ECDC TECHNICAL REPORT

Guidance for wearing and removing personal protective equipment in healthcare settings for the care of patients with suspected or confirmed COVID-19

February 2020

Scope of this document

This document provides support to healthcare workers managing suspected or confirmed cases of novel coronavirus 2019 (COVID-19). The general objectives of the document are:

- to present the minimal set of personal protective equipment (PPE) required for managing suspected or confirmed COVID-19 cases;
- to make healthcare workers aware of the critical aspects of the donning and doffing of PPE; and
- to strengthen occupational safety in healthcare workers for patients suspected of, or confirmed with, COVID-19.

This document is based on current COVID-19 knowledge and PPE best practices.

ECDC will update this document based on the evolving situation and if new relevant information arises.

Target audience

Healthcare workers and infection prevention and control personnel in EU/EEA countries and in the United Kingdom.

Background

What is SARS-CoV-2 and COVID-19?

The causative agent involved in the current outbreaks of COVID-19 is a virus belonging to the family of *Coronaviridae* (genus: *Betacoronavirus*), a large family of enveloped, positive-sense single-stranded RNA viruses. Coronaviruses are transmitted in most instances through large respiratory droplets and contact transmission, but other modes of transmission (i.e. airborne and faeco-oral) have also been proposed.

The average incubation period is estimated at 5 to 6 days, ranging from 0 to 14 days [1]. There is currently no specific treatment or vaccine against COVID-19.

More disease background information is available online from ECDC [2] and WHO [3], and in the last ECDC Rapid Risk Assessment [4].

Suggested minimal PPE set

The suggested minimal PPE set protects from contact, droplet and airborne transmission. The composition of the set is described in Table 1 and shown in Figure 1.

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Table 1. Minimal composition of a set of PPE for the management of suspected or confirmed cases of COVID-19

Protection	Suggested PPE
Respiratory protection	FFP2 or FFP3 respirator (valved or non-valved version)*
Eye protection	Goggles (or face shield)
Body protection	Long-sleeved water-resistant gown
Hand protection	Gloves
* In case of shortage of respirators, the use of face masks (surgical or procedural masks) is recommended. When this type of PPE is used, the limitations and risks connected to its use should be assessed on a case-by-case basis.	

Respiratory protection

The respirator protects from the inhalation of droplets and particles. Because different types of respirators fit differently between users, the respirator requires a fitting test.

ECDC suggests the use of class 2 or 3 filtering face-piece (FFP) respirators (FFP2 or FFP3, Figure 1) when assessing a suspected case or managing a confirmed case. A FFP3 respirator should be always used when performing aerosol-generating procedures.

Face masks (surgical masks) mainly protect from exhaled droplets [5]; their use is recommended in case of shortage of respirators and on a case-by-case assessment. Surgical masks do not require fit testing.

Eye protection

Goggles, or face shields (Figure 2), should be used to prevent virus exposure of the eye mucosa.
Important: goggles need to fit the user's facial features and have to be compatible with the respirator.

Body protection

Long-sleeved water-resistant gowns should be used to prevent body contamination. This PPE item does not need to be sterile unless it is used in a sterile environment (e.g. operating room).

If water-resistant gowns are not available, a single-use plastic apron worn over the non-water-resistant gown can be used.

Hand protection

Gloves should be used when managing suspected or confirmed COVID-19 patients.

For more detailed information about PPE when caring for COVID-19 suspected or confirmed patients in healthcare settings, please refer to this ECDC technical document [6].

Figure 1. Suggested minimal PPE set for the management of suspected or confirmed cases of COVID-19: FFP2 or FFP3 respirators, goggles, long-sleeved water-resistant gown and gloves

Figure 2. A face shield

Most PPE components come in different sizes, and it is important to stress that PPE does not follow a one-size-fits-all principle. A proper PPE fit is essential to obtain protection; a non-suitable size will not protect its wearer.

There are different options for wearing (donning) and removing (doffing) PPE. ECDC suggests the following procedure for safe donning and doffing.

Wearing (donning) the PPE

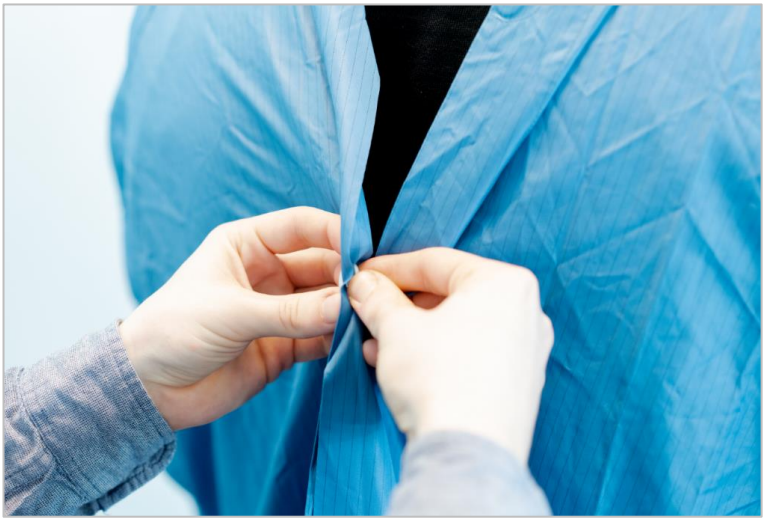
Before wearing the PPE for managing a suspected or confirmed COVID-19 case, proper hand hygiene should be performed following international recommendations [7]. This is a critical aspect in this setting and should be performed using an alcohol-based solution in accordance with the manufacturer's instructions (Figure 3).

Figure 3. Hand hygiene performed using alcohol-based solution

The first PPE to be donned (Figure 4) is the gown. There are different types of gowns (single use, reusable); this guidance presents a reusable long-sleeved water-resistant gown. When using a gown with back closure, as shown below, a second operator should assist in buttoning up the back (Figure 5).

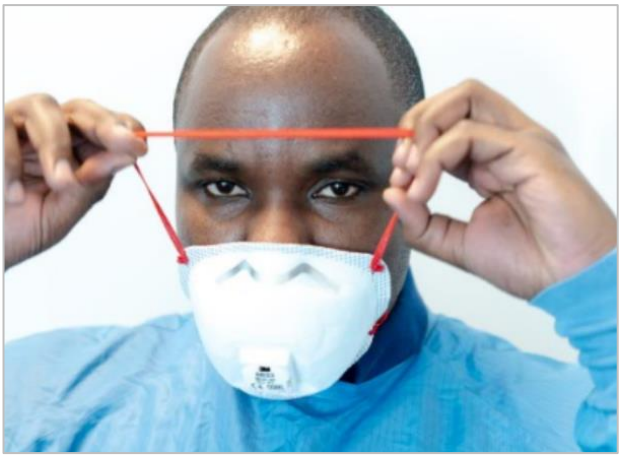
Figure 4. Donning of a long-sleeved water-resistant gown

Figure 5. Buttoning up the backside of the gown; performed by an assistant



After wearing the gown, it is suggested to proceed with the respirator that protects from the inhalation of droplets and particles. ECDC suggests that FFP2 or FFP3 respirators (Figure 6) be used for all procedures when managing a suspected or a confirmed COVID-19 case. It is important to perform a fitting test after the respirator has been put on, following the manufacturer's instructions. There are different methods to fit-test a respirator. Further information can be found in the ECDC technical document 'Safe use of personal protective equipment in the treatment of infectious diseases of high consequence' [5].

Figure 6. Wearing of a FFP (class 2 or 3) respirator



The metal nose clip needs to be adjusted (Figure 7) and the straps have to be tightened to have a firm and comfortable fit. If you cannot achieve a proper fit, position the straps crosswise. However, this minor modification could imply a deviation from the recommendations in the manufacturer's product manual.

Figure 7. Fitting the respirator's metal nose clip

If a face mask (surgical mask) is worn as substitution for a respirator (Figure 8), it is important to correctly position it on the face and adjust it with the metal nose clip (Figure 9) in order to achieve a proper fit.

Figure 8. Wearing of a face mask (surgical mask)

Figure 9. Fitting the face mask's metal nose clip

Once the respirator has been properly positioned, put on the goggles for eye protection. Place the goggles over the mask's straps and ensure that the textile elastic strap fits snugly – but not too tightly (Figures 10 and 11).

Figure 10. Wearing of goggles with textile elastic strap

Figure 11. Side view of goggles with an elastic textile strap

If goggles with temples are used, make sure that they are properly positioned and fit well (Figure 12).

Figure 12. Wearing of goggles with temples

After the goggles, the gloves are next. When wearing gloves, it is important to extend the glove to cover the wrist over the gown's cuffs (Figure 13). For individuals allergic to latex gloves, an alternative option, for example nitrile gloves, should be available.

Figure 13. Wearing of gloves

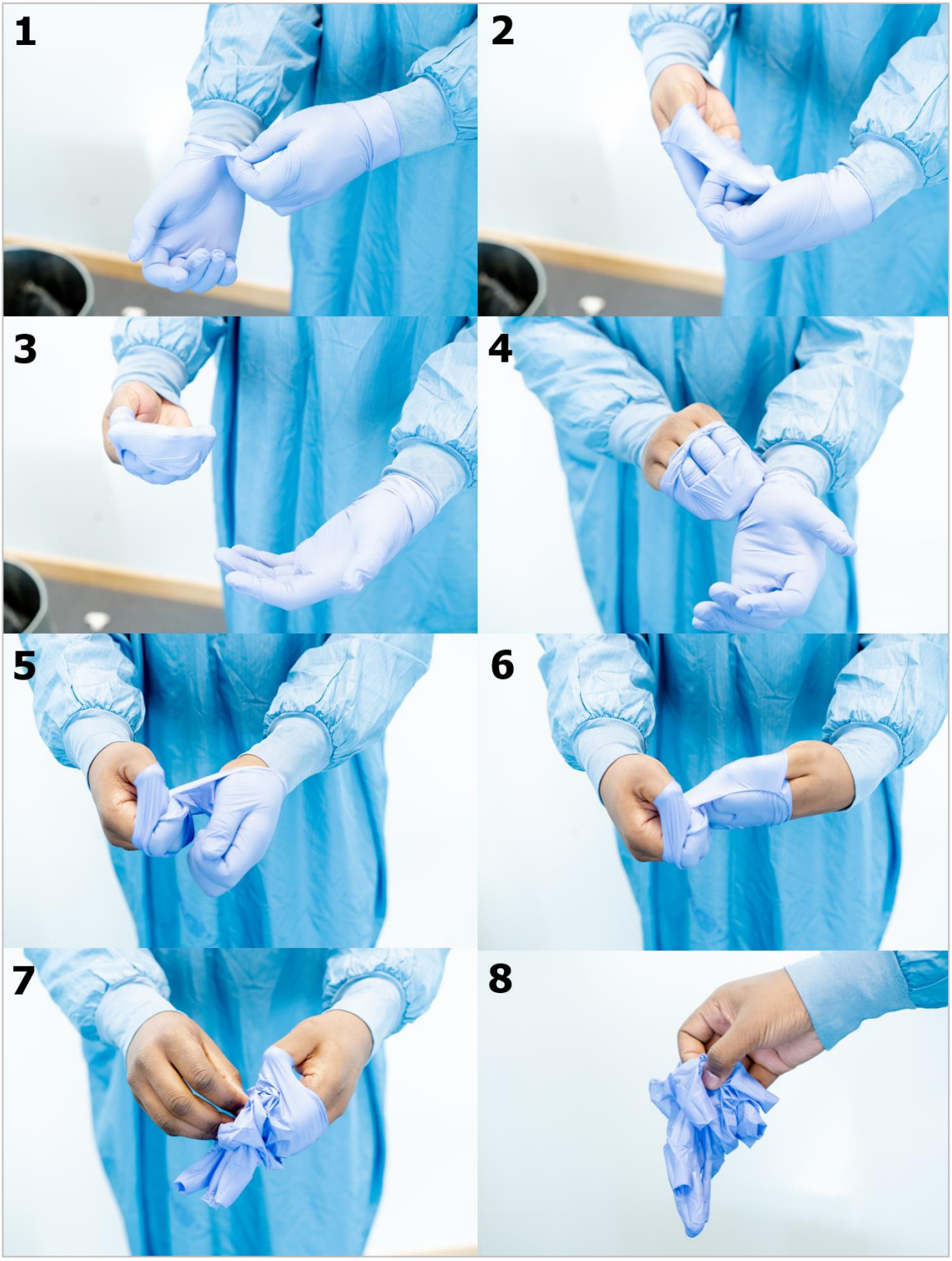
Removing (doffing) the PPE

Wearing the PPE correctly will protect the healthcare worker from contamination. After the patient has been examined, the removal (doffing) of the PPE is a critical and important step that needs to be carefully carried out in order to avoid self-contamination because the PPE could by now be contaminated.

The gloves are removed first because they are considered a heavily contaminated item. Use of alcohol-based hand disinfectant should be considered before removing the gloves. The gloves should be removed following eight steps (Figure 14).

Start by (1) pinching and holding the glove (with the other gloved hand) between the palm and wrist area, (2) peeling the glove away from the wrist (3) until it turns inside out covering the fingers. With the now half-gloved hand, (4) pinch and hold the fully gloved hand between the palm and wrist, (5) peel the glove away from the wrist (6) until it turns inside out and covers the fingers. Now that both hands are half-gloved, (7) remove the glove from one hand completely by grabbing the inside part of the glove and peeling it away from the hand, and do the same for the remaining half-gloved hand using the non-gloved hand, while always grabbing the inside part of the glove. Dispose of the gloves (8) in a biohazard bin.

Figure 14. Removal of gloves (steps 1 to 8)



After the removal of gloves, hand hygiene should be performed and a new pair of gloves should be worn to further continue the doffing procedure. Using a new pair of gloves will prevent self-contamination.

With the new pair of gloves on, the gown should be removed. When using a gown with back closure (as used in this document), a second operator should assist in unbuttoning the backside of the gown (Figure 15). The assistant should wear gloves and a surgical mask, which need to be removed after opening the gown. After the gloves of the assistant are removed, hand hygiene should be performed using an alcoholic solution. After the gown has been unbuttoned, the gown can be removed by the healthcare worker by grabbing the back of the gown (Figure 16) and pulling it away from the body, keeping the contaminated front part inside the gown (Figure 17).

Figure 15. Unbuttoning of the backside of the gown, performed by an assistant

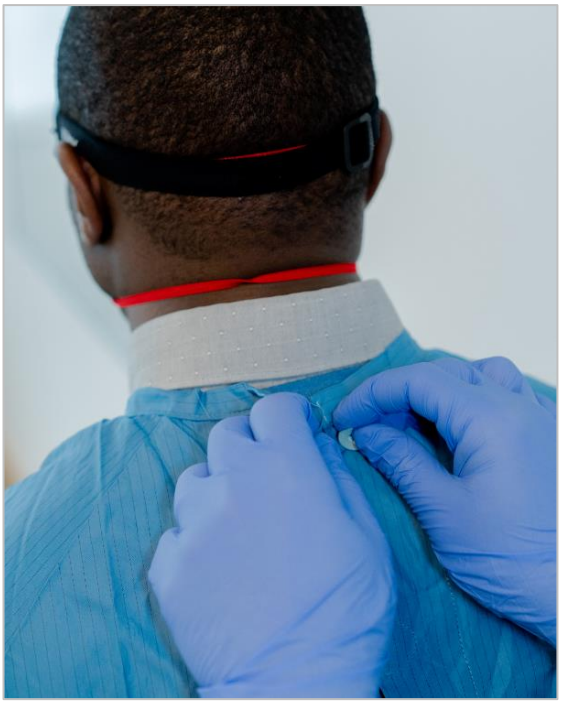


Figure 16. Removal of gown: grabbing the back of the gown

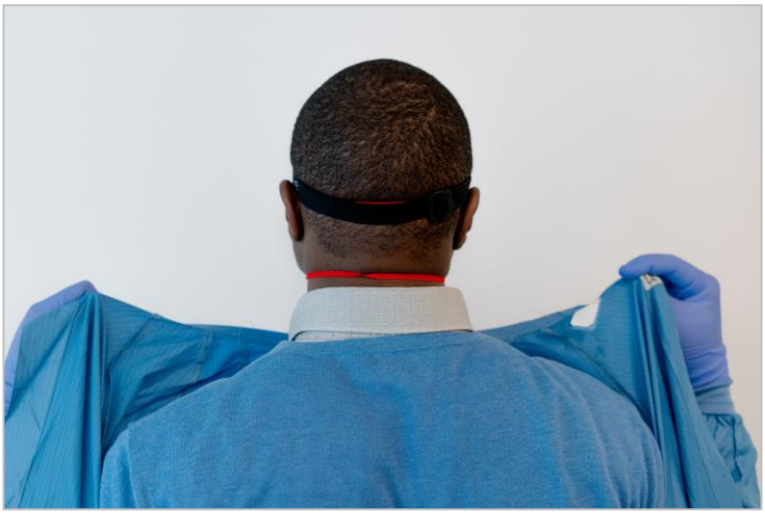


Figure 17. Removal of gown: pulling the gown away from the body

Single-use gowns can now be disposed of; reusable gowns have to be placed in a bag or container for disinfection (Figure 18).

Figure 18. Placing the gown in a biohazard container for disinfection

After the gown, the goggles should be removed and either disposed if they are single-use, or placed in a bag or container for disinfection. In order to remove the goggles, a finger should be placed under the textile elastic strap in the back of the head and the goggles taken off as shown in Figure 19. Touching the front part of the googles, which can be contaminated, should be avoided. If goggles with temples are used, they should be removed as shown in Figure 20.

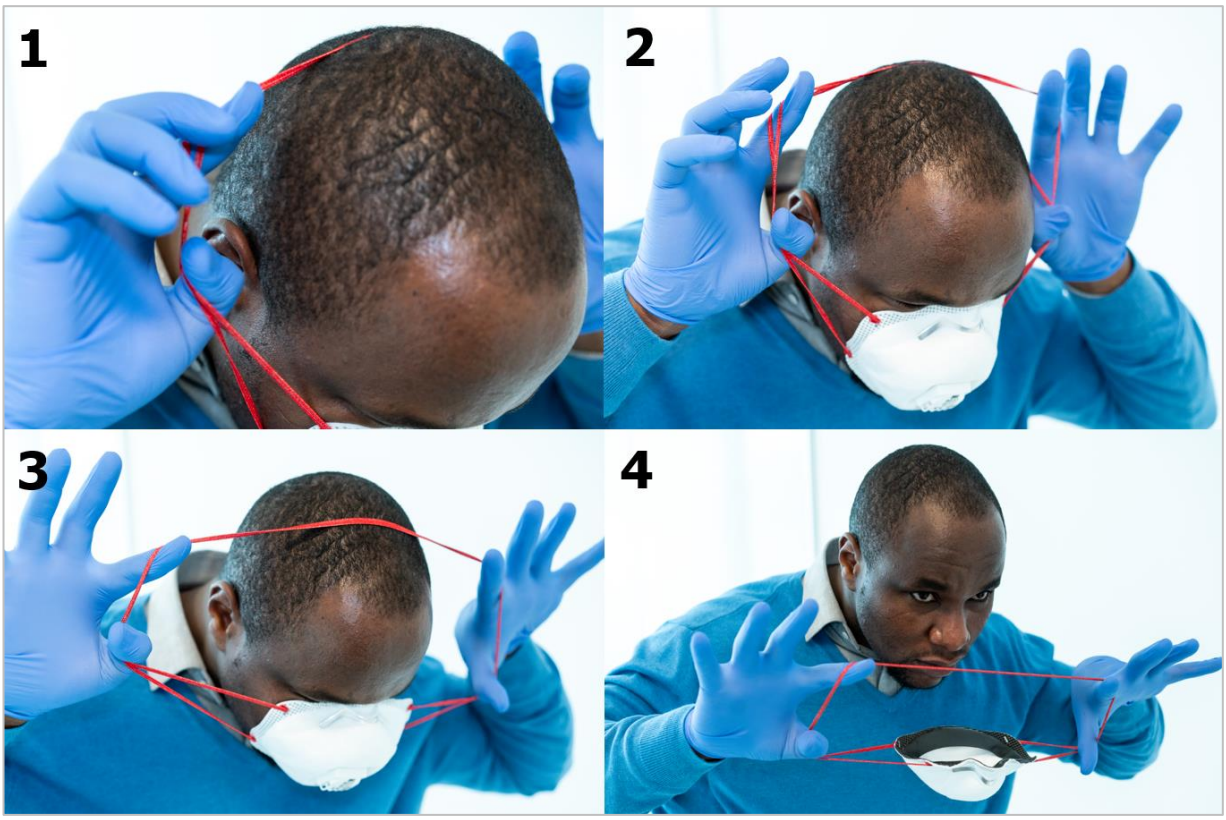
Figure 19. Removal of goggles with textile elastic strap (steps 1 to 4)

Figure 20. Removal of goggles with temples (steps 1 and 2)

The respirator should be removed next. In order to remove the respirator, a finger or thumb should be placed under the straps in the back and the respirator taken off as shown in Figure 21.

The respirator (or the surgical mask) should be disposed of after removal. It is important to avoid touching the respirator with the gloves (except for the elastic straps) during its removal.

Figure 21. Removal of respirator (steps 1 through 4)



The last PPE items that should be removed are the gloves. Use of alcohol-based solution should be considered before removing the gloves. The gloves should be removed in accordance with the procedure described above. After glove removal, hand hygiene should be performed.

Contributing ECDC experts (in alphabetical order)

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