

# Infection prevention and control in health care settings during COVID-19 pandemic

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## ABSTRACT

*Infection prevention and control (IPC) practices are of critical importance in protecting the frontline healthcare providers in the ongoing Coronavirus disease 2019 (COVID-19) pandemic and keep the healthcare services functioning. Healthcare facilities should apply strict IPC measures to minimize the risk of transmission of COVID-19 to their staff and other patients. The backbones of IPC in healthcare facilities are administrative measures, physical distancing, hand hygiene and the appropriate use of personal protective equipment. All healthcare workers working in any type of healthcare settings must have proper knowledge of IPC. Rational, correct and consistent use of personal protective equipment according to level of exposure to patients decreases the transmission of pathogens and protects the frontline fighters. Cleaning and disinfection procedures of environmental surfaces, medical devices and equipments, laundry etc must be done correctly and consistently. Administrative authority should provide logistic support, arrange training for health care personnel and monitor their compliance to IPC practices. As there is still no definite treatment of this disease, comprehensive IPC programmes are the only hope to control this pandemic.*

**Key words:** Coronavirus, COVID-19, Infection control, Infection prevention, IPC.

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## BACKGROUND

The ongoing pandemic Coronavirus disease 2019 (COVID-19) is an acute infectious disease caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). Knowledge of its pathophysiology, transmission and management protocol is evolving and changing almost daily as the pandemic is still ongoing, presenting with new features and complications.<sup>1</sup> Unfortunately, there is still no definite curative treatment available for this deadly disease. So, preventive measures are the only way to stop this pandemic. Staying

at home if possible, wearing masks while with other people, washing hands with soap, maintaining social distance with other people, and avoiding crowded places are important measures of prevention in social life. More strict measures in healthcare settings are to be followed to prevent and control the spread of the disease.

World Health Organization (WHO) describes 'Infection prevention and control' (IPC) as a scientific approach and practical solution designed to prevent infection to patients and health care workers (HCWs).<sup>2</sup> IPC is of utmost important in preventing healthcare associated infections (HAI), decreasing spread of antimicrobial resistant (AMR) organisms, thereby will reduce the mortality and morbidity and health care cost. Even the most advanced health care facility in a developed country is not free from HAIs. So, IPC should be followed in every healthcare facility, and physicians play the pivotal role in implementing IPC. In the context of COVID-19, healthcare providers (HCPs) are at higher risk of getting infection and spreading the disease to their family, colleagues and other patients because of

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frequent exposures to COVID-19 patients.<sup>3</sup> A study in UK and USA showed that HCWs who were directly involved in dealing with COVID patients, had 3.4-fold more risk of getting the virus than people of other profession.<sup>4</sup> There are multiple healthcare associated outbreaks affecting HCWs, their families and patients.<sup>5</sup> In China, 10% of the reported cases,<sup>6</sup> and in Italy, 9% of all cases<sup>7</sup> were among HCPs. So, the main goal of IPC during this COVID pandemic period is to keep both HCPs and patient's safe by containing and preventing COVID 19 transmission within the health care facilities. For this reason, we aim to focus on the IPC practices that have to be followed in all health care settings.

WHO suggests the following five strategies to be followed in all health care settings for effective IPC implementation in this COVID situation:<sup>2</sup>

1. Ensuring triage, early recognition, and source control
2. Applying standard precautions for all patients
3. Implementing empiric additional precautions
  - Contact and droplet precautions
  - Airborne precautions for aerosol-generating procedures
4. Implementing administrative controls
5. Using environmental and engineering controls

The following discussions include the above strategies in different sections.

### **TRIAGE, EARLY RECOGNITION AND SOURCE CONTROL**

Triage is a system for assessing all patients at admission for early recognition of possible COVID-19 and immediate isolation of patients with suspected disease in an area separate from other patients (source control). Screening everyone entering the healthcare facility for sign-symptoms of COVID-19 and triage them accordingly are two very effective methods of source control.<sup>8</sup> A well-equipped triage station should be established at entrance with graphical information to patients. Screening questionnaires should be provided to all patients attending healthcare facilities. Physical barriers with glass or plastic windows can be established in screening and triage area, registration desk at emergency department (ED) or pharmacy counter to reduce risk of virus transmission to HCWs. Patients with features of COVID-19 should be kept in a well-

ventilated waiting room before admission. Adequate ventilation is considered to be air flow of 60L/sec per patient in a naturally ventilated room.<sup>2</sup> There should be at least 1-meter distance between seats/beds in the waiting room. A separate area should be designated in the outpatient department or emergency for patients with respiratory symptoms. All patients and their attendants must wear masks while entering the healthcare facility ('Universal masking'),<sup>9,10</sup> and must follow respiratory etiquettes. They should be advised to cover their nose and mouth with bent elbow or tissue while coughing or sneezing. Tissues must be disposed immediately to waste bin, followed by performing hand hygiene. Strict restrictions should be applied to limit the number of visitors in all types of health care facilities. The additional practices include implementation of tele-health services, maintenance of social distance everywhere within hospitals, universal masking and restrictions in visitor numbers. Telemedicine will reduce the risk of disease transmission while providing adequate patient care.

### **STANDARD AND ADDITIONAL PRECAUTIONS**

Standard precautions are some basic practices which have to be followed by all HCPs always to protect the patients from HAIs and protect themselves from getting infections from the patients. Standard precautions include hand hygiene, appropriate patient placement, prevention of sharp injury, cleaning and disinfection of equipment, safe waste management, cleaning of environment and use of personal protective equipment (PPE) according to risk of exposure. WHO's 'five moment of hand hygiene' should be practiced by all HCWs.<sup>11</sup> Hands should be washed with soap and water for 40 to 60 seconds, especially when they are soiled. At least 20 to 30 seconds should be spent for hand rubbing with alcohol-based hand rub. In this pandemic condition of COVID-19, HCWs should clean their hands before donning PPE, after doffing, when changing gloves, and after contact with any suspected/confirmed COVID-19 patients or their respiratory secretions in addition to WHO's '5-moments of hand hygiene'. Functional facilities to perform hand hygiene for all HCWs, patients and their family members/visitors should be arranged in different places inside the healthcare settings, especially where donning and doffing are done, in waiting room, and where health care wastes are handled.

**Table I:** Additional precautions

| Route     | Description  | Preventive measures  |
|-----------|--|--|
| Droplet   | <ul style="list-style-type: none"> <li>• Droplets are infectious particles <math>&gt;5\mu\text{m}</math> in size</li> <li>• Created when patient coughs, sneezes or talks, and during certain procedures</li> <li>• Usually travels short distance (1 meter)</li> <li>• Transmitted indirectly to mucosal surfaces (e.g. via hands)</li> </ul> | <ul style="list-style-type: none"> <li>• Surgical mask</li> <li>• Hand hygiene</li> <li>• Gloves</li> <li>• Long-sleeved gown</li> </ul>               |
| Air borne | <ul style="list-style-type: none"> <li>• Small-particle (<math>&lt;5\mu\text{m}</math>) aerosols</li> <li>• Created during breathing, talking, coughing or sneezing</li> <li>• Aerosols can be dispersed over long distances (<math>&gt;1</math> meter)</li> </ul>   | <ul style="list-style-type: none"> <li>• Fitted filtering facepiece respirator</li> <li>• Eye protection if splash/spray to eyes are likely</li> </ul> |
| Contact   | Direct : i) Direct skin to skin contact (hands),<br>ii) Ingestion,<br>iii) Injection<br><br>Indirect: Through a contaminated intermediate object or person   | <ul style="list-style-type: none"> <li>• Hand hygiene</li> <li>• Gloves</li> <li>• Gown</li> </ul>   |

Both WHO and CDC advocate some additional precautions for COVID-19.<sup>2,8</sup> These precautions are second-tier of precautions which have to be followed in case of infectious diseases depending on mode of transmission. As SARS CoV-2 is transmitted between people through respiratory droplets, aerosol, contaminated surfaces and equipment, so the HCWs should follow airborne, droplet and contact precaution.<sup>12</sup> The basic techniques of these precautions are given in table-I. Contact and droplet precautions are for HCWs who take care of suspected or confirmed COVID-19 patients; and in addition air-borne precautions also necessary for HCWs who perform aerosol generating procedures (AGPs) (table-II ) or who work in places where frequently AGPs take place.

**Table II:** Aerosol generating procedures<sup>2,14</sup>

- Tracheal intubation and extubation
- Non-invasive ventilation (BiPAP, CPAP)
- High Flow Nasal Canula
- Tracheostomy
- Cardio-Pulmonary Resuscitation
- Manual ventilation before intubation
- Bronchoscopy
- Open suctioning
- Nebulization
- Sputum induction

HCPs working in an area with moderate to substantial community transmission, must follow the standard precautions and transmission-based precautions all the time as they may encounter asymptomatic carriers and pre-symptomatic patients. It must be remembered always that sensitivity of RT-PCR for SARS CoV-2 is not 100% and vary depending on site and quality of sample collection procedure.<sup>13</sup> So, a 'negative RT-PCR test' does not rule out COVID-19. HCPs should continue the standard and transmission-based precautions based on anticipated exposures and diagnoses while working in areas with minimal to no community transmission.

### PERSONAL PROTECTIVE EQUIPMENT

Coronaviruses are transmitted from person to person via respiratory droplets, either directly by inhalation, or indirectly by deposited droplets on mucosal surfaces.<sup>3</sup> These droplets including aerosols come out from an infected person when he/she speaks, coughs or sneezes. The production of aerosols is increased during any type of AGPs. SARS-CoV-2 has been detected in respiratory, blood and faecal specimens. But till date there is no evidence of infection through contact with blood of infected persons.<sup>6</sup> Viral RNA has been detected in air samples and other things of patients' rooms.<sup>15-18</sup> For prevention of transmission of SARS-CoV-2 through aerosol, droplet and fomites, different components of PPE provide different level of protection.<sup>19,20</sup> Transmission of this infectious virus through skin, either

intact or non-intact, has not occurred yet. HCWs should wear gloves and gowns to prevent contamination of their hands, skin and clothes which might cause transfer of virus to the nose, mouth and eyes. A meta-analysis of several studies of SARS in HCWs showed that the use of gloves and/or gown is protective in univariable analysis, along with wearing masks.<sup>21-27</sup>

Personal protective equipment (PPE) has different components like- different type of masks, clean, non-sterile long-sleeved gown, water-proof apron/coverall, boots, goggles or face shield. Selection of PPE depends on activity and type of exposure of HCWs to suspected/confirmed COVID-19 patients (table III); like boots or coverall are needed only in special situation, not during routine care.<sup>28</sup> An ideal PPE not only protects the

HCWs, but also protect the non-infected patients from contracting infection. Hand hygiene should be done always, even with PPE. Spectacles do not give protection to ocular mucous membrane. So, either protective goggles or face-shield should be worn for eye protection. There is no need to wear both at a time. Pair of non-sterile gloves should be worn by those who come in direct contact with COVID patients. All healthcare providers must be trained about the appropriate PPE with a clear understanding of followings:

- What type of PPE he/she needs
- When to use PPE
- How to do donning and doffing
- How to disinfect/clean the PPE

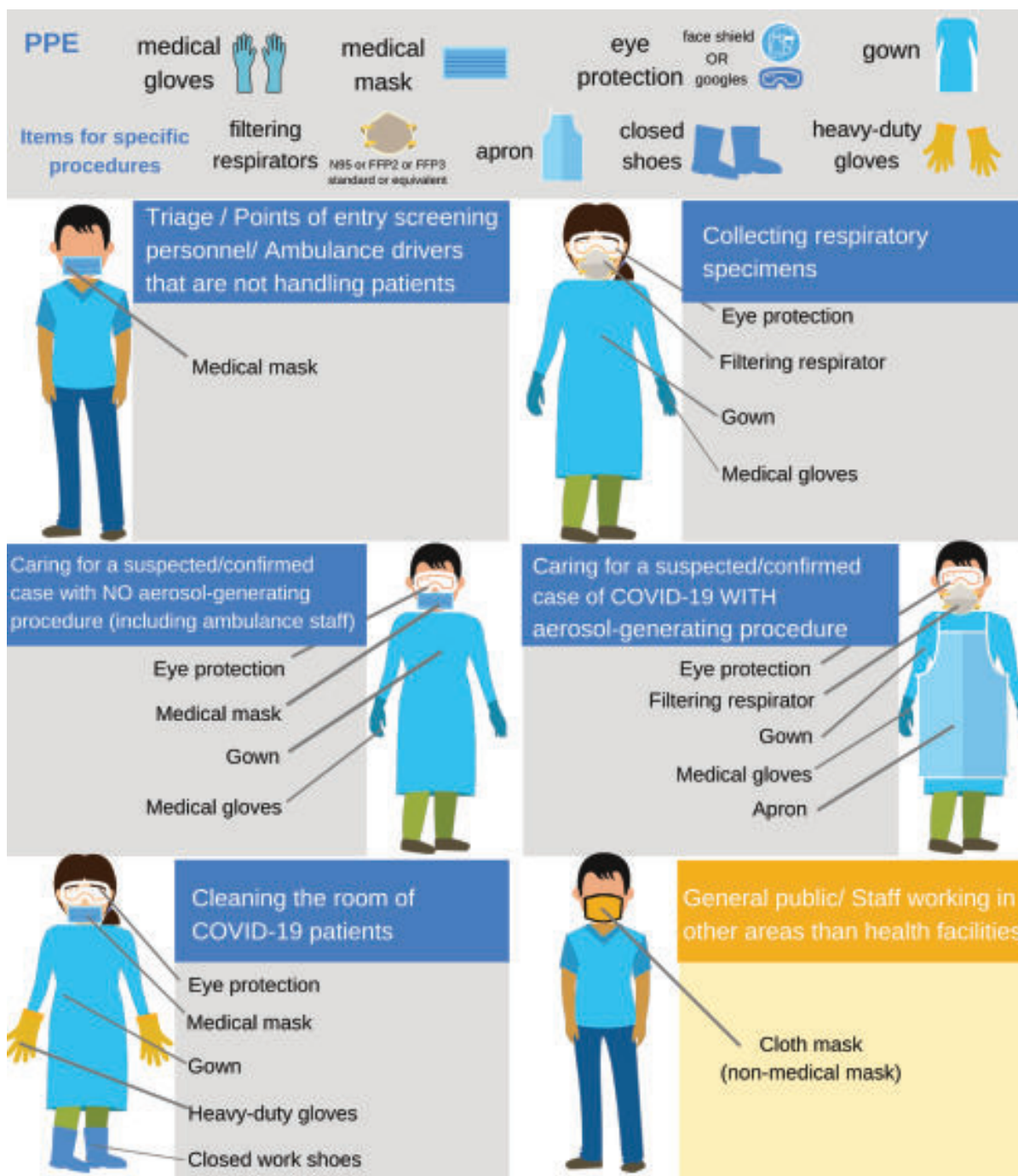
**Table III:** Type of PPE for HCWs<sup>28</sup>

|                      | Activity  | PPE*  |
|----------------------|---|---|
| Doctors and Nurses   | Screening   | <ul style="list-style-type: none"> <li>• Surgical mask</li> <li>• Eye protection**</li> <li>• Physical distance of at least 1 m (if possible)</li> <li>• Glass/plastic barrier (if possible)</li> </ul>   |
| Doctors and Nurses   | Direct care of Suspected/confirmed COVID-19 patients, but no AGP                | <ul style="list-style-type: none"> <li>• Surgical mask/respirator</li> <li>• Gown</li> <li>• Gloves (Clean, non-sterile)***</li> <li>• Eye protection</li> </ul>  |
| Doctors and Nurses   | Direct care of Suspected/confirmed COVID-19 patients including AGPs             | <ul style="list-style-type: none"> <li>• Respirator (N95 or equivalent or higher)</li> <li>• Gown</li> <li>• Gloves (Clean, non-sterile)*</li> <li>• Eye protection</li> </ul>                            |
| Medical Technicians  | Collecting, handling and processing of specimens, including respiratory samples | <ul style="list-style-type: none"> <li>• Apron (fluid resistant) over the gown</li> <li>• Respirator (N95 or equivalent or higher)</li> <li>• Gown</li> <li>• Gloves</li> <li>• Eye protection</li> </ul> |
| Cleaners             | Working in rooms of suspected/confirmed COVID-19 patients                       | <ul style="list-style-type: none"> <li>• Surgical mask</li> <li>• Gown</li> <li>• Heavy duty gloves</li> <li>• Closed work shoes/boots</li> <li>• Eye protection (if there is risk of splash)</li> </ul>  |
| Driver of ambulances | Carrying suspected/confirmed COVID-19 patients                                  | <ul style="list-style-type: none"> <li>• Surgical mask</li> <li>• Eye protection, and gloves if only they come in contact with patients</li> </ul>  |

\* Hand hygiene and respiratory etiquette should be followed always

\*\*Eye protection with either goggles or face-shield

\*\*\*Sterile gloves should be worn while performing any procedure to patients to minimize the risk of transmission of infection to patients



**Figure:** Personal protective equipment for HCWs according to health care activities<sup>29</sup>

All HCWs and other administrative staffs of health care facilities must wear surgical mask all the time while inside the health care facilities; it is called ‘targeted continuous medical mask use’.<sup>10</sup> They should change the masks and put on new surgical masks before going

home. Cloth masks are not recommended for use in healthcare settings.<sup>28</sup> Filtering facepiece respirators should be worn instead of facemasks while taking care of suspected/confirmed COVID patients. Respirators should be as protective as United States National

Institute for Occupational Safety and Health (NIOSH) certified N95, or European Union (EU) standard FFP2, or equivalent, or higher.<sup>26</sup> This type of respirators must be worn by HCWs who perform aerosol generating procedures and surgical procedures that generate aerosols or involving areas where viral load are higher (nose, throat, respiratory tract etc.).<sup>10</sup>

Any reusable PPE must be properly cleaned, decontaminated and maintained after and between uses. PPEs must be removed at doffing area. Wearing same PPE while visiting non-COVID patients is highly discouraged. It is better to change the gloves and gowns after visiting each suspected/confirmed COVID-19. But as there is scarcity of PPEs all over the world and due to financial constraint, gloves and gowns may be changed after visiting suspected/confirmed COVID patients in one ward or group. Physicians should be careful not to go to common room, rest rooms, dining area or other non-infected area wearing the same gowns and not to touch common things outside of COVID patients' rooms with the infected gloves. HCWs who are directly involved in taking care of suspected/confirmed COVID-19 patients should use different stairs or elevator if possible. If it is not possible to provide them separate facilities, then it must be ensured that they use common facilities only after removing the gowns and gloves.

Effectiveness of any PPE strongly depends on staff training about the PPEs. Hospital authority should provide adequate training for all HCWs about PPEs and hand hygiene. They should provide sufficient PPEs according to the need of HCWs. Compliance is needed for successful IPC implementation. So, regular monitoring and feedback by IPC personnel or any designated person is required. Authority should arrange training programs at regular intervals to reinforce the IPC practices of HCWs.

### **ENVIRONMENTAL CLEANING**

As the SARS CoV-2 is an enveloped virus with a fragile outer membrane, so it is less stable in environment and is more susceptible to oxidants like chlorine.<sup>30</sup> Survival of corona viruses on various surfaces range from 2 hours to 9 days.<sup>31,32</sup> Survival time of these shed viruses on different surfaces depends on type of surface, temperature, humidity and strain of virus. For effective infection control, various surfaces of healthcare settings

and different equipment used for COVID-19 patients along with their bedsheets, cloths and other used materials should be cleaned and disinfected regularly to prevent the spread of the disease.

Till date no study has found survival of SARS-CoV-2 in drinking water or sewerage.<sup>31</sup> Furthermore, other corona viruses have not been detected in surface water or groundwater sources.<sup>33</sup> Conventional water treatment methods that utilize filtration and disinfection usually inactivate this virus. Even the household techniques like boiling, nanomembrane filters, chlorine tablet, solar irradiation etc can effectively destroy SARS-CoV-2.<sup>31</sup> So, no separate special water treatment to provide drinking water is needed for hospital settings.

Cleaners working for suspected/confirmed COVID-19 patients should be properly trained in cleaning procedures and waste disposal. They should wear appropriate PPE (table III), and should do frequent hand hygiene. They must know how to prepare chemical disinfectant solutions properly and safely. Disinfectants should be prepared in a well-ventilated room.<sup>34</sup> Regular cleaning followed by disinfection using hospital disinfectants active against viruses is recommended. All surfaces of rooms, beds, tables and other utensils of suspected/confirmed COVID patients should be cleaned and disinfected at least once in a day, and after patients are discharged, or transferred, or expired. High touch surfaces like switches, bed-railings, side of curtains, door knobs etc should be cleaned twice daily. As efficacy of all disinfectants are affected by organic material (like blood, sputum, secretions etc), so all surfaces should be cleaned first with detergent/soap and water. Cleaning with water and soap or neutral detergent along with some mechanical action like brushing or scrubbing help to remove pathogens and significantly reduce their load on contaminated surfaces.<sup>34</sup> Then those should be disinfected with appropriate disinfectants for adequate time. Chemical disinfectant solution must be prepared in correct concentration according to manufacturer's recommendations. Too high or too low concentration reduces the efficacy of the disinfectants, and may also damage surfaces. Enough disinfectants must be applied to surfaces for adequate time to kill or destroy the pathogens. Room surfaces of COVID-19 patients and other things may be cleaned with a neutral detergent first, and then decontaminated with 0.05-0.1% sodium hypochlorite (i.e. dilution 1:100 to 1:50 if household

bleach at an initial concentration of 5% is used).<sup>3</sup> Cleaners or the personnel using sodium hypochlorite (0.1% for large surfaces and 0.5% for spilled blood or body fluids) must be very careful while cleaning as it is highly corrosive. Small surface areas and medical equipment which do not tolerate sodium hypochlorite, can be disinfected with 70% ethyl alcohol. Contact time of minimum 1 min is recommended while disinfecting with ethanol, chlorine-based products and >0.5% hydrogen peroxide. Any equipment like stethoscope, medical hammer etc of the isolation/COVID ward is potentially contaminated. So, these should be kept inside that ward/room, and should not be used for non-COVID patients. Disposable equipment should be disposed properly. Reusable equipment should be cleaned before using for each patient. Decontamination of special reusable medical devices should follow the manufacturer's instructions. Critical devices like surgical instruments, dental instruments etc, and semi-critical devices like laryngoscope, cystoscope, oesophageal probe etc should be cleaned first with hot sterile water with some mechanical action like brushing following dismantling. Then the critical devices should be sent for sterilization. High level disinfectants are used for the semi-critical devices followed by washing them in clean sterile water as presence of disinfectants may cause erosion to mucous membrane.

Any type of samples/specimens from suspected or confirmed COVID-19 patients should be collected, handled and transported following standard precaution measures and bio-safety practices.<sup>35</sup> Patients' documents, charts etc should be kept at working/nursing station, away from patients and their beds. When any patient is discharged or transferred or died, the bed area or room should be kept vacated for sufficient time for enough air exchanges to take place that can remove potentially infectious particles.<sup>2</sup> Then the environmental service personnel should do appropriate cleaning and disinfection before it is returned to routine use.

Standard methods of waste disposal should be followed in health care facilities always irrespective of pandemic. There should be separate arrangements to collect and dispose sharp objects, infectious material, biohazard product, non-infectious wastes and organic products in all healthcare settings. Usually colored bins are used to collect these things, and different colors are used for different types of wastes. HCWs should know where to

dispose different things and cleaners should collect the things accordingly in colored container, treated properly and at last disposed safely. Faeces or any other excreta or body fluid from suspected/confirmed COVID-19 patients should be treated as biohazard or infectious clinical waste category B(UN3291).<sup>31</sup> So these should be handled cautiously according to local policies and regulations.<sup>36</sup> Tissues or other materials used during sneezing or coughing should be thrown immediately in a covered bin or plastic bag and then disposed. Correct hand hygiene should be followed after disposing. Separate wash rooms/toilets should be provided for suspected or confirmed COVID-19 patients. These toilets should be cleaned twice daily by trained cleaner. Patients should be asked to flush the toilet with keeping the lid down to prevent droplet splatter and aerosol clouds. For patients who are unable to walk and use the wash rooms, bed pans can be used. After use, the excreta in bedpans should be disposed first. Then the bedpan should be cleaned with neutral detergent and water, followed by disinfection with 0.5% chlorine solution. It should be remembered that chlorine or any other disinfectants cannot disinfect large amounts of solid and dissolved organic matter. So, cleaning should be done first always, followed by disinfection. Used diapers in unconscious/semiconscious patients should be disposed as infectious waste. Used/soiled linens should be collected in a leak proof bag or covered bucket. These can be washed in machine with laundry detergent and warm water at 60° to 90°C.<sup>31</sup> Alternatively, these can be soaked in soap/detergent mixed hot water, stirred with stick and then soaked in 0.05% chlorine solution for at least 30 minutes. These should be dried properly, preferably in sunlight, after rinsing with clean water. Reusable PPEs are also cleaned first with soap and hot water, and then decontaminated with 0.5% sodium hypochlorite solution followed by rinsing with clean water. Specific instructions should be followed according to material of PPEs. Disposable PPEs should be disposed as infectious waste.

Ventilation plays a key role for the prevention of respiratory infections in healthcare settings. The minimum number of air exchanges per hour, in accordance with the applicable hospital regulations, should be ensured at all times. Increasing the number of air exchanges per hour will reduce the risk of transmission in closed spaces. This may be achieved by

means of natural or mechanical ventilation, depending on the setting. Air recirculation without filtration should be avoided as much as possible. All admitted suspected or confirmed COVID patients should be placed in adequately ventilated (60L/sec/patient) rooms with natural ventilation.<sup>2</sup> If it is not possible to provide separate rooms for patients, then they should be grouped together in a ward with beds placed at least 1 meter or more apart. Beds should be placed in opposite direction of airflow to minimize aerosolization and spread of virus. Sitting arrangements inside of physicians' personal chamber should also be arranged in such a way that direction of air flow is away from patients. Suspected or confirmed COVID patients should be instructed to stay within their rooms. They should be transported out of their rooms only when it is necessary for medical purpose. If facility is available, all type of AGPs should be performed in airborne infection isolation room (AIIR).<sup>12</sup> This is a room for single patient in which the air pressure is negative compared to surrounding area with six to twelve air changes per hour.<sup>8</sup> In absence of such facility, air flow of rooms, where frequently AGPs are performed, should be at least 160L/sec per patient.<sup>2</sup> Exhausted air from this room should be directed directly outside, away from air-intake vents, clinical area and people, or filtered through high efficiency particulate air (HEPA) filter. In absence of negative pressure room or AIIR, hospital administration should consider installment of exhaust fan, or whirly birds in consultation with environmental engineer.<sup>2</sup> Minimum number of HCPs should be present during any type of AGPs.<sup>37</sup>

Though risk of getting infection by handling the deceased COVID patients is very low, standard precautions (mask, impermeable disposable gown and gloves) must be followed by the personnel who interact with the dead bodies.<sup>38</sup> They should wear face shields or goggles if there is risk of splashes to eyes or faces. Special attention should be given to contain any body fluid leaking from any orifices of the dead body. Body bags, made up of solid, leakproof, non-biodegradable products, may be used in case of excessive body fluid leakages. Minimum handling of the dead body should be done. No special transport vehicle is needed to carry the deceased to graveyard or similar places.<sup>38</sup> Dead bodies should be buried or disposed according to religion or family wish. At all stages of handling deceased, their dignity, religious and cultural tradition

should be respected and protected. Minimum number of family members and friends may visit according to customs maintaining social distance and wearing masks. But they should be instructed clearly not to touch the dead body under any condition. If family wishes, personal belongings of dead patients may be handed over them after proper cleaning and disinfection. Healthcare or mortuary staff, or members of burial team must follow hand hygiene before and after each procedure. Persons aged more than 60 years and those who are immunosuppressed, should not directly interact with dead bodies.

If autopsy has to be done on any COVID patient, suspected or confirmed, it must be done in a well ventilated and well-lighted autopsy room. Concerned personnel should wear appropriate PPE remembering that there will be aerosolization of infected viruses when any part of the respiratory tract is opened. So, they must wear respirator along with gown, gloves and eye protection. The body should be handed over to the authorized persons with dignity after completing the autopsy procedure. Surfaces of autopsy room and used instruments should be cleaned properly first, followed by disinfection.<sup>32,39</sup>

#### **ADMINISTRATIVE ROLE FOR IPC**

Hospital authority plays the vital role in implementation of IPC. In general, all healthcare settings should have their own dedicated and trained IPC team or at least one IPC focal point.<sup>40</sup> Different hospitals in different countries practices IPC in accordance with advice by national authority in context of COVID-19. Healthcare administration should set up a 'COVID-19 preparedness and response team' to deal with this pandemic. This team may include senior administrators and representatives from all main departments.<sup>41</sup> They should ensure adequate patient to staff ratio for proper care of COVID patients. Adequate supplies of PPEs and other necessary things and provision of adequate training for all HCWs are two very important tasks for the hospital authority. HCPs must be trained about the correct use of PPE and other measures of IPC including demonstration of competency in appropriate procedures for putting on and removing PPE.<sup>28</sup> Besides these, they have to monitor the compliance of the HCWs and their adherence to IPC policies. They have to arrange for regular feedback from the HCWs for better implementation of IPC. In case of shortage of PPEs or



for low-income countries, HCPs should be taught the re-use of some PPE components with appropriate decontamination or sterilization.<sup>28</sup>

Hospital administration is directly responsible for preventing overcrowding in hospital by restricting entry of excess people inside the healthcare facilities. They should also emphasize in wearing masks and maintaining social distance within the facilities along with educating patients' caregivers about hand hygiene and respiratory etiquette. Minimum number of attendants should be allowed to stay with patients who need assistance. Some hospitals may be designated exclusively for the management of COVID-19 patients; however, the probability of exposure to the virus should be considered high at all healthcare facilities. Provision of dedicated areas for suspected and confirmed COVID-19 patients, and non-COVID patients separately is another important task of hospital authority. This is highly needed for prevention of spread of infection. WHO advocated that designated and dedicated cohort of HCWs should take care of COVID-19 patients. But in case of shortage of HCPs, it may not be possible to follow always. In that situation, HCPs should first take care of non-COVID patients, and then visit the COVID patients. There should be minimum number of HCWs during clinical round. Bedside teaching is discouraged in COVID patients. Doctors may discuss about patients' condition outside the room or ward. Decision of performing any surgery in this pandemic is based on need (like emergency or trauma cases), risks and benefit of surgery; not on COVID status of the patient.<sup>2</sup> If possible, RT-PCR or other tests should be done prior to surgery. Standard and additional precautions must be followed during operation with presence of minimum staff in operation theatre. Administrative policies for COVID-19 pandemic include establishing sustainable IPC infrastructure and activities. Healthcare facilities may use tools which are developed to monitor and evaluate implementations of IPC measures.<sup>42</sup> These tools can also be used to identify IPC gaps and to monitor progress in addressing them. WHO recommended that basic IPC standards should be followed in all healthcare facilities to provide minimum protection for HCPs, patients and their visitors in countries where IPC is not existing or available in limited places.<sup>2</sup>

## **ROLE OF IPC IN SPECIALIZED HEALTH CARE FACILITIES**

As part of routine infection control, all type of health care facilities like outpatient dialysis unit, dental unit, blood and plasma facilities etc, should have established their own policies and practices to reduce the spread of this contagious respiratory pathogen.<sup>43</sup> All patients and their attendants visiting any type of healthcare facilities must wear masks and maintain social distance with others. All HCPs should wear masks, eye protection and gloves depending on their level of interaction with patients. Nursing homes or long-term care facilities (LTCF) should assign at least one individual with training in IPC to provide on-site management of their COVID-19 prevention.<sup>44</sup> Unfortunately residents of LTCF have high risk of COVID-19, its complications and death due to their advanced age and comorbidities.<sup>45,46</sup> In European countries, it has been found that 66% of all fatal cases were among LTCF residents.<sup>46,47</sup> So, proper IPC implementation is crucial to save their lives. All emergency services and primary care staff must be aware about the risk factors for COVID-19, mode of transmission, clinical sign/symptoms, recommended IPC measures and procedures of reporting and transferring the suspected or confirmed cases. Hospital administration with support from Government must ensure their training with provision of necessary logistics.

After returning home, healthcare workers who have managed COVID-19 patients should practice physical distancing, especially with elder persons of the family or anyone with comorbidities, to minimize the risk of transmission to their household members.<sup>48</sup> Active syndromic surveillance of HCWs should be established so that they do not infect other HCWs or non-COVID patients.<sup>49</sup> They should be tested and be relieved of their duties if they become unwell or get infected with SARS-CoV-2. They should be isolated or quarantined according to hospital or national policy. The workload and psychological health needs of the staff should be addressed. Virological, radiological and other necessary investigations should be arranged for patients and HCWs in a timely manner for rapid diagnosis and management.<sup>35</sup> HCPs who tested positive or suffered from COVID-19, should return to work as per local or national rules. Retesting is not required to see the infectious status, but may be done as per need of working

authority. It is to be remembered that presence of viral particles may cause positive RT-PCR test even long after the illness ends which does not mean that patient can infect others. CDC stated that any infected person can spread virus for 10 days in case of mild to moderate disease; and for 21 days in severe to critical illness due to COVID-19.<sup>50</sup>

## CONCLUSION

The health and safety of healthcare workers and other staff working at healthcare premises during this deadly pandemic is supreme, not only for their own protection but also to help prevent the spread of the virus and improve overall care to patients. In absence of definite treatment, only comprehensive IPC can stop this pandemic along with control of other emerging infectious diseases, HCAI and AMR. Healthcare Administration should arrange training for health care personnel and monitor their compliance to IPC practices, and arrange for necessary logistic supports. The IPC programme of all healthcare settings should be supported by the national authority for effective management of COVID-19.

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