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# COVID-19 as an occupational disease

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**Abstract:**

During the pandemic of coronavirus in our country and in the world, workers and particularly health-care personnel, the frontline fighters, are known to develop the disease and even die due to exposure in the process. According to international definitions and our national legislation, if health-care personnel are infected while they are performing their job and at their workplace, the condition will be defined as an occupational accident and the disease as an occupational disease. Accident at work and occupational diseases are preventable health conditions. Reporting is mandatory. The first thing coming to mind as a result of such reporting is to acquire compensation and similar rights. Yet, the main purpose of notification of an accident at work and occupational diseases should be recording and identifying which conditions cause health issues in which sectors, and planning interventions for prevention. This review paper evaluates the pandemic of coronavirus disease 2019, the identification of conditions required for occupational disease diagnosis, especially in health-care personnel, the necessary procedures following diagnosis, the return to work recommendations, and the preventive strategies especially for health-care personnel from the view of occupational exposure.

**Keywords:**

COVID-19, corona virus, occupational diseases

## Introduction

The virus responsible for coronavirus disease 2019 (COVID-19) is an enveloped, RNA virus, for which a new name was accepted as severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2). It may result in clinical presentations with various degrees of respiratory, enteric, hepatic, nephrotic, and neurological involvements in humans and animals. The spectrum of diseases caused by coronavirus in humans varies from simple common cold to severe acute respiratory syndrome. The disease is mainly transmitted through droplets. Based on observations, the average incubation period is 5–6 days (2–14 days)

with a possibility of up to 14 days in some cases.

According to international definitions and our national legislation, if health-care personnel are infected while they are performing their job, the condition is defined as an occupational disease. Accident at work and occupational diseases are preventable health conditions. Therefore, the primary objective should be preventing disease development through principles of a “preventive strategy,” which is the most important matter within the scope of occupational health and safety, rather than establishing an occupational disease diagnosis.

Health-care personnel is the labor expected to be the most essential and most effective as the frontline fighters during the COVID-19

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pandemic. Due to their close contacts with patients affected by SARS-CoV-2, the health-care personnel is at higher risk for COVID-19 than other workers.<sup>[1]</sup> In China, 1716 health-care personnel, 1502 of whom were in Wuhan city, were infected by the virus, resulting in the death of six during the peak of the COVID-19 outbreak.<sup>[2]</sup> A case series of 138 patients treated in a hospital in Wuhan had 40 (29% of cases) cases as health-care personnel. Among the affected health-care personnel, 31 (77.5%) were working in general services, 7 (17.5%) in emergency service and 2 (5%) in the intensive care unit.<sup>[3]</sup> This review will evaluate the COVID-19 pandemic from the view of occupational exposure and particularly health-care personnel.

## Exposure Assessment and Risk Identification

### Exposure definition and biological risks

*Exposure:* It is defined by the World Health Organization (WHO) as encountering an act, a condition or an agent. The definition describes “a contact of an organism with an agent that can be absorbed.” It is stated that the term agent should be a chemical, physical, or biological entity. Every exposure does not result in a biological or chemical event in the human body. For instance, there is a theoretical possibility of a disease caused by a single fiber for asbestosis, while such dose is much higher for the development of other pneumoconiosis. Biological risks are one of the five main risk factors for occupational health. It covers a highly broad group of agents, including viruses, bacteria, fungi, cell cultures, genetically-modified microorganisms, and human parasites.<sup>[4]</sup> There are occupational exposure limits defined for physical and chemical risk; however, establishing thresholds is not possible for biological risks. Major issues with biological risks include the continued reproduction after the entry into the human body, the often requirement of media for growth and reproduction, different behaviors under different physicochemical characteristics, ability to change their own structure (ability of mutation; COVID-19 is a good example), and causing a disease potentially with a very few number of agents.<sup>[5]</sup>

Exposure is attempted to be determined through certain methods based on measurement or estimation. Risk identification and demonstration is one of the key points in planning the measures to be taken. Biological risks are possible to sample and demonstrate in the working environment or through personal measurement methods. Yet, it should be more careful and cautious with agents for which there are limited data, and all routes of exposure are not fully known, such as COVID-19, than the known agents.<sup>[6]</sup>

Exposure is formulated as  $E = C \times \Delta t$ . The formulation provides two main variables defining exposure (E): The concentration of the agent in the environment (C) and duration of exposure ( $\Delta t$ ).<sup>[7]</sup> In order to define the parameters determining the variables according to this formula in terms of the risk of exposure to novel coronavirus, the routes of exposure to the virus should be known well. The use of this formula is suggested also for COVID-19 by the studies supporting the association of viral load with the severity of disease and its infectivity. Data support that severe COVID-19 cases have a higher viral load and a longer period of infectivity, just like SARS. On the mean viral load of severe cases was found 60 times higher than mild cases, a high viral load was considered to be associated with the clinical symptoms of severe disease. In conclusion, viral load is an important factor for COVID-19 cases. There are studies, in turn, which established that asymptomatic and less-symptomatic cases also carry a risk of infectivity.<sup>[8]</sup>

The review of available publications and literature data on SARS-CoV-2 suggests an average incubation period of 5–6 (2–14) days with a possibility of up to 14 days in some cases. The infectivity period of COVID-19 is not clearly known. It is believed to start 1–2 days before the symptomatic period and ends on the clearance of symptoms.<sup>[9]</sup> There are mainly two routes of transmission; respiratory exposure and exposure through contact to body fluids, like saliva or mucus, and droplets of an infected person.<sup>[9,10]</sup> Besides, There are newborns with virus detected so far, and assessments are ongoing regarding fetomaternal transmission.<sup>[11]</sup>

### Exposure levels/categories and classification

The COVID-19 infection is mainly transmitted from human to human through close contact and droplets. This makes complete isolation of the infected person highly important. Risky exposures are defined as exposure to an infected person or a patient, knowingly or unknowingly, within <2 m and for an average time of 10–15 min (this is the average time provided in guidelines; transmission may happen in a shorter time in case of procedures with an intense viral load or in case the person has immunodeficiency or chronic diseases).<sup>[12,13]</sup> There is an increased risk for workers who have to be with a COVID-19 patient within <2 m and for <15 min while performing their job-related duties in the working environment. Beyond doubt, health-care personnel is the most important risk group.

The study by Kohn that evaluated cases in Wuhan established that more than half of the cases at the onset of the outbreak were salespersons and customers at the market in Wuhan. With the increased number of cases, the risk for health-care personnel increased. Particularly emergency service and intensive care unit workers were

infected more. Then, 47 cases were reported in Singapore and 17 of these cases were reported to be infected due to occupational exposure. Accordingly, it was verified that workers of various occupations as a taxi driver, technical personnel worked at a meeting organization, security personnel, casino workers, and jeweler were infected.<sup>[14]</sup>

The document by Occupational Safety and Health Administration classifies occupations into four categories by exposure risks.<sup>[15]</sup>

Group 1 is a very high-risk category. These are workers with close contact with the infected patient. As close contacts, this group of jobs is defined as aerosol-generating procedures, specimen collection, and handling procedures, postmortem procedures on close contacts, known or suspected COVID-19 cases (doctors, nurses, dentists, paramedics, emergency medical technicians, health-care or laboratory personnel collecting or handling specimens, morgue workers performing autopsies).

Group 2 is the high-risk category. The risk is lower than Group 1 but is still high. As close contacts, this group includes health-care delivery and support personnel (e.g., doctors, nurses, and other hospital staff who must enter patients' rooms) exposed to c known or suspected COVID-19 patients during procedures not generating aerosol, medical transport workers moving known or suspected COVID-19 patients in enclosed vehicles (e.g., ambulance vehicle operators), mortuary workers engaged in preparing (e.g., for burial or Cremation) the bodies of people known to have or suspected of having COVID-19 at the time of their death.

Group 3 is the medium-risk category. As contacts, this group includes jobs requiring frequent and/or close contact with (i.e., within 2 m of) people who may be infected with SARS-CoV-2, but who are not known or suspected COVID-19 patients. In areas without ongoing community transmission, this risk group of

workers may be in frequent contact with travelers who may return from international locations that have widespread COVID-19 transmission. In areas with ongoing community transmission, this risk group of workers may be in contact with the general public (e.g., schools, high-population work environments, some high-volume retail settings).

Group 4 is the low-risk category. As accidental, this low-risk exposure group includes jobs not requiring any contact with people known to be or suspected of being, infected with SARS-CoV-2 nor any close contact with (i.e., within 2 m of) the general public.

This guidance and similar others define health-care personnel within very-high and high-risk groups. In our country, there is also guidance by the Ministry of Health on health-care personnel monitoring in this regard. According to the guidance prepared by the Ministry of Health, health-care personnel is classified into low risk, medium risk, and high-risk categories based on their duties and the presence of personal protective equipment (PPE). Such guidance is updated on a daily basis, and possible to be different at the time of publication of this paper.<sup>[16]</sup> Table 1 provides the risk table on guidance. Furthermore, Table 2 provides the epidemiological risk classification for asymptomatic health-care personnel following exposure to patients with COVID-19 on the guidance by the Centers for Disease Control (CDC-USA).<sup>[17]</sup>

Here, monitoring definitions are as follows:

Self-monitoring means health-care personnel should monitor themselves by measuring body temperature twice a day and remain alert for respiratory tract symptoms (e.g., cough, shortness of breath, and sore throat). A communication plan should be provided for anyone on self-monitoring to determine whether the medical evaluation is needed in case they develop fever or respiratory tract symptoms during the period of self-monitoring.

**Table 1: Evaluation of the contact of the healthcare worker with the coronavirus disease 2019 patient**

	Healthcare professional's use of personal protective equipment	Risk of exposure
Prolonged close contact with a COVID-19 patient who was wearing a facemask	No Medical Mask or N95 used/ use of medical mask in the case of N95 mask use	Medium
	HCP PPE: Not wearing eye protection	Low
	HCP PPE: Not wearing gown or gloves	Low
	HCP PPE: Wearing all recommended PPE	Not risky
Prolonged close contact with a COVID-19 patient who was not wearing a facemask	HCP PPE: None	High
	use of medical mask in the case of N95 mask use	Medium
	HCP PPE: Not wearing eye protection	Medium
	HCP PPE: Not wearing eye protection	Low
	HCP PPE: Wearing all recommended	Not risky

Retrieved from the Republic of Turkey Ministry of Health COVID-19 (SARS-CoV-2 infection) Guideline. SARS-CoV-2: Severe Acute Respiratory Syndrome-Coronavirus-2, COVID-19: Coronavirus disease 2019, HCP: Healthcare personnel, PPE: Personal protective equipment

**Table 2: Epidemiologic risk classification for asymptomatic healthcare personnel following exposure to patients with Coronavirus Disease or their secretions/excretions in a healthcare setting, and their associated monitoring and work restriction recommendations**

Epidemiologic risk factors	Exposure category	Recommended monitoring for COVID-19 (until 14 days after last potential exposure)	Work restrictions for asymptomatic HCP
<b>Prolonged close contact with a COVID-19 patient who was wearing a facemask (i.e., source control)</b>			
HCP PPE: None	Medium	Active	Exclude from work for 14 days after last exposure
HCP PPE: Not wearing a facemask or respirator	Medium	Active	Exclude from work for 14 days after last exposure
HCP PPE: Not wearing eye protection	Low	Self with delegated supervision	None
HCP PPE: Not wearing gown or gloves <sup>a</sup>	Low	Self with delegated supervision	None
HCP PPE: Wearing all recommended PPE (except wearing a facemask instead of a respirator)	Low	Self with delegated supervision	None
<b>Prolonged close contact with a COVID-19 patient who was not wearing a facemask (i.e., no source control)</b>			
HCP PPE: None	High	Active	Exclude from work for 14 days after last exposure
HCP PPE: Not wearing a facemask or respirator	High	Active	Exclude from work for 14 days after last exposure
HCP PPE: Not wearing eye protection <sup>b</sup>	Medium	Active	Exclude from work for 14 days after last exposure
HCP PPE: Not wearing gown or gloves <sup>a,b</sup>	Low	Self with delegated supervision	None
HCP PPE: Wearing all recommended PPE (except wearing a facemask instead of a respirator) <sup>b</sup>	Low	Self with delegated supervision	None

<sup>a</sup>The risk category for these rows would be elevated by one level if HCP had extensive body contact with the patients (e.g., rolling the patient), <sup>b</sup>The risk category for these rows would be elevated by one level if HCP performed or were present for a procedure likely to generate higher concentrations of respiratory secretions or aerosols (e.g., cardiopulmonary resuscitation, intubation, extubation, bronchoscopy, nebulizer therapy, sputum induction). For example, HCP who were wearing a gown, gloves, eye protection and a facemask (instead of a respirator) during an aerosol-generating procedure would be considered to have a medium-risk exposure. COVID-19: Coronavirus disease 2019, HCP: Healthcare personnel, PPE: Personal protective equipment

Active monitoring means that the health authority is responsible for establishing regular communication with people who are potentially exposed to evaluate the presence of fever or respiratory tract symptoms (e.g., cough, shortness of breath, and sore throat). CDC recommends at least once daily of such communication for high- or medium-risk health-care personnel. The health authority can decide the means of communication, which may include phone calls or any electronic or Internet-based media of communication. If it is convenient for health-care personnel, active monitoring can be conducted by the occupational health or infection control committee of the personnel's facility. Interregional coordination will be needed if healthcare personnel's place of living and healthcare facility are in different regions.

Self-Monitoring with delegated supervision means, if the health-care facility is in agreement, health-care personnel can perform self-monitoring under the supervision of the occupational health or infection control program of their facility in coordination with the Ministry of Health. Health-care facilities may consider body temperature measurement and symptom assessment before starting work on days health-care personnel are planned to work. Communication channels may include

phone calls or any electronic or internet-based means of communication. Occupational health or infection control personnel should establish the communication between health-care personnel and health authorities. A plan should be provided for medical assessment of personnel developing a fever or respiratory tract symptoms (e.g., cough, shortness of breath, sore throat) during the period of self-monitoring. Such a plan should include instructions for reporting to occupational health and health authorities, and if required medically, and transportation to a designated hospital.<sup>[17]</sup>

High-virus load procedures are described as those that are related to airways, and cause intense and sudden viral dispersion. High-risk procedures with intensive contact are described as aspiration, intubation, specimen collection from the respiratory tract, noninvasive ventilation, high-flow oxygen therapy, cardiopulmonary resuscitation, nebulizer usage, bronchoscopy, endoscopy, videolaryngoscopy, dental procedures, oral-throat-nasal examination, ophthalmologic examinations, and central catheter insertion procedures.<sup>[16]</sup>

Doctors and nurses are the first to come to mind when health-care personnel is mentioned. On the other



hand, the WHO classification describes 38 major group codes and more than 200 sub-major group codes for occupations related to healthcare service providing and health-care service delivery. Accordingly, it covers about > 50 million workers across the world, including sales (market, canteen, etc.), transport and service jobs, health-care professionals providing home care, technicians, and health-care service providers involved in alternative medicine in health-care facilities.<sup>[18]</sup> The number of health-care personnel is expected to be 67.3 worldwide in 2020.<sup>[19]</sup>

Other risk groups stressed by the WHO are tourism and transportation workers. Tourism workers provide service to a very dynamic and variable population and therefore encounter several people who are potentially carrier for short or middle term. For transportation workers, in turn, there is an increased risk due to close contact and traveling in an enclosed environment with potentially carrier passengers.<sup>[20]</sup>

### **Assessment of risk groups (screening, surveillance and return to work recommendations)**

Health-care personnel is again the most discussed group about screening, surveillance, and return to work.

#### *Screening*

Screening of risk groups, including health-care personnel, is still not performed. However, some documents prepared for workplaces have provided instructions for measuring body temperature and questioning respiratory and other complaints of workers. Accordingly, it has been emphasized that workers with fever and respiratory complaints should stay at home, and suspected cases should be managed according to the recommendations of health-care facilities.<sup>[21]</sup> There is not any clear return to work assessment for cases other than health-care personnel. The Ministry of Health guidance recommends 14-day complete isolation at home after discharge for confirmed cases.

#### *Risk groups/specific groups*

Especially on publications from China, which suggested the COVID-19 infection was more mortal in individuals above 65 years of age and with comorbidities, such groups have gained a special place in prevention policies.<sup>[22]</sup> There is an ongoing discussion about the diseases to be included in chronic diseases. The risk of infection is known to increase in people, especially with immune system-related chronic diseases, Diabetes Mellitus (DM), malignancies and who are receiving immunosuppressive therapy. Shahid *et al.* reported a possibility of increased risk also for chronic kidney patients.<sup>[23]</sup>

The case report form by the Ministry of Health specifies cardiovascular disease, chronic respiratory disease, DM,

cancer, HT, pregnancy, and smoking in the risk factors section.<sup>[24]</sup> Turkish Respiratory Society Environmental and Occupational Diseases Work Group published an announcement that evaluated the association of COVID-19 infection incidence, especially with occupational diseases. Accordingly, an increased risk should be considered for cases with chronic complicated pneumoconiosis, asthma, and COPD.<sup>[25]</sup>

Management of chronic conditions at the workplace during a pandemic requires an assessment in several aspects such as results of risk assessment for the working environment, COVID-19 action plan and measures of the workplace, personality features of workers (ability to self-monitor) and managerial attitude toward such workers. The occupational physician can send workers without any mentioned diseases to home for isolation during a pandemic if considered necessary.

### **Diagnostic Process of Occupational Diseases/How to Diagnose an Occupational Disease**

Occupational diseases are conditions caused by certain occupations and exposures. Definition of occupational diseases consists of two main elements,<sup>[26]</sup>

- Exposure in a certain work environment or a causal relationship between occupational activity and certain disease, there is a direct causal relation (causality) between work and disease
- The disease occurs among exposed people with an above-average frequency in comparison with the rest of the population.

Several criteria are considered to determine if the association among variables is causal. Among these, the most valuable criteria in epidemiological terms are Hill's criteria, which were proposed by Austin Bradford Hill (1897–1991), a British biostatistician.<sup>[27]</sup> These criteria include the strength of association (relative risk), consistency of association (similar distribution of disease and cause in the population by various characteristics), specificity of association, temporality (cause must always be present before the effect), dose-response relationship (as exposure increases, effect/disease increases), the biological plausibility of association and coherence with all knowledge (the cause has to make sense biologically in order to lead to disease). Evidence for the disease and related to exposure should be acquired through a detailed occupational history (anamnesis).

In conclusion, first, disease should be diagnosed, and then, it should be demonstrated that the disease has occurred in the workplace or is caused by a factor exposed in the workplace. A detailed occupational history is of importance in this regard. Occupational

history is the most effective tool to accurately diagnose an occupational disease.<sup>[28]</sup> Nonwork history should also be assessed. When SARS-CoV-2 infection is incidental at workplace or there is a common exposure in the entire workplace, the claim of exposure to the disease and infection may not be considered as occupational. If there is not an evident difference between the possibility of viral transmission through society and through the respective workplace, i.e., if the disease occurs in society with a similar frequency, it will be difficult to be considered as occupational. The classification of workers' exposure situations<sup>[15]</sup> and the exposure history considering such classification will enable establishing the causal link.

### **How Would Be the Reporting and Notification Process of Accident at Work and Occupational Diseases?**

Accident at work and occupational diseases are mandatory to notification in our country. The main purpose of notification is to record and identify which conditions cause health issues in which sectors and to plan preventive interventions, rather than obtaining compensation and similar acquisitions. Occupational disease is defined as "a disease as a result of exposure to occupational risks" by the Occupational Health and Safety Law No: 6331; "a temporary or permanent disease, physical or mental disability experienced by the insured for a repeating reason due to the work or the nature of the work, or because of the conditions for work execution" by the Social Security and General Health Insurance Law No: 5510<sup>[29,30]</sup>

During contacts with a suspected or confirmed COVID-19 patient, all incidents of workers and particularly health-care personnel with the spread or contamination of cough, sneeze and other body fluids of the patient to their respiratory tract, eye mucosa or open wounds, or all injuries with sharp objects contaminated with these should be assessed as an accident at work and recorded. An "ACCIDENT-INCIDENT REPORT FORM" should be completed and given to the Occupational Health Unit (OHU) of the establishment. OHU should obtain an OCCUPATIONAL ACCIDENT provision from MEDULA on HIMS. This serves as reporting. Additionally, the ICD code Z57.8 Exposure to other occupational risk factors should be marked. Furthermore, OHU, on behalf of the administrator, should complete the "OCCUPATIONAL ACCIDENT AND DISEASE REPORT FORM" within 3 days and report to their registered Social Insurance Office Pension Services by post. If the employees who had such accidents develop COVID-19 during the following process, this shall be notified to the boards designated by the legislation and assessed as an occupational accident sequel.

For employees with a confirmed COVID-19 diagnosis, who work at jobs with a high risk of OCCUPATIONAL DISEASE SARS-CoV-2 exposure and are not considered to have an occupational accident; occupational and environmental exposures should be evaluated. Reporting shall be done as occupational for COVID-19 patients for whom the condition cannot be explained with nonoccupational exposures and cannot be evaluated as incidental based on such evaluation. For health-care personnel with contact, and a positive result of any of COVID-19 screening tests, Z57.8 Exposure to other occupational risk factors is coded if there is not any incident identified as an occupational accident. Besides, either of the following codes should be preferred on the HIMS program for health-care personnel with contact, who is diagnosed with COVID-19 through clinical, laboratory and/or radiological examinations;

- U07.3 (COVID-19, virus identified) (emergency): This code should be assigned if COVID-19 laboratory test is positive
- U06.0 (COVID-19, not confirmed) (emergency): This code should be assigned if COVID-19 laboratory test is negative.

For health-care personnel with COVID-19 diagnosis, an OCCUPATIONAL DISEASE provision should be obtained from MEDULA on HIMS. This serves as reporting. Furthermore, OHU, on behalf of the administrator, should complete the "OCCUPATIONAL ACCIDENT AND DISEASE REPORT FORM" and report to their registered Social Insurance Office Pension Services by post.

### **Permanent sequel assessment**

In the following months of the monitoring of COVID-19-related occupational accidents, diseases and exposures, the patients should be referred to Occupational Hospitals, Training and Research Hospitals or State University Hospitals authorized by the SSI for final reports and legal notices. The Medical Board reports to be prepared in such institutions are notified to the Provincial Social Security Offices, where the employee and the establishment are registered together with the supporting medical documents.

### **Return to Work Criteria for Healthcare Personnel with Confirmed or Suspected COVID-19**

Health-care personnel is undoubtedly affected the most by COVID-19-related incidents. In our country, the Ministry of Health guidance on this matter specifies the level of contact and the criteria of working afterward. A management strategy is provided based on the risk level for health-care personnel with contact. A hydroxychloroquine therapy

**Table 3: Recommendations of centers for disease control on return to work for healthcare personnel with confirmed or suspected Coronavirus disease 2019**

Strategy	Conditions
Test-based strategy	
Exclude from work until	Resolution of fever without the use of fever-reducing medications AND Improvement in respiratory symptoms (e.g., cough, shortness of breath), AND Negative results of an FDA Emergency Use Authorized molecular assay for COVID-19 from at least two consecutive nasopharyngeal swab specimens collected $\geq 24$ h apart (total of two negative specimens)
Nontest-based strategy	
Exclude from work until	At least 3 days (72 h) have passed since recovery defined as resolution of fever without the use of fever-reducing medications and improvement in respiratory symptoms (e.g., cough, shortness of breath); AND At least 7 days have passed since symptoms first appeared

Retrieved from the CDC Guidance<sup>[32]</sup>. If the HCP has not been tested for COVID-19 and has an alternative diagnosis (influenza positive), these criteria should not be used. Decision should be made by assessing these criteria based on personal characteristics and workplace conditions. COVID-19: Coronavirus disease 2019, HCP: Healthcare personnel

is initiated for health-care personnel with high-risk contact. The personnel is isolated at home for 7 days and monitored through active symptom monitoring; a PCR test is conducted on the day of symptom if any symptom develops, and at day 7 if not. If PCR is negative, working is recommended to the personnel by wearing a mask for 14 days starting from the day of contact. If PCR is positive, treatment is administered based on the confirmed case definition. The condition for terminating the isolation of COVID-19 health-care personnel is the negative results of two tests collected minimum 24 h apart, provided that after the first 7 days of the symptom onset and also at least 3 days after the resolution of symptoms. The personnel can return to work afterward.<sup>[31]</sup> Wearing a mask and symptom monitoring are recommended to health-care personnel with a medium-and low-risk contact. For the medium-risk group, the recommendation is to decide whether a confirmed case or termination of isolation based on the PCR test result at day 7. CDC has also a guidance on return to work for health-care personnel [Tables 3 and 4]. Such guidance describes two methods of test-based and nontest-based. The test-based method recommends returning to work when: 1. Fever is resolved without using any fever-reducing medications, AND 2. Respiratory symptoms are improved, AND 3. COVID-19 tests (FDA approved rapid test) are negative from at least two consecutive nasopharyngeal swab samples collected  $\geq 24$  h apart. The nontest-based method recommends excluding from work until: 1. At least 3 days have passed since recovery (recovery: Fever is resolved without using any fever-reducing medications and respiratory symptoms are improved, AND 2. At least 7 days have passed since the first appearance of the symptoms.

Health and local authorities may want health-care personnel to return to work earlier in terms of crisis strategies to minimize staffing shortages. In such cases, the worker can be assessed by occupational health and safety unit for an early return to work. It is emphasized that the above-stated Return-to-Work Practices and Work Restrictions should still be followed in cases return-to-work is required earlier than the above recommendations.<sup>[32]</sup>

**Table 4: Recommendations of Centers for Disease Control after return to work for healthcare personnel with confirmed or suspected Coronavirus disease 2019**

After returning to work, HCP should
Wear a facemask at all times while in the healthcare facility until all symptoms are completely resolved or until 14 days after illness onset, whichever is longer
Be restricted from contact with severely immunocompromised patients (e.g., transplant, hematology-oncology) until 14 days after illness onset
Adhere to hand hygiene, respiratory hygiene, and cough etiquette in CDC's interim infection control guidance (e.g., cover nose and mouth when coughing or sneezing, dispose of tissues in waste receptacles)
Self-monitor for symptoms, and seek re-evaluation from occupational health if respiratory symptoms recur or worsen

CDC: Centers for Disease Control, HCP: Healthcare personnel

## Preventive Strategies for Healthcare Personnel

Based on available evidence, COVID-19 transmits from human to human via close contact and droplets. Preventive and mitigating measures are of critical significance both in health-care and social settings.

As occupational diseases are preventable conditions, protective actions should always be prioritized. Therefore, "preventive approach principles" are the most important matter in general, occupational health. Hazard and risk identification at work involves control at source and engineering prevention methods. Administrative measures should be effective in every step. Personnel training is also included in such measures.

### Risk assessment at workplace

It is intended to assess the risks of workers for potential encounters, exposures and effects, and to determine the processes of hazard monitoring, and monitoring, control, and communication after contact.

### Control at source

It is described as the elimination of the source or

**Table 5: Recommended personal protective equipment during the COVID-19 outbreak, according to the setting, personnel, and type of activity<sup>a</sup>**

Setting	Target personnel or patients	Activity	Type of PPE or procedure
Health care facilities			
Inpatient facilities			
Screening/triage Clinical triage for prioritization of care according to severity (e.g. Manchester classification) should be performed in separate area for individuals with symptoms and signs	Health care workers	Preliminary screening not involving direct contact <sup>c</sup>	Maintain physical distance of at least 1 m Ideally, build glass/plastic screens to create a barrier between health care workers and patients No PPE required When physical distance is not feasible and yet no patient contact, use mask and eye protection
	Patients with symptoms suggestive of COVID-19	Any	Maintain physical distance of at least 1 m Provide medical mask if tolerated by patient Immediately move the patient to an isolation room or separate area away from others; if this is not feasible, ensure spatial distance of at least 1 m from other patients Perform hand hygiene and have the patient perform hand hygiene
	Patients without symptoms suggestive of COVID-19	Any	No PPE required Perform hand hygiene and have the patient perform hand hygiene
	Patient room/ward		
	Health care workers	Providing direct care to COVID-19 patients, in the absence of aerosol-generating procedures	Medical mask Gown Gloves Eye protection (goggles or face shield) Perform hand hygiene
	Health care workers	Providing direct care to COVID-19 patients in settings where aerosol-generating procedures are frequently in place <sup>d</sup>	Respirator N95 or FFP2 or FFP3 standard, or equivalent Gown Gloves Eye protection Apron Perform hand hygiene
Cleaners	Entering the room of COVID-19 patients	Medical mask Gown Heavy-duty gloves Eye protection (if risk of splash from organic material or chemicals is anticipated) Closed work shoes Perform hand hygiene	
Visitors <sup>b</sup>	Entering the room of a COVID-19 patient	Maintain physical distance of at least 1 m Medical mask Gown Gloves Perform hand hygiene	
Areas of transit where patients are not allowed (e.g. cafeteria, corridors)	All staff, including health care workers	Any activity that does not involve contact with COVID-19 patients	Maintain physical distance of at least 1 m No PPE required Perform hand hygiene

*Contd...*



**Table 5: Continued...**

Setting	Target personnel or patients	Activity	Type of PPE or procedure
Laboratory	Lab technician	Manipulation of respiratory samples Specimen handling for molecular testing would require BSL-2 or equivalent facilities	Maintain physical distance of at least 1 m Medical mask Eye protection Gown Gloves Perform hand hygiene
Administrative areas	All staff, including health care workers	Administrative tasks that do not involve contact with COVID-19 patients	Maintain physical distance of at least 1 m No PPE required Perform hand hygiene

\*Retrieved from the WHO Guidance. i. The screening procedure refers to prompt identification of patients with signs and symptoms of COVID-19, ii. AGP: Tracheal intubation, noninvasive ventilation, tracheotomy, cardiopulmonary resuscitation, manual ventilation before intubation, bronchoscopy, <sup>a</sup>In addition to using the appropriate PPE, frequent hand hygiene and respiratory etiquette should always be performed. PPE should be discarded in an appropriate waste container after use according to local guidance, and hand hygiene should be performed before putting on and after taking off PPE, <sup>b</sup>The number of visitors should be restricted. If visitors must enter a COVID-19 patient's room, they should be provided with clear instructions about how to put on and remove PPE and about performing hand hygiene before putting on and after removing PPE; this should be supervised by a health care worker, <sup>c</sup>This category includes the use of no-touch thermometers, thermal imaging cameras, and limited observation and questioning, all while maintaining a spatial distance of at least 1 m. Taken from WHO. Interim guidance (Rational use of personal protective equipment for COVID-19 and considerations during severe shortages). WHO: World Health Organisation, COVID-19: Coronavirus disease 2019, PPE: Personal protective equipment

substitution by a less harmful substance. However, the elimination of the source may not be possible as the source is a viral agent. Measures related to the isolation of the materials transmitting from a patient and the source at the transmission places of such materials, disinfection and removal of contaminated media, and minimizing the number of encountering people can be implemented when combined with administrative measures. Creating an isolation space for confirmed or suspected patients, isolation of risk groups, and restricting entry of personnel into such spaces can be effective along with administrative measures for minimizing the exposure time as much as possible. Such measures also include providing enough space to maintain an at least 1-m social distance among health-care personnel, presence of well-ventilated isolation rooms for suspected or confirmed COVID-19 patients, adequate environmental cleaning, and disinfection.

### Engineering preventive methods

Engineering measures for COVID-19 infection may include providing efficient ventilation systems in all reception-examination and waiting rooms, installing wide-surface physical barriers of glass/transparent plastic during conversations between staff and patients (including the staff areas in registration and waiting units), and providing the barrier designs, which enable performing procedures during intervention on patients by health-care personnel, to the prioritized departments (Chest Diseases, Dentistry, ENT, Ophthalmology, etc.).<sup>[33]</sup>

### Personal protective equipment

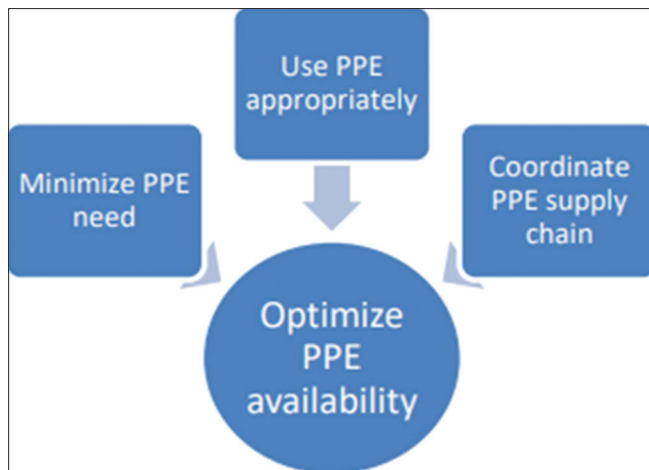
PPE should be used as the primary prevention strategy. PPE has limited benefits in the absence of effective administrative and engineering controls.<sup>[34]</sup> PPE involves gloves, surgical

masks, goggles, or a face shield and gowns as well as certain procedures, respirators (N95 or FFP2 standard or equivalent) and gowns. Figure 1 shows the WHO's strategies to optimize PPE availability.<sup>[35]</sup> Table 5 provides the PPEs recommended by WHO for the COVID-19 outbreak based on environment, personnel, and activity type.<sup>[35]</sup>

Surgical masks and respirators play an important role in the protection of health-care personnel; however, there are different opinions regarding how to, in which cases and for how long these products should be used. Many international health-care organizations offer various suggestions about the use of these products. The one thing in common of all health-care organizations and countries is the recommendation of wearing masks by the suspected or infected COVID-19 cases (control at source) to prevent the spread of infection. WHO recommends the use of surgical mask during routine care and respirator during aerosol-generating procedures to health-care personnel for protection against COVID-19. CDC and European Center for Disease Prevention and Control COVID19, in turn, recommend the use of respirators in both cases. In conclusion, health-care personnel are primarily advised to use a properly worn respirator as much as possible and to wear a surgical mask if the respirator is not available. Prolonged use and repeated use are high-risk practices and may pass on the disease to the user, which should be avoided.<sup>[36]</sup>

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**Figure 1:** Strategies to optimize the availability of personal protective equipment.  
\*Retrieved from WHO Guidance

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### Conflicts of interest

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