



Protecting Worker Health

Personal Protective Equipment for SARS-CoV-2

White Paper

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As the impact of SARS-CoV-2 continues AIHA is proactively educating the public about the proper use of personal protective equipment (PPE) and addressing misconceptions about the devices. AIHA's membership is made up of occupational health and safety professionals (industrial hygienists). They are experts in the proper selection and use of PPE, and in keeping workers safe and healthy. This short fact sheet is being written for workers who may be expected to be in contact with known or potentially contagious clients or members of the public during their jobs. Examples include nurses, physicians, law enforcement, nursing home aides, maintenance workers, medical transporters, or correctional facility guards, etc.

Hazardous Agents

Workplaces often contain hazardous agents such as toxic chemicals in various physical forms including liquids, powders, gases, and vapors. Other agents may present physical hazards such as ionizing and nonionizing radiation, noise, heat, or vibration. In addition, workers may sometimes be exposed to hazardous biological materials and infectious agents, such as SARS-CoV-2.

Pathways of Exposure

In order for workers to be at risk of being exposed to a hazardous agent, there must be a pathway (mode of transmission) for the agent to reach the worker. The dangerous agent could travel through the air, water, surfaces, other people, vectors (such as a mosquito), and even food. SARS-CoV-2 has been shown to be transmitted through contact with surfaces contaminated with droplets from coughs or sneezes, direct contact with, and by virus containing aerosols exhaled by infectious people. The virus has been shown to survive in and be carried on air currents for up to 3 hours, and on surfaces for up to 3 days. (Doremalen, 2020)

Routes of Exposure (Portal of Entry)

After the hazardous agent travels through the work environment and reaches the worker, it needs to be able to get inside or onto the body. The most common route of exposure for workers is inhalation of gases, vapors, dusts, mists, microbes, or fumes into the respiratory tract (nose, mouth, trachea, and lungs). But hazardous materials can also enter the body by direct contact with and absorption into the skin, or through needle sticks or cuts in the skin directly to the bloodstream. Toxic agents can also interact with, and make entry into the body through mucous membranes with direct exposure to the agent, this includes the eyes, mouth, and nose. SARS-CoV-2 can enter the body by inhalation of aerosolized droplets from the exhalation of an infectious person, or exposure of the mucous membranes in the eyes, nose, or mouth.



Personal Protective Equipment

When hazardous agents in the workplace cannot be controlled by elimination, isolation, ventilation, administrative controls, or another better means, then Personal Protective Equipment (PPE) is used as a last resort to protect workers. When selecting PPE we need to keep the agent, pathways of exposure, and routes of exposure in the forefront of our selection process and worker risk assessment.

Respiratory Protection

Once we have done everything possible to minimize the hazardous agent in the air that a worker breathes through such means as ventilation or isolation, and the concentration remains above a “hazardous level”, then we may decide to use a respirator to filter the air that the worker breathes to reduce how much of the toxic agent the worker inhales into their lungs. Respirators have different filtering efficiencies with protection factors ranging from about 10 to 10,000. This means that if there are 100 particles per cubic meter of dust in the air that the worker might be breathing, and they wear a respirator with a protection factor of 10, then they would actually only be breathing in 10 particles per cubic meter.

Workplaces with known hazardous concentrations of airborne agents that cannot be controlled through other means, must provide workers with respirators that ensure they are protected. Employers must provide the respirators to workers at no cost, train them on the proper use and maintenance, conduct initial and annual fit-testing to ensure it fits properly, and have a written respiratory protection program. In addition, anyone wearing a respirator must pass a medical clearance by a licensed health care provider. When an employer allows a worker to voluntarily wear a filtering facepiece (dust mask) they are not required to have a written respiratory protection program.

In the United States respirator design and efficiencies are tested and approved by the National Institute for Occupational Safety and Health (NIOSH) and approved models will be labeled as such. Other countries have similar registration requirements. Respirators typically have designated shelf lives and expiration dates. Respirator efficiencies can also be altered greatly by environmental factors such as exposure to ionizing or nonionizing radiation, chemicals, and temperature extremes. When these occur, the respirators may not continue to meet the initial NIOSH approval measures.

Protection of Mucous Membranes and Skin

Impermeable face shields and goggles are commonly used to keep a variety of hazardous agents from reaching the eyes, face, or mucous membranes of the mouth and nose. Where skin protection is needed, workers should use gowns, suits, shoe covers, and gloves* to the extent warranted to ensure minimal contact with the hazard. Workers should receive detailed training on how to effectively don the protective clothing and also on how to remove it in a manner that will minimize contact with the agent to ensure they do not cross contaminate themselves with the agent.

*Surgical masks are not considered PPE and should not be worn by SARS-CoV-2 workers.



Occupational Protection for SARS-CoV-2

Occupational Versus Community Exposure

In the case of broad outbreaks of infectious agents in the community, it is often difficult to determine the difference between an occupational exposure and an exposure that occurs during their normal existence in the community. For example, tuberculosis is fairly uncommon in the general population. It would be somewhat unusual to contract tuberculosis unless you had close contact with someone known to have the disease. Therefore, if a nurse who was not wearing the proper PPE while caring for patients with tuberculosis suddenly tested positive for tuberculosis, it could be presumed they were exposed on the job, and that the illness was job-related.

Based on what is currently known about the pathways and routes of transmission for SARS-CoV-2 it is assumed that health care providers caring for patients with the disease are at greater risk of contracting the disease than those who have little close contact with others. There is also a potential they could contract the disease from a community exposure. However, elevated incidence of the disease in health care workers, leads us to conclude that many of these cases are due to workplace exposures. Other occupations with increased contact with potentially infected clients/patients and work at nursing homes, police services, medical transport, public health, facilities services, firefighting, laboratories, etc., could also potentially have occupational exposures that lead to disease.

PPE for SARS-CoV-2 Workers

We now understand that the SARS-CoV-2 virus can move in the environment through air, water, surfaces, and direct contact with people. Routes of exposure primarily include mucous membranes and inhalation. Environmental survival for most infectious viruses on different surfaces and in the air range from seconds to hours, and even days, depending on such factors as humidity, exposure to sunlight or radiation, and temperature. At this time, the infectious dose of SARS-CoV-2 virus particles is unknown. But it has shown to be easily transmissible, and for many patients quite virulent (capable of producing serious illness); there is no vaccine, and definitive treatments do not yet exist.

Without clear knowledge of an infectious dose for a healthy worker, a conservative protection for SARS-CoV-2 workers is full protection from contact with the secretions, blood, or fluids from clients/patients through the use of gowns, suits, gloves, face shields, and goggles*. Workers must be trained on how to put on and remove the equipment appropriately to prevent the virus from ever contacting their broken skin, eyes, mouth or nose.

Respiratory protection with an N95 NIOSH-approved respirator, which offers a protection factor of 10, should be worn by workers coming into close and prolonged contact with potentially contagious public or patients. When working with highly infectious COVID-19 patients, or large numbers of patients in small spaces with inadequate ventilation, a Powered Air Purifying Respirator (PAPR) with a protection factor of 25-1,000 could provide added worker protection. Elastomeric half-face or full-face respirators with replaceable filter cartridges with protection factors from 10-50 could also be used. Elastomeric respirators can be easily cleaned, disinfected and reused.

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PPE for Non-SARS-CoV-2 Workers

In workplaces where employees do not come in contact with potentially contagious clients or patients as part of their jobs, employers may decide to provide workers with N95 respirators as a means to protect workers from community exposures from potentially contagious coworkers as a means to keep their workforce healthy. In these cases, the employer must implement all of the aspects of an OSHA required respiratory protection program including medical clearance to wear the respirator by a licensed health care provider, training, and a fit-test before allowing workers to wear the N95 on the job.

Reference

van Doremalen, D., Holbrook, M., et al., Aerosol and surface stability of SARS-CoV-2 as compared to SARS-CoV-1, *New Eng J Med*, (April 16, 2020) Vol.382, No. 16.

