. By keeping in mind the "Four Ds"—duration, density, distance, and dilution—we can manage this risk.

Density

Dilution
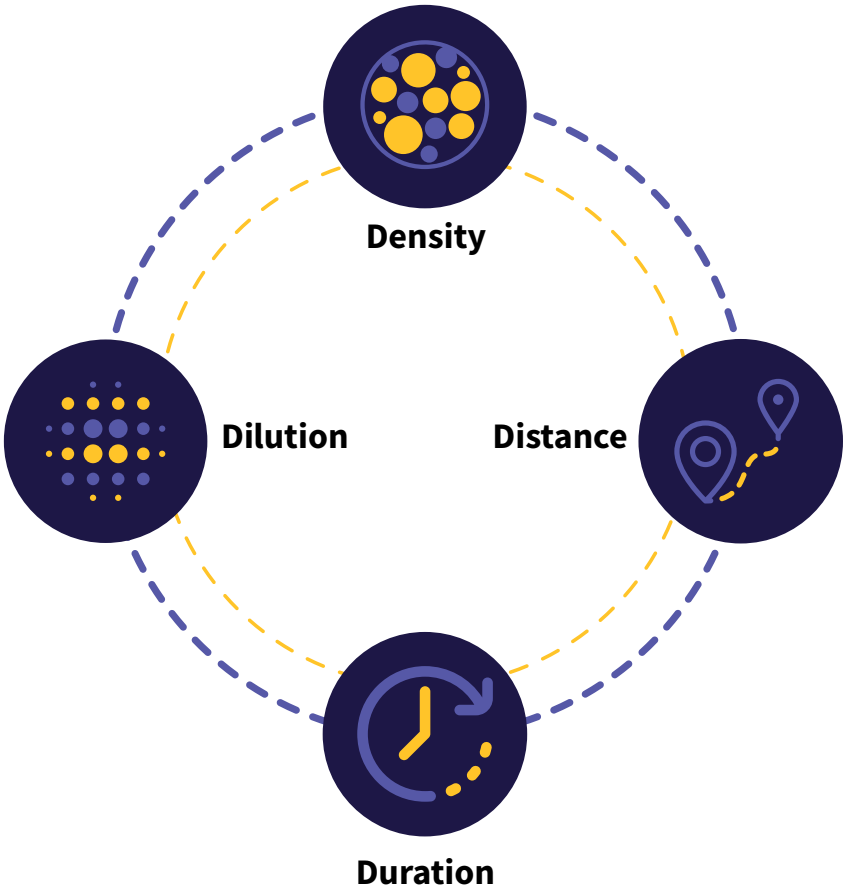
Distance

Duration

Fast Fact:

Disease will spread more easily if there are more unvaccinated, infectious but asymptomatic, unmasked, or poorly masked people in a space.

The Four Ds: Duration, Density, Dilution, and Distance

Duration:

A measure of how long a person shares an indoor space with a source of infection. The risk of transmission indoors is typically much higher than in outdoor spaces. Viruses are quickly inactivated by ultraviolet light, such as sunlight, and the wind may carry infectious particles away from an uninfected person. But indoors, infectious particles can remain active for hours. Therefore, the more time someone spends inside a space, the more likely they are to inhale contaminated air. Even with efficient heating, ventilation, and air conditioning systems, it can be difficult to recreate the effects of sunlight and wind in an indoor space, allowing infectious particles to build up over time.

> **Fast Fact:**
> Disease transmission is weakened by sunlight and constant airflow. By spending time indoors, you're remaining in spaces where infectious particles can stay active for hours and build up over time.

Density:

A measure of how many people are in a space. Do you know how many people use your workplace or community environment at a given time? Furthermore, do you know how many of them are not vaccinated? How many are infected, including those not showing symptoms? How many are not wearing masks or are wearing poorly designed masks? As these numbers increase, so does the concentration of infectious particles in the air and the risk that other people are exposed and become infected. The more unvaccinated, unmasked, poorly masked, or infected people in a room, the more likely it is that disease will spread.

Although vaccination does not provide complete immunity from infection, it can increase a person's resistance to being infected and reduce the length and severity of any infection that occurs. That's why the vaccination status as well as the density of people within a space are important risk factors to consider when developing infection control plans.

Dilution:

A measure of the concentration of infectious particles compared to the volume of air in the room. Outdoor areas are relatively safe compared to indoor environments because more open space, fresh air, and sunlight helps reduce the concentration of airborne infectious particles. Sunlight has been scientifically proven to reduce the viability of SARS-CoV-2, the virus that causes COVID-19, in two to four minutes. Without sunlight to deactivate infectious particles or wind to carry them away, they may remain active in the air for hours.

> **Fast Fact:**
> Increasing airflow, especially the flow of outdoor air into your space, helps prevent disease transmission by diluting concentrations of bacteria and viruses to safe levels.

In indoor settings, one way to reduce the concentration of viruses in an enclosed space is by diluting the air. An effective HVAC system introduces outdoor or filtered recirculated air into the space and removes air contaminated with infectious particles. Buildings with aging HVAC systems, or that lack HVAC systems, put people within them at greater risk for infection. However, even opening a window to allow outdoor air into a space may improve dilution in some cases and enables the control of carbon dioxide (CO_2) levels in indoor spaces. Peer-reviewed research continues to determine whether CO_2 concentrations may impact virus aerostability and infection risk in indoor environments.

Germicidal ultraviolet (GUV) radiation systems may also reduce concentrations of infectious particles. GUV applications use a kind of ultraviolet light known as UV-C, short wave UV, or simply GUV to deactivate microorganisms in the air, on hard surfaces, and in water. GUV can be such an effective supplement to air filtration that it has been used to protect patients and healthcare workers in medical facilities from airborne diseases, such as tuberculosis. GUV technologies may provide continuous, safe, effective treatment, particularly when mounted from the ceiling or in the upper part of the room, compared to the episodic treatment provided by mobile GUV technologies or those installed in HVAC systems.

Distance:

A measure of how far people are from each other. Infected individuals can exhale bacterial and viral particles, so being close to an infected person increases your risk of infection. But infectious particles tend to spread out and become less concentrated as they travel away from their source. Conversely, you are less at risk for infection the farther you are from an infected person.

> **Fast Fact:**
> If you're close to an infected person, you're at greater risk of becoming infected yourself. The farther away you are from an infected person, the lower your risk.

However, being at reduced risk for infection does not mean that by standing far away from an infected person, you are completely protected from inhaling infectious particles. Infectious particles can spread throughout a room, especially when ventilation is poor. The scientific literature documents superspreader events in which long-distance infections have occurred.

Distance is also important to consider when installing in-room filtration or GUV systems. Place the device in a location that pulls contaminated air away from the occupants, not toward them. It is best to place these devices at ceiling level.

The Risk Assessment Quiz

The ability to assess your risk of being infected or spreading an airborne illness is your best tool for keeping yourself and others healthy and safe in any environment. Use the Four Ds to help you and your employees identify your risk level and take steps to protect yourselves.

We have developed a simple quiz that evaluates your organization's potential risk of airborne diseases, such as COVID-19, flu, RSV, and tuberculosis. The Risk Assessment Quiz allows you to quickly and easily determine how likely virus or bacteria exposure is in your workplace or community space and what to do to address it. Feel free to test it out now and refer to it for different situations or scenarios you might encounter.

The quiz asks questions about two of the Four Ds, duration and density. For example, it asks how much time people typically spend in your space (duration) and how many people are in your space (density), as well as how many of these people may be infected but not showing symptoms, how many may be unvaccinated, and how many are not masked or not wearing effective masks, if relevant to your current disease of concern. This will help you to determine your risk. The two of the four Ds remaining, dilution and distance, can assist you in making decisions after you know your risk level.

Determine Your Risk Quiz

To get the most out of the Risk Assessment Quiz, it will help to understand three concepts:

- **The source**: This is the infected person who spreads bacteria or viruses through breathing, talking, sneezing, and coughing. A person does not have to show symptoms of illness to spread infection. Depending on the illness in question, even vaccinated individuals may become infected and can serve as a source of bacteria or viruses.

- **The pathway**: This is the route that infectious particles take from an infected person to an uninfected person.

- **The receiver**: This is the individual who may become infected by bacteria or viruses transmitted from the source.

The Risk Assessment Quiz will rate your risk level as low, moderate, or high and outline clear, specific actions you can take to help manage the risk of disease transmission. You can use the Risk Assessment Quiz to ensure that you are protecting workers and members of your community in different scenarios they may encounter.

Take a few minutes to complete the Risk Assessment Quiz on page 21.

Cleaning and Disinfecting

In addition to applying the Four Ds, it's important to clean and disinfect surfaces. Cleaning and disinfecting surfaces in your workplace or community setting can help you:

- Prevent secondary transmission of airborne diseases: airborne pathogens can settle on surfaces and potentially infect people if they touch contaminated surfaces and then their faces.

- Integrate safety practices: combining air quality management with surface cleaning and disinfecting addresses all potential disease transmission pathways.

- Build public confidence: regular cleaning and disinfecting reassures employees, customers, visitors, and others of their safety, enhancing trust in using the space.

- Limit transmission of diseases spread through contact: cleaning and disinfection is effective against illnesses spread through surface contact in addition to those spread through airborne pathways.

- Comply with Healthcare Guidelines: cleaning and disinfecting practices align with infection prevention and control recommendations from health organizations.

Cleaning and disinfection, along with good hygiene and proper ventilation, keeps people healthier and reduces the spread of disease.

Employer Recommendations

Employers may use the following strategies to help keep workers, visitors, and community members safe from airborne infectious diseases. These strategies have been divided into six areas of focus:

1. Ventilation
2. Distancing Measures
3. Respiratory Protection and Masks
4. Workplace Policies
5. Cleaning and Disinfection
6. Training and Communication

Ventilation

Ventilation is a way of applying the third of the Four Ds, dilution. To dilute indoor air, you can introduce outdoor, GUV-treated, or filtered recirculated air into an enclosed space through the building HVAC system. When reviewing and updating your facility's ventilation system, you should work with an HVAC professional. An HVAC professional's work focuses on two critical areas: ensuring your facility HVAC system is operating at peak performance and increasing and improving air quality and flow in indoor spaces. When reviewing the ventilation in your facility, focus on these two goals.

Maintaining your HVAC system: monitor your system to make sure it functions effectively. This means:

- Replacing and upgrading air filters as needed.
- Cleaning air ducts.
- Meeting the guidance of ASHRAE Standard 241, Control of Infectious Aerosols, subject to the constraints of system design.
- Keeping relative humidity constant at 40 to 60%.

Work with an HVAC professional to ensure that workspaces, common areas, and restrooms are well ventilated. If your HVAC system includes filtration, ensure you implement the best air filtration practices. You can learn more about the importance of indoor air quality from AIHA's indoor environmental quality resources.

> **Do you need help reviewing or updating your HVAC system?** Locate an ASHRAE-certified HVAC professional via the association's online directory.
>
> Industrial hygienists and occupational and environmental health and safety (OEHS) professionals can also help you navigate the complexities of HVAC and building ventilation. AIHA also provides a directory of qualified OEHS professionals.

Increasing and improving air quality and flow:

Portable air cleaners can reduce concentrations of small airborne particles, such as viruses, if the building's HVAC system cannot handle higher-efficiency filters. GUV can reduce the concentration of viable viral and bacterial particles. Consider using GUV or air cleaners throughout your facility to supplement the HVAC system, especially in areas where people spend long periods of time.

To determine if a GUV device will be effective in your space, consider:

- The type of UV source.
- The duration of time that UV will be applied.
- The distance between the UV source and areas with high concentrations of infectious particles.
- Whether objects in the room block or reflect UV light, preventing it from deactivating infectious particles.

GUV devices are most effective when closer to infectious particles for longer periods of time. However, direct, short-term exposure to GUV sources not contained in a ceiling-mounted or in-room device can cause temporary damage to the eyes and skin. Proper installation and use of GUV devices, as well as limiting the amount of time room occupants are exposed to GUV, is critical for the devices' effectiveness and people's safety. The National Institute for Occupational Safety and Health has guidelines for the safe use of GUV light in the healthcare industry, which can also be applied to other indoor spaces. These guidelines can help you ensure that GUV devices reduce the transmission of airborne diseases in your facility while keeping workers and visitors safe.

When selecting an air cleaner, look at the device's clean air delivery rate (CADR). This rate is determined using test procedure developed by the Association of Home Appliance Manufacturers, so devices with CADR scores can be reliably compared. The CADR is the volume of air cleaned by the device expressed as cubic feet per minute. It measures the device's ability to remove airborne contaminants. In general, devices with higher CADRs remove contaminants at a faster rate than those with lower CADRs.

Check the device's label for its smoke, dust, and pollen CADR scores. The CADR label for smoke is particularly useful because smoke particles are similar in size to particles that carry viruses. If a specific CADR score for smoke is not provided, multiply the manufacturer's general CADR score recommendation by two-thirds to estimate the value for smoke.

Choose a device designed to work for the size of the space you'll use it in. The label should indicate the largest room size appropriate for your unit, assuming a ceiling height of up to eight feet. If the ceiling of your space is higher than eight feet, consider a unit with a higher capacity.

You should also consider how frequently all the air in the room will pass through the air cleaner within an hour. The air cleaner's CADR and its accompanying suggested room size are two of the factors used to determine the air cleaner's rate of air changes per hour (ACH). For air cleaners that carry the Association of Home Appliance Manufacturers (AHAM) Verifide® mark, the label suggests a room size based on 4.8 ACH, the minimum necessary for the device to keep up with unfiltered air entering the room. For more information, refer to AHAM's 2021 document, "Portable Air Cleaners and Air Change Per Hour" (PDF).

If your device doesn't have a CADR score, use the following method to calculate the air exchange rate needed for your room:

1. Determine the volume of the room in which you plan to use the unit by multiplying the room's length, width, and height.
2. Multiply the room volume by five, the baseline air change rate of 4.8 ACH rounded up to the nearest whole number.
3. Divide the result from Step Two by 60 minutes. The quotient will be the target air change rate for your space.

Once you have selected an air cleaner or GUV device, consider the following to install the unit most effectively:

- Position your device to collect as much air as possible while drawing the air away from the room's occupants.
- Place the unit's intake near potential sources of infection.
- Ensure that no objects or structures, such as walls or curtains, interfere with the outlet or intake vent.

Regularly replace air filters or GUV lamps according to the manufacturer's instructions to ensure your device continues to operate effectively.

Since the onset of the COVID-19 pandemic, numerous new indoor air cleaning products have emerged, citing laboratory findings in their marketing materials. But not everything that happens in a lab can be replicated in real life, and not all studies are performed independently. To ensure you select the safest and most effective solution for you, your building, and your community, look for cost-effective, well-known, consistently proven air cleaning technologies based on filtration or GUV.

Now that you have tools to increase the amount of clean air in your space, consider ways to move that air through the room or building. Pedestal or hard-mounted fans can be cost-effective solutions for air circulation. However, it is important to minimize direct airflow from one person to another, especially when there is a potential risk of infection. In addition to fans, or when fans aren't an option, you can introduce fresh outdoor air by opening windows and doors, if local weather and air quality permit it.

Distancing Measures

Distancing measures are practical means of applying the fourth D, distance, to prevent transmission of airborne infectious diseases. People with viral infections can exhale a large amount of infectious particles, regardless of whether they show symptoms of illness. An uninfected person who is physically close to an infected person is at greater risk of becoming infected themselves. When considering measures to reduce airborne disease transmission, ask yourself how near or far people in your building are located with respect to each other.

Layering distancing measures with other strategies, such as ventilation, increases their effectiveness and ensures more protection. If you intend to include distancing measures in your plan to reduce the spread of airborne infectious diseases in your facility, you may consider the following actions:

- Limit the occupancy of rooms or other areas where people are likely to congregate for long periods of time.
- Arrange workstations and seating areas so that employees and others remain at least six feet apart when using the space.
- Post visual cues, like floor markings and signs, to encourage employees and others to remain at least six feet apart when interacting with each other or moving through the building.
- Install barriers, screens, or partitions to separate employees and others in areas where they are likely to remain stationary for some time, such as between workstations and at front desks, while recognizing that barriers can disrupt ventilation and airflow.

Respiratory Protection and Masks

Use of respiratory protection and masks, in combination with ventilation and distancing measures, may help you reduce the concentration of airborne viral particles in a room, even if there is a high density of people. The more people who are not properly wearing masks or respirators in a space, the more likely it is that disease will spread.

NIOSH-approved respirators, such as N95s, are the best wearable devices for preventing infection. People at higher risk of serious respiratory illness, such as older adults and people with weakened immune systems, as well as their caregivers, should wear N95 respirators to achieve the most protection possible in public indoor spaces, especially hospitals. People with serious lung or heart health issues should talk to their doctors about whether using a respirator or face mask is right for them.

Surgical or cloth masks and KN95s, which are N95 alternatives not tested to NIOSH standards, are not approved for use by workers when there is a known risk of airborne disease transmission. If employers know or strongly suspect that workers are being exposed to airborne transmissible diseases, they should ensure workers use NIOSH-approved respirators for optimal protection. However, masks may be appropriate options if respirators are not available.

Respiratory Protection:

Disposable filtering facepiece respirators, such as N95s, remove contaminants from the air before wearers can inhale them. Healthcare workers, construction workers, painters, and others working in environments with airborne hazards often wear N95 respirators and other protective gear. When fitted properly, NIOSH-approved respirators that meet the requirements of OSHA's respiratory protection standard are significantly more effective than masks at minimizing wearers' exposure to airborne infectious diseases.

To use an N95 respirator effectively, you must put it on correctly before you believe you will be exposed and wear it correctly during the exposure. Your respirator must fit snugly against your face, with no gaps between your skin and the respirator seal. This should be confirmed with a fit test. The respirator filter must capture more than 95% of the particles that pass through it.

You must put on, wear, and take off your respirator correctly to ensure maximum reduction of your risk of infection. Only with training and practice can you ensure that your respirator fits properly every time. Follow these steps when putting on your N95 respirator:

- Ensure glasses, jewelry, or clothing will not prevent the respirator from fitting properly. Shave any facial hair.
- Wash or sanitize your hands.
- Hold the respirator to your face with one hand. The facepiece should cover your nose and mouth, extending under your chin. The straps should hang down in front of your hand.

- Pass the top strap over the top of your head and secure it at the crown of your head.

- Pass the bottom strap over your head to secure it at the base of your neck.

- If the respirator has a nosepiece, use both hands to fit it to your nose.

- Conduct a seal check.

During a seal check, the wearer typically covers any exhalation valves on the respirator with their hands. For respirators without exhalation valves, the wearer covers the entire surface of the mask. With their hands still in place, they should inhale quickly to ensure the respirator seals tightly against their face. Then they should exhale, feeling a slight pressure build-up inside the respirator that indicates a proper seal.

Follow these tips to properly remove your respirator:

- Don't touch the front of the respirator, which may be contaminated with viral particles.

- Touching only the bottom strap, carefully pass it over the top of your head.

- Grasp the top strap and carefully pull it over your head.

- Pull the respirator away from your face. Again, be sure not to touch the facepiece.

- Do not touch your eyes, nose, or mouth when you remove your respirator.

- Throw away your respirator.

- Wash or sanitize your hands.

> **! CAUTION**
> Respirators with exhalation valves must not be used for limiting the transmission of viral particles.

During the COVID-19 pandemic, counterfeit N95 respirators not meeting NIOSH criteria permeated the marketplace. Here are some signs that your respirator may be counterfeit:

- No NIOSH or other markings on the filter.

- If there are markings, "NIOSH" is spelled incorrectly.

- No approval number on the filter or headband.

- Ear loops instead of straps.

- Decorative materials, such as sequins.

- Claims of approval for children.

Educate your staff or visitors about respirator use to reduce the risk of spreading infectious diseases. Unlike some of the other recommendations described in this ebook, people can select and manage respirators based on their individual situations, risk tolerance, and need. To learn about respirators in healthcare settings, see Commit to C.A.R.E.'s risk assessment tools.

Masks:

Masks, when chosen correctly and worn properly, can limit the spread of infectious particles exhaled by the wearer and reduce the number of infectious particles inhaled by the wearer. Although N95s and other respirators provide more protection, masks can be an effective tool in a multi-layered approach to limiting the spread of infectious diseases in indoor spaces. Some KN95s and medical masks can provide the next highest level of protection, but not all KN95s are the same. You should take caution to ensure you choose masks tested and approved to meet certain standards. Cloth or homemade masks provide little protection.

Consider advising workers to wear masks, especially when:

- There are high levels of infectious disease transmission in the community.

- They are personally vulnerable or interact with vulnerable people.

- They have been recently exposed to illness.

- They are using mass transportation.

For a mask to be as effective as possible, it must fit tightly to the wearer's face. A tighter fit may be possible with a metal nosepiece that shapes the mask to the wearer's nose, which may provide a tighter fit. Adjustable ear straps provide a better fit around the sides of the face. The wearer must also ensure their mask completely covers both their mouth and nose and extends below their chin. Facial hair can impair the seal of the mask on the face and reduce its ability to filter air.

Masks do not eliminate all risk of infection, but they can significantly reduce the risk for wearers and others when properly selected, worn, and cared for. Like respirators, people can choose to wear masks based on their individual situations, risk tolerance, and needs. To learn about masking in general office settings, see Commit to C.A.R.E.'s risk assessment tools.
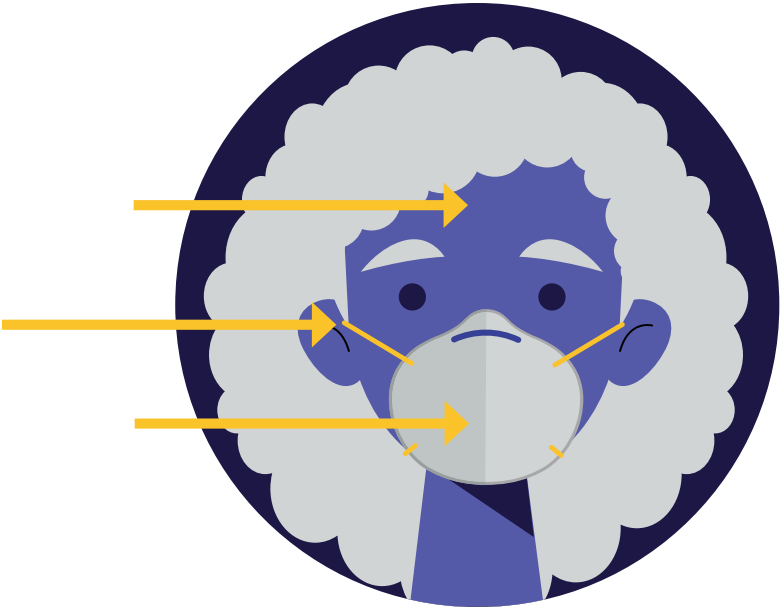
Workplace Policies

Through workplace policies that address two of the Four Ds, duration and density, you can implement risk mitigation strategies specific to your workplace and workforce. Examples of workplace policies that reduce the spread of infectious diseases include:

- Designate separate entrances and exits and use visual markings to direct employees and others to follow one-way foot traffic patterns.
- Close rooms that are poorly ventilated. If these rooms must be used, install ceiling GUV or in-room air cleaners.
- Encourage workers to use virtual meeting tools instead of holding in-person meetings.
- Explore work-from-home options, staggered work shifts or hours, and other flexible work arrangements.
- Provide paid, flexible sick leave to encourage workers to stay home if they or someone in their household has symptoms of illness.
- Prepare for worker absences by developing plans for alternative shift or task coverage.
- Monitor and track employee absences related to infectious diseases.
- Implement alternative methods for receiving clients, patients, or visitors, such as call-ahead practices, face-covering requirements, or the use of outdoor spaces, to minimize risks of disease transmission in reception areas.

When you revise your workplace policies, you can add layers of protection that help prevent the spread of airborne infectious diseases. These policies may be influenced by factors such as community infection rates, the vulnerability of individual workers or their families, and your organization's ability to implement ventilation or other strategies.

Cleaning and Disinfection

By combining ventilation, distancing measures, and respiratory protection or masking with surface cleaning and disinfection, you may implement a comprehensive approach that addresses all potential pathways of airborne disease transmission. A comprehensive cleaning and disinfection strategy should assess all an employer's responsibilities to enhance safety and compliance. When developing cleaning and disinfection procedures for your workplace, you should consider the following:

- Prioritize frequently touched surfaces in the workplace for cleaning and disinfecting.
- Provide clear guidelines that ensure consistent implementation of cleaning and disinfection practices across all parts of the organization.
- Emphasize the importance of hand washing, coughing etiquette, and staying home when sick in preventing disease transmission.
- Implement technology such as HEPA filters, GUV sanitization, carbon dioxide monitors, and air quality monitors that can enhance cleaning and disinfecting strategies.

Additional Resources

Courtesy of the International Sanitary Supply Association (ISSA)

The ISSA Clean Standards, including the ISSA Clean Standard K-12, provide frameworks that help K-12 schools and other institutional facilities assess the effectiveness of their cleaning measures.

ISSA's "Risk Assessment for Cleaning and Disinfection Work" tip sheet (PDF) walks users through completing a risk assessment and implementing controls.

Training and Communication

Training and communication help workers, visitors, and community members understand the steps your organization is taking to prevent the transmission of infectious diseases. Education on infectious diseases or disease variants of concern helps workers recognize symptoms and take appropriate action if they or someone close to them develops symptoms of illness. Workers and others who understand how your workplace programs benefit them can better self-advocate and identify ways to reduce the spread of infectious diseases themselves.

When preparing a communication and training program, keep in mind that content that is easy to understand lead to better adoption and implementation of infection control programs. This may require translating the content into workers' preferred languages and using multiple communication methods, such as emails, text messages, and signs, to ensure access to timely and accurate information. Adopt a communication strategy tailored to your organization that emphasizes transparency, allowing workers, visitors, and others to share their concerns, questions, comments, and feedback.

When you have a training and communications plan in place, you are better positioned to keep workers and others in your facility healthy and safe. Training and communication complement each other, enabling you to implement the Four Ds: duration, density, dilution, and distance.

COMMIT TO C.A.R.E. You can find educational materials on risk assessment and the Four Ds, as well as other tools for reducing the spread of infectious diseases, through Commit to C.A.R.E, an interactive training program developed by AIHA and the Integrated Bioscience and Built Environment Consortium (IBEC). Commit to C.A.R.E.'s free resources include more than 20 short animated training videos, supporting worksheets, tip sheets, and infographics, targeted towards various workplaces and designed with accessibility in mind, including closed captioning, and translations in eight languages.

Recommendations for Employees:

As an employer, you have a responsibility to protect your employees, as well as suppliers, customers, visitors, and others who enter your facility. Employer assistance can help workers and others take practical steps to protect themselves and their colleagues, families, and friends. Your responsibilities to reduce the transmission of airborne infectious diseases include informing workers of the following:

- Provide training on workplace hazards to all employees or workers before they are assigned to a job. This includes risks attributed to airborne infectious diseases.

- Communicate the need to follow workplace and community health and safety policies in place to protect workers.

- If possible, use virtual alternatives to face-to-face meetings that limit workers' proximity to others.

- Remind employees to regularly evaluate their health and that of their household and to stay home if they or anyone in their household shows symptoms of illness.

- Arrange alternatives for shift coverage in case an employee or someone in their household gets sick.

- Remind employees to regularly clean surfaces and frequently touched objects with soap and water, following with use of an EPA-approved disinfectant. If an EPA-approved disinfectant is not available, disinfect with one-third cup of bleach added to one gallon of water or 70% alcohol solution. Do not mix bleach or other cleaning and disinfection products together. For additional information, refer to CDC's guidance on cleaning and disinfecting (PDF).

- Ensure that employees correctly wear effective, properly fitted masks at close quarters in enclosed spaces. Commit to C.A.R.E. provides educational videos on mask wearing:

  – The Power of Masks - How to Prevent COVID-19 Infection

  – How To Properly Wear and Store a Mask

- Instruct employees to limit the number of objects they touch. Reinforce the importance of good general hygiene and washing hands with soap and running water, when available. If not, require employees to sanitize their hands with a product that contains at least 70% alcohol when arriving and leaving a facility, as well as frequently throughout their shift.

- Educate staff members on the importance of maintaining space between themselves and others to limit their risk of illness.

- Maintain an "open door" policy: encourage employees to talk to their supervisors if they have concerns about masking, respirator use, or other infection control strategies.

A metal nose piece can help shape the mask to your nose and create a tight fit.

1 Handle the mask only by grasping either the ear loops or string ties.
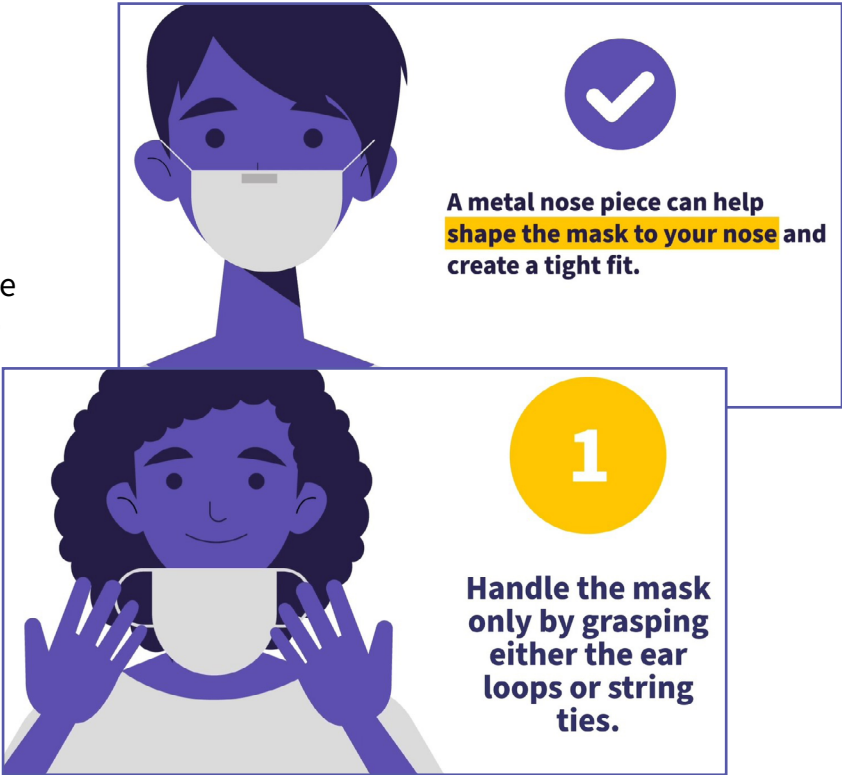
Conclusion

Part One of this ebook walked you through several approaches to mitigating the risk of airborne infectious diseases in your workplace or community. The ability to assess the risk of becoming infected or transmitting disease is your most important tool for keeping yourself and others healthy and safe. The Four Ds are other items in your toolbox that are essential for determining and managing the risk of infection.

You now know how to make your facility safer and healthier for workers and others. Because every building and situation is different, it will not be possible for every employer to implement every strategy. But the more layers of protection you add, the more you reduce the risk of infectious disease transmission in your workplace or community. With the knowledge provided in Part One of this ebook and the resources offered by Commit to C.A.R.E., you are better equipped to create a healthier and safer environment.

In Part Two of this ebook, you will learn additional ways to address infectious diseases specific to your workplace or community setting.

PART TWO

# Guidance for Specific Workplaces and Community Settings

Now that you have a basic understanding of airborne disease transmission, as well as the Four Ds, you can apply guidance specific to your workplace or community setting. In Part Two of this ebook, choose the type of workplace or community that best matches your own. Implement these workplace-specific strategies in concert with the general strategies presented in Part One.

The workplace and community settings addressed in Part Two include: healthcare facilities, childcare and educational facilities, manufacturing facilities and warehouses, cultural institutions and venues, sports and outdoor events, and transit systems. Remember that there are many different types and sizes of spaces and facilities, so some of the guidelines below might not apply to your workplace. Instead of implementing all the following recommendations, implement as many as possible. A multilayered approach will help keep the people in your workplace or community safer and healthier.

Healthcare Facilities

Healthcare settings face unique challenges in reducing the transmission of airborne infectious diseases, such as COVID-19, respiratory syncytial virus (RSV), influenza, tuberculosis, and respiratory Staphylococcus aureus infections. Healthcare workers are in close contact with patients and visitors, many of whom have symptoms of illness. They must work indoors, often with large numbers of people, and they are exposed to saliva, blood, and microorganisms.
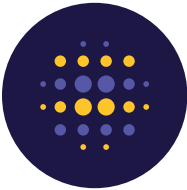
Ventilation

HVAC systems in healthcare facilities operate differently than those in other environments due to their emphasis on pressurization. In healthcare facilities, differences in air pressure between rooms control air movement and decrease the spread of bacteria and viruses. This is why it's generally not recommended to open windows in healthcare facilities, although in other environments, introducing fresh air might help dilute concentrations of airborne pathogens. Pressurization can increase clean air flow into areas where people spend more time or where they may be exposed to airborne infectious particles. For example, in a hospital waiting room, clean air should flow from the areas where staff work towards the areas where patients sit. If you're using an in-room air cleaner, make sure it is set up to collect as much air as possible.

As discussed in the section on ventilation in Part One of this ebook, you should consider the number of times per hour air is filtered through your space. CDC guidance recommends five or more air changes per hour for most facilities. To learn more about clean air delivery rate (CADR) scores for high-risk environments, consult ASHRAE Standard 241, Control of Infectious Aerosols, which complements CDC's ventilation mitigation strategies. According to CDC:

> "One misperception is that the S241 clean air requirements conflict with the "five or more ACH" ventilation recommendations from CDC. The S241 is written with a compliance focus. Jurisdictions with legal authority that adopt S241 can then enforce its requirements. In contrast, CDC's Ventilation Mitigation Strategies are voluntary, offering improved ventilation strategies for those seeking increased protection from respiratory aerosol exposures. Both S241 and CDC's Ventilation Mitigation Strategies emphasize the importance of bringing building HVAC systems up to current code requirements."

Distancing Measures

- Rearrange workspaces, beds, machines, and equipment so that staff, patients, visitors, and others in your facility do not come within six feet of each other for more than 15 minutes per day.
- If patients must wait indoors, limit the number of chairs in the waiting room to the number of people you expect to check in.
- Spread the remaining chairs as far apart as possible.

Workplace Policies

- Close patient waiting rooms and request that patients wait outside or in their cars. Call or text patients when it's time for their appointments.
- Permit as few visitors to interact with patients as possible.

Training and Communication

Adopting a communication strategy that is customized to your healthcare facility and emphasizes transparency will allow workers, patients, and visitors to share concerns, questions, comments, and feedback. Ensure that workers in your healthcare facility know they can take steps to help protect themselves and others from COVID-19, RSV, influenza, and other infectious diseases, such as the following:

- Ensure that staff members wear effective, properly fitted respirators indoors or at close quarters. Watch these videos by Commit to C.A.R.E. to learn how to find an effective respirator and make sure it fits properly:
  - The Power of Respirators
  - Properly Putting Your Respirator On and Taking It Off
- Discourage staff from sharing personal protective equipment (PPE), like safety glasses, goggles, and face shields.
- Require staff to clean and disinfect PPE before using it again.
- Ensure staff members who wear scrubs or lab coats don't take them home after their shifts.

Childcare and Educational Facilities

Childcare and educational facilities, including daycare centers, K-12 schools, colleges, and universities, face challenges in reducing the spread of airborne infectious diseases. Outdated HVAC systems, building layouts, and high volumes of foot traffic may make it difficult to implement ventilation adjustments and distancing measures. Crowded hallways, classrooms, and common areas increases the risk of pathogens spreading among students, guardians, faculty, and staff.

Due to the diverse nature of educational facilities, recommendations for limiting the spread of infectious diseases vary depending on factors such as layout, capacity, and the activities conducted in each location. Therefore, the guidance in this section is often subdivided by facility type: daycare centers, K-12 schools, and colleges and universities. This allows you to navigate directly to the guidance that is most appropriate to your facility.
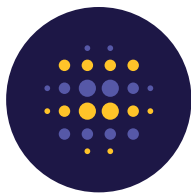
Ventilation

Many childcare and educational facilities must use outdated HVAC systems that may be unable to efficiently circulate or properly filter air. Insufficient ventilation and inadequate air filtration can cause the buildup of infectious airborne particles, increasing the risk of disease transmission. Implementing additional ventilation controls, such as increased filtration or GUV, can reduce disease transmission in educational facilities.

In 2023, ASHRAE published "Design Guidance for Education Facilities: Prioritization for Advanced Indoor Air Quality" (PDF), which provides guidance on improving indoor air quality in educational facilities. This document includes checklists, budgetary guidelines, and sections addressing filtration and GUV technology. The National Institutes of Standards and Technology also issued a report in 2023 that compares mitigation strategies for schools using various types of HVAC systems.

Distancing Measures

Guidance for daycare centers:

- Limit the number of children per room.
- Separate each group, class, or cohort of children by room.
- Avoid assigning children to communal tables and group work.
- Arrange desks or tables to face the same direction and allow children to follow distancing measures.

Guidance for K-12 schools:

- Hold classes outdoors or in large rooms such as auditoriums.
- Seat students at individual desks rather than at communal tables.
- Limit the number of students per classroom and minimize close contact between students during group projects.
- Arrange desks three to six feet apart, depending on grade level, so that students face the same direction rather than towards each other or the center of the classroom.
- Mark six-foot intervals on the pavement outside school entrances to inform students, guardians, teachers, and staff members to follow distancing measures when entering the building.

Guidance for colleges and universities:

- Arrange workstations so that faculty, staff, students, and others remain at least six feet apart.
- Separate faculty, staff, and students in common areas such as entrances, exits, and classrooms.
- Restrict seating in large lecture halls to allow students, faculty, and others to follow distancing measures.
- Limit the density of students by holding smaller classes in larger rooms.

Workplace Policies

Guidance for daycare centers:

- Assign the same staff member to the same children each day rather than rotating staff between groups of children.
- Use all building entrances as drop-off and pick-up locations, not only the main entrance.
- Stagger drop-off and pick-up times so that staff members can anticipate arrivals and departures and not all children are dropped off or picked up at the same time.
- Instruct staff members to greet children outside as they arrive and escort them inside, rather than allowing guardians to enter. At pick-up, require staff members to accompany children to their guardians' cars outside the building.

Guidance for K-12 schools:

- Assign teachers to the same students in the same classroom each day, and ensure students only interact with their classmates.
- Stagger school start times or dates.
- Stagger activities in common areas to reduce density and limit mixing between classes or grade levels.
- Offer virtual middle and high school classes to prevent student grades or cohorts from mixing.
- Restrict visitors from entering school buildings.
- Encourage administrative staff to work from home.
- Close student lounges and cafeterias to limit students from interacting with others outside of their class.
- Restrict or prohibit the use of lockers.

Guidance for colleges and universities:

- Assign seating in classrooms to assist contact tracing.
- Investigate ways to reduce disease transmission during activities in which distancing measures aren't feasible.
- Cancel or postpone nonessential group events or gatherings. Host essential events outdoors or online as often as possible.
- Require administrative staff to work from home to reduce the number of people on campus.
- Combine online and in-person lectures or classes in a hybrid approach to learning.

Manufacturing Facilities and Warehouses

Ventilation

Manufacturing facilities and warehouses often include large rooms with high ceilings, which present difficulties for employers trying to reduce workers' risk of exposure to infectious diseases. Dilution of airborne pathogens in these large rooms would require significant amounts of fresh air. The ventilation systems in manufacturing facilities and warehouses are often unable to effectively ventilate and dilute the air in these larger spaces. Large spaces also make the application of in-room air cleaners and GUV less effective at reducing disease transmission in these settings. Building HVAC systems that can move large amounts of air or fans offer more efficient and effective strategies for increasing and improving air quality and flow in these large indoor spaces. However, in-room air filters or GUV devices may be effective in smaller rooms, such as break rooms, offices, and conference rooms.

Distancing Measures

- Modify the production line setup to minimize employees' close contact with coworkers.
- Limit the occupancy of breakrooms and other areas where people congregate for long periods of time.

Cultural and Entertainment Spaces

Employers face unique challenges in preventing the spread of infectious diseases in cultural and entertainment spaces, including medium and large indoor venues such as concert halls, nightclubs, casinos, and theaters, as well as museums, places of worship, and libraries. These spaces often draw large, diverse crowds of visitors who congregate together in shared indoor spaces, along with employees who work registers and concession stands, clean the facilities, guide tours, and provide other services.

Due to the diverse nature of cultural and entertainment venues, control strategies for infectious disease may vary depending on factors such as layout, capacity, and the nature of the activities conducted in each location. Therefore, guidance in this section is subdivided by the type of space: small and medium-sized entertainment venues, museums and cultural institutions, places of worship, and libraries. This allows you to navigate directly to the guidance that is most appropriate to your facility.

Ventilation

The spaces where cultural and entertainment events are held often feature large rooms with high ceilings and few dividing walls. In these large, indoor spaces, it may be difficult to ensure that adequate fresh air enters these large indoor spaces and stale air flows out of them, and the use of in-room air cleaners is impractical for reducing infectious disease transmission. Modifications to building HVAC systems, as well as the use of fans, may increase and improve air quality and flow more effectively in these spaces. However, in-room air cleaners and GUV devices may effectively dilute airborne contaminants in smaller rooms, such as break rooms, offices, and conference rooms. You should consult with an HVAC professional to determine the effectiveness of HVAC modifications, fans, in-room air cleaners, and GUV devices in your facility.

Distancing Measures

Guidance for small and medium-sized entertainment venues:

- Assign seating for screenings, shows, and other events so that patrons don't sit next to each other.
- Keep parties of patrons separate with marked-off tables, darkened bowling lanes, closed slot machines, and so on.
- Limit the number of employees and patrons in areas where people are likely to congregate and discourage parties from mingling.
- Install barriers that separate employees and patrons at registers, ticket booths, concession stands, and attractions but recognize that barriers can disrupt ventilation and airflow.
- Discourage customers from congregating in lobbies or parking lots before or after events.

Guidance for museums and other cultural institutions:

- Limit the number of people permitted to enter the building in accordance with local, state, or federal guidelines.
- Limit the number of patrons per group, tour, program, or event in accordance with local and state guidelines.
- Separate employees, volunteers, and visitors in spaces such as break rooms, elevators, galleries, theaters, and entrance and exit areas, where people are likely to congregate.
- Limit patrons' access to elevators, galleries, and gift shops.
- Limit seating in common spaces and reading rooms to ensure people using collections remain at least six feet apart.
- Relocate, temporarily close, or install barriers in exhibits that do not permit patrons to stand six feet apart.
- Assign seating in theaters and auditoriums so that different parties do not sit next to each other.
- Suspend services that require patrons to wait in line and interact with employees, such as coat and bag checks. Consider alternatives such as lockers in areas monitored by staff from a distance.
- Restrict access to storage areas and workrooms to essential personnel. Implement strategies to inform others when these rooms are occupied.
- Mark off eight-foot sections of benches or replace benches with chairs spaced at least six feet apart.
- Discourage patrons from congregating around entrances or exits.

Guidance for places of worship:

- Limit the number of attendees for services.
- Ensure participants and community members remain at least six feet apart.
- Separate participants and community members in common areas and entrance and exit areas.
- Consider staggering participants' arrivals and departures to the service to avoid close contact between different groups.

Guidance for libraries:

- Limit the number of patrons in the library.
- Post signs in common areas to convey the maximum occupancy limit.
- Post signs around the library and provide infographic sheets on the library's website reminding patrons to stay more than six feet away from those not in their party.
- Discourage employees and patrons from congregating in the library, common areas, or break rooms.
- Close shared common areas to prevent crowding.

Workplace Policies

Guidance for small and medium-sized entertainment venues:

- Designate areas of the venue for use by reservation only (for example, eating tables, bowling lanes, and pool tables).
- Use tape, paint, and other visual markers to direct patrons to follow one-way foot traffic patterns.
- Encourage patrons to purchase tickets and make reservations online to limit interactions with employees at the point of sale.
- Implement smartphone apps for food and drink orders to reduce congestion around ordering areas.
- Stagger screenings, shows, and events so that patrons do not arrive at the same time.

Guidance for museums and other cultural institutions:

- Restrict the number of staff allowed in loading docks and use virtual courier services.
- Implement timed entry for popular exhibits or for the museum in general.
- Direct employees, volunteers, and patrons to follow one-way foot traffic patterns in stairways, galleries, and special exhibitions.
- Offer virtual or app-based audio tours.
- Host events outdoors. Limit the duration of these events to avoid overcrowding in outdoor areas.
- Stagger the timing of events so that patrons for different events do not arrive at the same time.

Guidance for places of worship:

- Use pre-recorded music and ask community members not to sing aloud. Infectious particles can travel up to 25 feet from the source, depending on the ventilation in the space.
- Livestream services or conduct services outdoors.
- Investigate other flexible approaches for holding services.

Guidance for libraries:

- Limit the amount of time patrons can spend in the library or limit the library's hours of operation.
- Automate library services, such as checkout, to limit contact between staff members and patrons.
- Allow patrons to request books and other materials before their visit, which they may pick up at a secure outdoor location.
- Arrange for administrative employees to work from home.
- Designate specific days and times for vulnerable populations, such as older adults, to visit the library. Permit only members of those groups to enter during those hours.
- Cancel, postpone, or host virtually events such as readings, story times, community gatherings, and meetings.
- Stagger computer access times.

Outdoor Event Locations

When preventing the spread of airborne diseases at outdoor event locations, it's important to distinguish between outdoor markets, such as farmers' and flea markets, and recreational activities held in campgrounds, parks, pools, and concerts or sports venues. Guidance in this section is subdivided by location type: outdoor markets, recreational facilities, and sports venues. This allows you to navigate directly to the guidance that is most appropriate to your location.

Distancing Measures

Outdoor event locations have advantages over indoor settings in providing more space and fresh air, which help dilute concentrations of infectious particles. Ultraviolet light in sunlight can inactivate viruses. These factors reduce the risk of infectious disease transmission when compared to indoor environments. But distancing measures remain crucial for ensuring the safety of workers, volunteers, and clients at outdoor events.

Outdoor markets present greater risks of transmission due to close contact between vendors and customers, sometimes in crowded conditions. These events draw diverse crowds of patrons hoping to purchase products in person, which can make it difficult for vendors, patrons, and others to remain at least six feet apart.

In outdoor recreational spaces and sports facilities, close contact typically occurs among members of patrons' parties rather than between strangers. These environments generally feature wide open spaces and afford more opportunities to implement and enforce distancing measures. Activities that require participants to be less than six feet apart may be safe, although caution is still warranted. It is also important to implement precautions when distancing measures may be difficult to enforce, such as in crowded areas. Spending prolonged periods of time in crowded spaces, even outdoors, increases risks of infectious disease exposure for employees, volunteers, patrons, and others.

Guidance for outdoor markets:

- Limit the number of customers allowed at each vendor at once to ensure physical distancing measures are followed.
- Increase space between vendors, and rearrange the market to allow workers and patrons to follow distancing measures.
- Install plastic partitions at payment kiosks to create barriers between workers and patrons.
- Limit the number of people allowed in restrooms at one time.

Guidance for recreational facilities:

- Limit the number of patrons at any given location at one time.
- Track party sizes to better manage visitor numbers.
- Require supervision for young children to ensure they follow distancing measures.
- Require pets to be leashed to reduce unintended breaches of distancing measures.
- Ensure that patrons follow distancing measures during equipment rental processes.
- Install barriers to separate employees and patrons in facilities where services are provided.
- Mark six-foot increments on the floor to encourage people to follow distancing measures in restrooms and shower areas.
- Limit restroom occupancy.

Guidance for sports venues:

- Require athletes and coaches to stay at least six feet apart during warm-ups, exercises, and social activities.
- Make announcements on the importance of following distancing measures before the start of the event.
- Post signs about distancing measures around the venue.
- Explain the need for distancing measures on the venue website.
- Limit the number of audience members to allow for adequate space between parties.
- Limit the number of attendees at associational or organizational meetings.
- Ensure that coaches, athletes, and officials leave the event in a manner that discourages close interactions.
- Rearrange check-in desks and concession stands to limit close contact between event staff, audience members, and athletes.
- Install barriers to separate people in locker rooms and entrance and exit areas. Remember, barriers can disrupt ventilation and airflow.
- Assess the feasibility of keeping showers and locker rooms open based on athletes' ability to follow distancing measures when using these facilities.

Workplace Policies

Guidance for outdoor markets:

- Encourage customers to pre-order items online and schedule pickups at designated intervals.
- Discourage vendors from offering samples.
- Discourage customers from consuming food on site and from bringing pets.
- Implement measures like pre-bagged items and numbered menus to streamline purchasing.
- Require vendors to display pricing on signs and implement contactless payment systems.
- Suspend penalties for last-minute cancellations by vendors.

Guidance for recreational facilities:

- Require patrons to make reservations to manage crowding during peak times.
- Suspend penalties for last-minute cancellations.
- Post signs promoting handwashing in restrooms.

Guidance for sports venues:

- Livestream events for virtual audience members.
- Host associational or organizational meetings online.
- Use social media, texts, emails, and verbal announcements to remind coaches, athletes, and audience members to follow safety precautions, such as masking.

Transit Systems

Public transit systems, like buses, subways, and light rail, complicate efforts to stop the spread of infectious diseases. Passengers and employees must sit or stand in small, crowded spaces without much fresh air intake, which makes it difficult to keep the air clean and limit disease transmission.

Ventilation

Effective strategies for improving indoor air quality depend on the type of transit system in question. Air filtration and GUV may be effective in reducing airborne disease transmission. Evaluate each car or vehicle for the feasibility of adding filters or GUV devices.

Distancing Measures

Factors such as vehicle design, carrying capacity, and use can play a role in determining the best strategies for enforcing distancing measures. Each type of public transit has its own unique considerations.

- Adjust workstations, such as ticket counters or help desks, so that employees do not remain within six feet of each other and passengers for 15 minutes or more over a 24-hour period.
- Mark six-foot increments inside and outside transit stops and within transit vehicles to help passengers and operators follow distancing measures while waiting for and riding on vehicles.
- Close every other row of seats to ensure passengers follow distancing measures.
- Allow passengers to sit only with those from their party.
- Mark a six-foot radius around vehicle operators' seats to limit contact between them and passengers.
- Install barriers to separate employees, operators, and passengers in vehicles or station facilities, while recognizing that barriers can disrupt ventilation and airflow.

Workplace Policies

- Implement protocols for entering and exiting the transit vehicle. For example, let passengers at the stop, station, or platform wait to board until those inside have exited, or designate some doors for entering and others for exiting, creating one-way foot traffic patterns.
- Accommodate reduced numbers of passengers in transit vehicles by scheduling more frequent service for busy lines.
- Stagger employees' access to work areas outside of transit vehicles, such as break rooms, office spaces, and lockers.
- Stagger shift start and end times to limit the number of employees who need to access locker rooms, restrooms, and break areas.
- Close some station entrances to limit the areas you must clean and disinfect. Post signs to guide passengers to available entrances and exits.
- Communication and Training
- Allow drivers of overcrowded transit vehicles to skip some stops, if feasible.
- Instruct drivers to keep the vehicle door closest to them shut to deter passengers from walking past them. However, if only the front door is equipped with a ramp for passengers with disabilities, it must remain operational.

Recommendations for Passengers

Here are tips to provide to passengers to help keep them safe from infectious diseases when using public transit:

- Take a private car or rideshare when travelling to the doctor's office or hospital, instead of public transport, if possible.
- Check transit providers' websites or apps before trips for guidance related to infectious diseases.
- Travel when it's less busy to avoid crowds.
- Ask drivers to open windows on transit vehicles to let in fresh air.

COMMIT TO

# Airborne Infectious
Disease Risk Assessment

To determine your organization's potential exposure to airborne infectious diseases, this assessment uses a control banding process adapted from research by Sietsema. The framework focuses on two primary variables — density (the likelihood of exposure based on the number of people sharing a space) and duration (the time spent indoors). We have also expanded this approach to consider spacing, ventilation/dilution, vaccination, and mask use. Answer the following questions to determine your organization's overall exposure risk.

Instructions

Answer each question by selecting A, B, or C based on the accuracy of the statements or what best describes the conditions at your organization.

The 4 Ds of Airborne Risk

4Ds
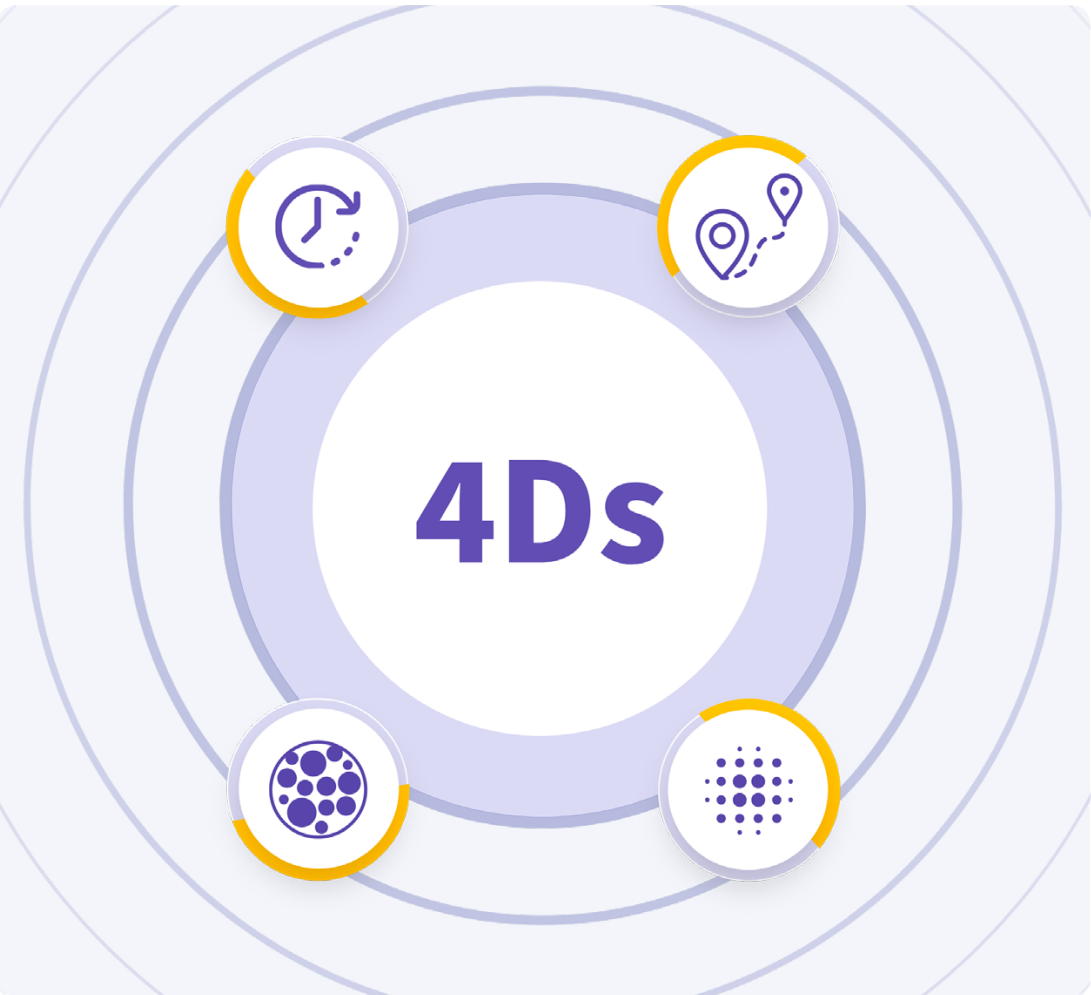
Duration:

How long people spend indoors.

Density:

How many people share the space.

Distance:

How close people are to one another.

Dilution:

How much fresh/filtered air is available.

Questions

Q1. Most people in my organization are up to date on recommended vaccinations for airborne infectious diseases (e.g., flu, RSV, COVID-19).

a Accurate **b** Partially accurate **c** Inaccurate

Q2. People who frequent my organization generally maintain the recommended distance (about 6 feet apart from one another).

a Accurate **b** Partially accurate **c** Inaccurate

Q3. People in my organization frequently wear properly fitted masks or respirators in higher-risk situations (e.g., during outbreaks or when crowded indoors).

a Accurate **b** Partially accurate **c** Inaccurate

Q4. The average time people spend in my organization's building space is:

a 0–3 hours **b** 3–6 hours **c** More than 6 hours

Q5. This space uses ventilation or air-cleaning strategies (e.g., HVAC, HEPA filters, open windows).

a Accurate **b** Partially accurate **c** Inaccurate

Q6. The number of people in this space is typically manageable, allowing for reduced crowding.

a Yes **b** Somewhat **c** No

Results & Recommendations

- Score your responses (A = 1, B = 2, C = 3) and add the values up to obtain a total score.
- Compare your total score to the ranges below.
- Review the tailored recommendations for your setting.

LOW Risk of Exposure   (6 to 9 points)

The risk of exposure to **airborne infectious diseases** in your organization appears to be low.

While low risk is preferable to high risk, there are still meaningful steps you can take to minimize the risk of transmission in your building.

When implementing protections, think about the **three stages where infection can occur:**

The Source:

The person who is infected and releases airborne particles through breathing, talking, coughing, sneezing, or singing.

The Pathway:

The route those airborne particles travel through the air.

The Receptor:

You or the individuals who may become sick after inhaling those particles.

Based on your results, your organization falls into **Control Band A**. This means:

1 Prioritize source control.

Encourage vaccination, reinforce "stay home when sick" policies, and consider mask use in high-risk situations.

2 Pathway controls are optional but beneficial.

Improvements to ventilation and air circulation can provide an extra layer of safety.

3 Minimal receptor protections needed.

Personal protections (like mask use or additional spacing) are generally optional at this level.

Managing the Risk of the Source	Managing the Risk of the Pathway	Managing the Risk of the Receptor
Encourage employees and visitors to stay home when sick.	Maintain HVAC systems and replace filters regularly.	Encourage individuals to use masks when they feel at higher risk.
Promote vaccinations relevant to airborne diseases (e.g., flu, COVID-19).	Use portable HEPA filters or open windows to improve air exchange.	Provide flexible seating or spacing options for those who prefer extra distance.
Use masks or respirators in crowded or higher-risk conditions.	Arrange spaces to support good airflow.	Remind staff of personal hygiene practices that support overall safety.

MODERATE Risk of Exposure (10 to 13 points)

The risk of exposure to **airborne infectious diseases** in your organization is moderate.

This means some protections are in place, but significant gaps remain. Adding additional layers of protection can significantly reduce your overall risk.

When designing protections, think about the **three stages where infection can occur:**

The Source:

The person who is infected and releases airborne particles through breathing, talking, coughing, sneezing, or singing.

The Pathway:

The route those airborne particles travel through the air.

The Receptor:

You or the individuals who may become sick after inhaling those particles.

Based on your results, your organization falls into **Control Band B**. This means:

1 Prioritize source control

Vaccination, stay-home-when-sick policies, and mask/respirator use should be actively reinforced.

2 Implement multiple pathway controls

Improvements to ventilation, filtration, and air movement are strongly recommended.

3 Consider receptor protections

Use these when source and pathway measures alone are not enough.

Managing the Risk of the Source	Managing the Risk of the Pathway	Managing the Risk of the Receptor
Require or strongly encourage the use of masks or respirators during outbreaks or when density is high.	Upgrade HVAC filters and increase outdoor air exchange where possible.	Encourage individuals to use masks in crowded or poorly ventilated spaces.
Reinforce policies that prevent sick individuals from entering the building.	Add portable HEPA air cleaners to rooms with limited ventilation.	Provide flexible work or class arrangements to reduce time in high-risk environments.
Support vaccination campaigns for seasonal and emerging diseases (flu, RSV, COVID-19).	Monitor air quality (e.g., CO_2 levels) as a proxy for ventilation performance.	Support at-risk populations (e.g., those with immunocompromising conditions) with additional accommodations.

HIGH Risk of Exposure   (14 to 18 points)

The risk of exposure to **airborne infectious diseases** in your organization is high.

This means significant gaps exist, and strong, multi-layered protections are urgently needed to reduce transmission risk.

When implementing actions, remember the **three stages where infection can occur:**

The Source:

The person who is infected and releases airborne particles through breathing, talking, coughing, sneezing, or singing.

The Pathway:

The route those airborne particles travel through the air.

The Receptor:

You or the individuals who may become sick after inhaling those particles.

Based on your results, your organization falls into **Control Band C**. This means:

1   **Prioritize all source controls immediately.**

Vaccination, staying home when sick, and mask/respirator use should be mandatory during outbreaks or in high-density settings.

2   **Implement multiple pathway controls.**

Robust ventilation, filtration, and air-cleaning measures are essential, not optional.

3   **Add receptor protections as backup layers.**

Ensure individuals have access to personal PPE and reduce exposure time wherever possible.

Managing the Risk of the Source	Managing the Risk of the Pathway	Managing the Risk of the Receptor
Enforce strict sick-leave policies to prevent infected individuals from entering shared spaces.	Upgrade HVAC systems with high-efficiency filtration.	Require PPE for individuals in high-risk roles (e.g., healthcare staff, frontline workers).
Require the use of masks or respirators (e.g., N95s) in shared or crowded areas.	Add portable HEPA units in all frequently occupied areas.	Provide enhanced protections for vulnerable populations (e.g., immunocompromised individuals).
Strongly encourage and facilitate vaccinations for relevant diseases.	Maximize fresh outdoor air supply and monitor air quality.	Reduce the amount of time people spend indoors by shortening shifts, rotating teams, or moving activities outdoors when feasible.
	Limit occupancy and stagger schedules to reduce crowding.	

Disclaimer

This risk assessment was developed with airborne and viral infectious diseases in mind (such as COVID-19, flu, RSV, and measles). However, most of the recommendations and principles also apply to airborne bacterial infectious diseases.