COVID-19 pandemic personal protective equipment (PPE): Guidance for intensive care.

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Endorsing organisations

COVID-19 pandemic personal protective equipment (PPE): Guidance for intensive care.

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COVID-19 pandemic personal protective equipment (PPE): Guidance for intensive care.

Summary

Infection Prevention & Control (IPC) guidance is developed on the best evidence available at any given time. It is for individual organisations to determine how best to implement it in order to protect their staff & patients.

These guidelines are written in support of critical care delivery and offer a pragmatic interpretation of the current generic PHE guideline.

https://www.gov.uk/government/publications/wuhan-novel-coronavirus-infection-prevention-and-control/covid-19-personal-protective-equipment-ppe

These guidelines should be read in conjunction with:

https://icmanaesthesiacovid-19.org/managing-theatre-processes-for-planned-surgery-between-covid-19-surges -

https://icmanaesthesiacovid-19.org/clarification-of-ppe-guidance-during-planned-surgery-restarts

The above documents provide a framework for local risk assessment based upon community transmission of COVID-19.

National and local policy on the safe delivery of care is changing frequently as lockdown relaxes and more targeted local interventions are introduced. Local risk assessment processes should be applied when interpreting guidance.

The critical care community must plan for the continuing provision of critical care services in the context of variable ongoing community transmission of the SARS-CoV-2 virus and the potential for further waves.

In addition to providing COVID-19 facing critical care capacity, there is a rise in demand for critical care for patients with non-COVID-19 illness.

The need for parallel streams of clinical care for COVID-19 positive and COVID-19 negative is placing a considerable demand on the ICU.

Minimising occupational transmission of COVID-19 infection to healthcare workers and nosocomial transmission of COVID-19 to patients, will require a combination of approaches.

The risk of transmission of the SARS-CoV-2 virus in this clinical area is related to contact with respiratory droplets and aerosols generated by the patient during clinical care and by fomite contamination of the clinical environment with persistence of viable virus.

Standard infection control measures must be applied and PPE must be appropriate: https://www.hse.gov.uk/coronavirus/assets/docs/face-mask-equivalence-aprons-gown-eye-protection.pdf and based upon transmission.

We advocate an approach which allows those who personally feel they prefer additional PPE to be provided with this and supported in its use. This should be influenced by individual risk assessments.

Summary of PPE guidance

<table>
<tr><td rowspan="5">Elective, non-COVID-19</td><td>Non AGP</td><td>AGPs</td></tr>
<tr><td colspan="2">Standard infection control precautions</td></tr>
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Eye protection if risk of splashing of body fluid</td></tr>
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<tr><td rowspan="6">Emergency, non COVID-19</td><td>Non AGP</td><td>AGPs</td></tr>
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<tr><td colspan="2">Enhanced environmental cleaning</td></tr>
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*Local decisions around placement in non COVID-19 areas will have been made by senior clinical staff in conjunction with local guidance, and take into account the risk/benefit balance based on clinical presentation, COVID-19 contact history, imaging results, COVID-19 prevalence and the nature and number of negative PCR samples. Routine use of side rooms for AGP in patients considered low risk is likely to be impractical in most units due to low numbers of side rooms.

Suspected or proven COVID -19

	Single Patient – no AGP	Single patient - AGP	Patients with AGPs in cohorted areas
Sessional use	FRSM mask	FFP3 mask	FFP3 mask
	Eye protection if risk of splashing of body fluid	Eye Protection Gown*	Eye protection
Change between patients and tasks	Gloves	Gloves	Gloves Gown* See below for IPC options for cohorting patients.
Patient location	Side room (if possible but prioritse for COVID-19 patients undergoing AGP)	Use side room	Designated areas in ICU with physical barrier
	Enhanced Environmental Cleaning		

*Gowns should be water repellent or protected with a plastic apron if there is a risk of splashing of body fluid. Short sleeved gowns enable hands and arms to be to be washed and therefore minimise the risk of cross transmission

Note: it is essential to apply Standard Infection Control Precautions in the care of all patients

COVID-19 risk assessment and clinical pathways

All critically ill patients admitted to the ICU should be assessed for their risk of COVID-19 infection. Local and regional incidence data will help inform this decision. With the increased availability and capacity of SARS-CoV-2 PCR testing, the infection status of many patients will be known on admission to ICU, or shortly thereafter.

Elective patients:

Current guidance should be followed re quarantine and screening.

Where this has not been possible local consideration could be given to managing this patient group as emergency patients.

Current guidance re repeat testing should be followed.

In the event that a patient develops an acute febrile illness of uncertain aetiology in the post-operative period, the possibility of COVID-19 infection should be considered.

Emergency patients:

These patients may be deemed:

1) at low risk of COVID-19 infection by virtue of low community transmission rates and/or the nature of the presenting illness and/or a negative PCR SARS-CoV-2 test on naso-pharyngeal swab or lower respiratory tract samples

2) suspected of COVID -19 infection by virtue of the nature of the presenting illness (and are awaiting SARS-CoV-2 PCR testing) or are test negative but still remain clinically suspicious

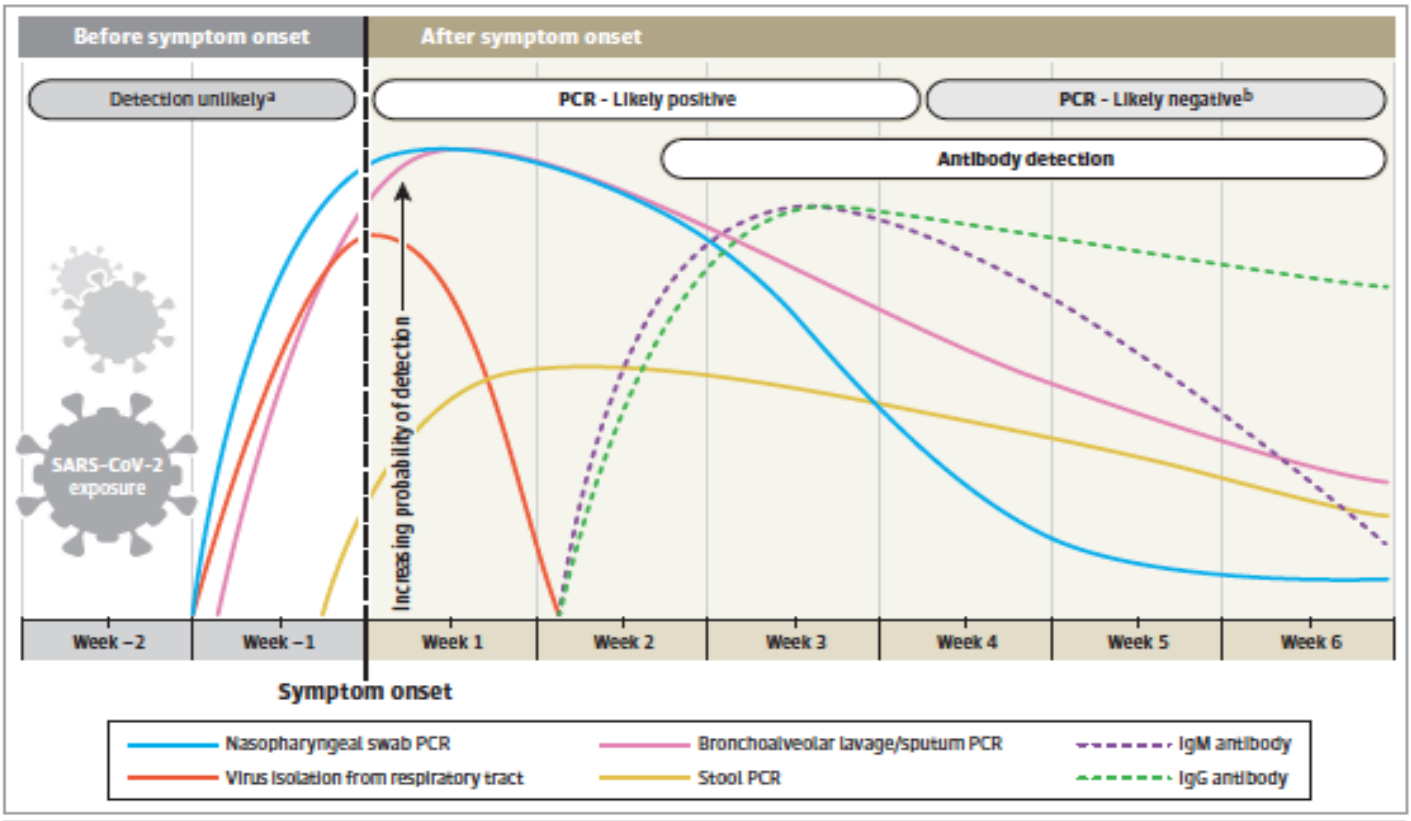
3) positive for COVID-19 infection on the basis of clinical symptoms and positive SARS-CoV-2 PCR testing

Previously confirmed COVID-19 infection, but no longer considered an infection risk.

Principles:

- Patients no longer infectious 14 days after onset of symptoms
- Period of infectivity may be longer in patients who are severely ill
- A positive PCR test does not indicate infectivity as the genome continues to be excreted from dead cells for weeks after the infection has been cleared (see figure)

Figure. Estimated Variation Over Time in Diagnostic Tests for Detection of SARS-CoV-2 Infection Relative to Symptom Onset



Estimated time intervals and rates of viral detection are based on data from several published reports. Because of variability in values among studies, estimated time intervals should be considered approximations and the probability of detection of SARS-CoV-2 infection is presented qualitatively. SARS-CoV-2 indicates severe acute respiratory syndrome coronavirus 2; PCR, polymerase chain reaction.

[a] Detection only occurs if patients are followed up proactively from the time of exposure.

[b] More likely to register a negative than a positive result by PCR of a nasopharyngeal swab.

Sethuraman et al JAMA April 2020

Recommendation (see appendix 1)

Isolation precautions for COVID-19 patients on or after Critical Care Unit admission are discontinued if the following conditions are met.

14 days have elapsed since first positive SARS-CoV-2 test **AND** there has been:

- sustained clinical improvement with at least some respiratory recovery
- absence of fever (> 37.8˚C) for 48 hours
- no underlying severe immunosuppression
- one negative SARS-CoV-2 tests taken on day 14 from the lower respiratory tract (or upper respiratory tract if lower not possible)
- if still positive on day 14, a further sample should be tested at 7-day intervals until a negative swab.

On occasion, critically ill patients recovering from COVID-19 infection may continue to demonstrate SARS-CoV-2 PCR positivity on serial testing for many weeks. This does not necessarily reflect the presence of viable virus nor the ability to transmit infection. In the absence of underlying severe immunosuppression, ICU clinicians should liaise with local infection experts (microbiology, infectious diseases) to agree when isolation precautions may be reasonably relaxed in such circumstances

ICU preparedness for the prevention and control of COVID-19 infection

To deliver Critical Care through different phases of pandemic, local ICU escalation policies should:

- identify the location of areas
- identify the number of beds
- identify the IPC measured required at each step of ICU escalation for patients with proven or highly suspected COVID-19

Intensive care services have developed plans and processes for dealing with patients with both COVID-19 infection and non-COVID critical illness. The principles and practice of running parallel streams of critical care provision are now well established.

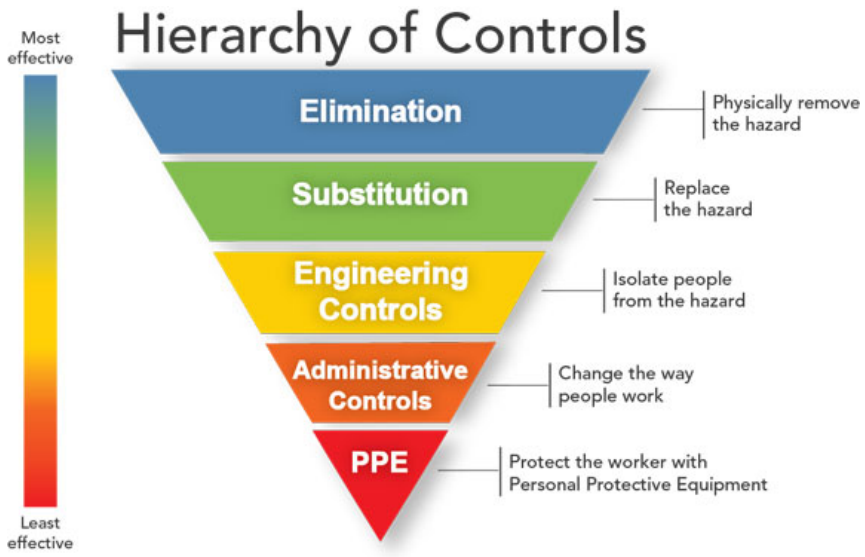
The use of colour descriptors to identify the nature of critical care beds has become widespread and is often integrated with Trust-wide policies. There is no nationally accepted process for this colour allocation - so care should be taken when interpreting guidance from elsewhere.

Within Critical Care standardisation would be beneficial, we suggest:

Green for non COVID-19 patients, Amber for suspected COVID-19 (clinically suspicious and awaiting test or high index of suspicion) and Blue for COVID-19 positive patients

Individual ICU design and side room availability will dictate how these pathways are managed.

All of the elements of the hierarchy of IPC measures must be considered.



https://www.cdc.gov/niosh/topics/hierarchy/

Standard infection prevention and control measures must be adhered to.

The form of PPE worn by staff should be commensurate with the risk to the healthcare worker of acquiring COVID-19 infection and should be informed by, community transmission the nature of the ICU clinical area and patient characteristics.

At the start of the pandemic, all ICUs were considered high risk areas, there is an opportunity now to consider that only critical care areas which cohort suspected/proven cases of COVID-19 or those areas admitting emergency patients for additional risk assessment/testing should be regarded as high risk areas, this must be done by local risk assessment based upon:

- Community transmission
- The number of COVID-19 patients within critical care units and hospitals
- Availability of rapid testing
- Estates ability to provide COVID-19 negative areas

Aerosol generating procedures (AGP)

These are defined by PHE https://www.gov.uk/government/publications/wuhan-novel-coronavirus-infection-prevention-and-control/covid-19-personal-protective-equipment-ppe.

Continued review of the evidence base for Aerosol Generating Procedures by NERVTAG is imperative, in a practical sense there is a difference between close proximity, time limited AGPs (intubation, tracheostomy insertion, open suctioning of tracheostomies) and continued low level, low droplet / aerosol dispersal procedures such as Nasal High Flow Oxygen and CPAP use. This impacts heavily on the practicalities of PPE use.

The non-COVID ICU

General Principles

It is recognised that it is neither practicable nor necessary to wear Airborne PPE in the lower risk area of the non-COVID ICU. Not only is this clinical practice potentially wasteful of a precious resource but the infection prevention and control implications of wearing this style of PPE whilst caring for a heterogenous critically ill population may be considerable and could give rise to an increased risk in healthcare associated infection.

The organisational control measures will serve to reduce the risk of COVID-19 infection arising in staff or patients working in the non-COVID ICU.

The universal wearing of FRSMs in the clinical environment combined with good respiratory hygiene and frequent hand washing is designed to reduce the risk of inadvertent transmission of coronavirus infection from asymptomatic individuals.

Infection control principles & PPE

Currently all staff entering the clinical environment of the non-COVID ICU should wear a FRSM in keeping with national guidelines.

The principles of social distancing should be adhered to wherever practicable.

Standard infection-control procedures should be adhered to by all staff in the ICU

Elective

Patients in the Green Elective patient group are neither suspected or confirmed COVID-19, and could therefore be considered to be low risk (dependent upon local risk assessment), the following minimal PPE is appropriate

Non AGP	AGPs
Standard infection control precautions	Standard infection control precautions
Fluid Resistant Surgical Facemask	Fluid Resistant Surgical Facemask
Single use gloves and apron, for direct contact with blood and body fluids only Eye protection if risk of splashing of body fluid	Single use gloves and apron, for direct contact with blood and body fluids only Eye protection if risk of splashing of body fluid
	No need to use Side rooms

Emergency

Patients in the non-COVID-19 Emergency patient group (i.e. low clinical index of suspicion, ix naso pharyngeal swab) are neither suspected or confirmed COVID-19 but with sustained community transmission continue to present a slightly increased risk above those in the Elective group. A negative lower respiratory tract sample for SARS-CoV-2 PCR has improved negative predictive value and provides increased confidence for decision making.

In areas of low community prevalence, the risk probably approaches that of the elective group, local policy should inform local PPE guidance based upon risk assessment.

Non AGP	AGPs
Standard infection control precautions	
Fluid Resistant Surgical Facemask	
Eye protection if risk of splashing of body fluid	
Single use gloves and apron, for direct contact with blood and body fluids only	Single use gloves and apron, within 2m of patient
	*Use of Side rooms for AGPs
Enhanced environmental cleaning	

*Local decisions around placement in non COVID-19 areas will have been made by senior medical staff in conjunction with local guidance, and take into account the risk/benefit balance based on clinical presentation, COVID-19 contact history, imaging results, COVID-19 prevalence and the nature and number of negative PCR samples. Routine use of side rooms for AGP in patients considered low risk is likely to be impractical in most units due to low numbers of side rooms.

The COVID-ICU / COVID-19 suspected or positive patients

General Principles

A clinical area should be designated as the COVID-ICU. This area should be large enough to meet the anticipated clinical demand.

Side-rooms (negative pressure if available) should be utilised for the admission of suspected cases of COVID-19 infection in whom test results are awaited.

Confirmed cases may be cohorted together.

Cohorting of suspected and confirmed cases of COVID-19 infection should be avoided where possible.

In patients with high clinical index of suspicion of COVID-19 who have a negative nasopharyngeal swab PCR on admission, re-testing in the following 12-24 hours is appropriate, obtaining a deep respiratory sample whenever possible. These patients should ideally, be cared for in side rooms, until their COVID-19 status is determined
As numbers of COVID-19 positive patients fall significantly within critical care units, it may me more practicable, where possible to care for them on a “normal” ICU, isolating these patients in side rooms, with appropriate areas for “donning and doffing” PPE. The doffing process (with the exception of the mask) should happen either prior to exiting the side room itself, or in the anteroom if present. The mask should then be removed having exited the room. Healthcare Workers should not be exiting the room wearing PPE.

When undertaking sterile procedures, existing gowns and gloves should be doffed, hands washed in the normal manner prior to a sterile procedure and a new set of sterile gloves and gown utilised.

Nursing staff should be dedicated to the care of a suspected COVID-19 patient and should not be assisting in the care of confirmed COVID-19 patients during the same clinical session.

Medical staff should prioritise the clinical review of COVID-19 suspected patients on a ward-round before seeing those with confirmed infection.

Infection control principles & PPE

Appropriate infection-control procedures must be adhered to by all staff in the ICU, including standard infection control principles.

Healthcare workers should wear appropriate PPE commensurate with the risk of transmission of COVID-19 infection

The risk of transmission of the SARS-CoV-2 virus in this clinical area is related to contact with respiratory droplets and aerosols generated by the patient during clinical care and by fomite contamination of the clinical environment with persistence of viable virus.

Suspected or proven COVID -19	Single Patient – no AGP	Single patient - AGP	Patients with AGPs in cohorted areas
Sessional use	FRSM mask	FFP3 mask	FFP3 mask
	Eye protection if risk of splashing of body fluid	Eye Protection Gown*	Eye protection
Change between patients and tasks	Gloves	Gloves	Gloves gown* See below for IPC options for co horting patients.
Patient location	Side Room (if possible but prioritse for COVID patients undergoing AGP)	Use Side room	Designated areas in ICU with physical barrier
	Enhanced environmental cleaning		

*Gowns should be water repellent or protected with a plastic apron if there is a risk of splashing of body fluid. Short sleeved gowns enable hands and arms to be to be washed and therefore minimise the risk of cross transmission.

Note: it is essential to apply standard infection control precautions in the care of all patients

Ensuring infection prevention and control when cohorting COVID-19 patients

Whilst delivering clinical care within the COVID-ICU, there is a significant risk of cross-infection. This is an inherent problem with the nature of the Airborne PPE, which is required to be worn in order to prevent transmission of COVID-19 infection to the health care worker. The risk of cross infection requires specific mitigation by staff providing care to multiple patients in a single clinical session.

Gloves are only required for direct contact with the patient or their immediate environment and must be changed between tasks on the same patient and between patients. They must not be worn to touch shared equipment such as computers, phones or desk surfaces.

COVID-19 is transmitted via the mucus membranes (eyes, nose and mouth), there is no reason for continual glove use and hand hygiene is best practice.

Whilst providing personal care or examining a patient, staff should wear a disposable plastic apron over the sessional use gown and change this between patients.

The apron can be donned by breaking the neck loop with a buddy re-tying the torn ends around the neck of their colleague. Following the clinical interaction, the plastic apron should be removed and discarded along with the gloves and hand hygiene performed.

If sessional use gowns are long sleeved, then there is still a risk that pathogens will be transferred between patients on the sleeves.

The maintenance of adequate hand / forearm hygiene, whilst delivering clinical care to multiple patients with COVID-19 infection in a cohorted clinical area, is a significant challenge. Failure to undertake adequate hand hygiene between patients within the cohorted intensive care area may give rise to outbreaks of nosocomial infection with bacterial pathogens. A number of possible solutions have been adopted including:

1. **The healthcare worker wears a single pair of gloves** which must be removed following delivery of each episode of clinical care and between different tasks on the same patient within the cohorted ICU area. The gloves should be discarded following removal. Hands must be washed with soap and water or alcohol hand gel/rub as per standard clinical practice. Once hand hygiene has been performed and the hands dried, a fresh pair of gloves could be donned.

   Although this requires the healthcare worker to remove their protective gloves and decontaminate their hands in the clinical area, removing gloves in the clinical area does not present a risk to the healthcare worker because the virus does not cause infection via the skin. If wearing a long sleeved gown it may be difficult to avoid wetting the arms if washing hands with soap and water. This can be avoided by using alcohol hand gel to decontaminate hands (this is perfectly acceptable given that hands have been protected with gloves and will therefore not be soiled.). Additionally, the cuffs can be pulled up the arms away from the hands to perform hand hygiene.

2. **The healthcare worker wears a single pair of gloves in combination with a disposable waterproof arm sleeve cover with elasticated cuffs**. Following delivery of each episode of clinical care within the cohorted ICU area both the gloves and the disposable arm sleeve covers must be removed and discarded. Gloves must also be removed between tasks on the same patient (as pathogens may be introduced to susceptible sites and cause infection). The hands must be washed with soap and water or decontaminate with alcohol gel. Once hand hygiene has been performed a pair of fresh gloves in combination with disposable arm sleeve covers could be donned.

   The use of a fresh pair of disposable arm sleeves in combination with fresh gloves would provide an enhanced level of hygiene thus potentially reducing the risk of cross infection.

3. **The healthcare worker wears two pairs of gloves whilst working within the cohorted ICU area**. **The base layer of gloves worn should be of a gauntlet style** and worn over the sleeves of the fluid resistant surgical gown. The second pair of gloves should be a standard pair of short-cuffed gloves.

   The second pair of gloves (with standard short cuffs) should be removed following the delivery of each episode of clinical care within the cohort in ICU area. The gloved hands, wrists and forearms of the healthcare worker wearing the gauntlet style glove should then be washed with soap & water and dried. A fresh pair of standard short-cuffed gloves should then be donned.

   The wearing of two pairs of gloves is not recommended in PHE guidance. However, some units have used this approach effectively during the recent surge.

4. **The Healthcare worker wears a specifically designed short sleeved gown** to cover their surgical scrubs. During patient care episodes (within 2m) they wear a disposable apron (which could be long sleeved) and gloves.

   This process allows the normal levels of hand hygiene, washing forearms and hands between patient contact episodes. Remaining sessional PPE protects the Healthcare worker against COIVD-19 in the general cohort areas, including self-contamination. Using a standard apron does not provide sufficient cover to the biceps area, a long-sleeved disposable apron should therefore be used.

Using a long-sleeved apron in combination with a short sleeved sessional gown appears to provide the best solution to this problem.

Infection Prevention and Control measures for COVID-19 do not recommend:

Double gloving, there is no evidence that decontaminating gloves in clinical settings is effective at providing an adequate level of hand hygiene.
https://www.who.int/gpsc/5may/Glove_Use_Information_Leaflet.pdf

The clinical practice of "double gloving" is not required in order to provide the healthcare worker with enhanced protection from the SARS-2 coronavirus.

Alcohol gelling gloves (rather than hand washing), there is no evidence that gelling gloves between patients is effective in clinical areas.

Hair coverings are not required, although we recognise that individuals may prefer to wear them, there is no evidence that hair acts as a route of transmission or that hair covering makes any contribution to preventing transmission.

Fluid repellent coveralls are not essential to protect Healthcare Workers from COVID-19 which is transmitted by respiratory droplets. Guidelines allow for their use however, whilst providing a good level of protection they are challenging to wear for long periods of clinical duty. In addition, the doffing of fluid repellant coveralls is a more complex process which requires practice by healthcare workers before attempting to use in the clinical environment.

References

https://icmanaesthesiacovid-19.org/managing-theatre-processes-for-planned-surgery-between-covid-19-surges -

https://icmanaesthesiacovid-19.org/clarification-of-ppe-guidance-during-planned-surgery-restarts

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https://www.who.int/gpsc/5may/Glove_Use_Information_Leaflet.pdf

https://www.cdc.gov/niosh/topics/hierarchy/

Appendix 1

Underpinning Guidance

Public Health England inpatient step-down of infection prevention and control (IPC) in hospitalised patients with COVID-19.

(Guidance on step-down 23rd April 2020)

Continue IPC measures until 14 days have elapsed since their first positive SARS-CoV-2 test.

IPC measures for hospitalised COVID-19 patients can be stopped if there is:

- clinical improvement with at least some respiratory recovery
- absence of fever (> 37.8˚C) for 48 hours
- no underlying severe immunosuppression

Consider testing at day 14 since first positive SARS-CoV-2 test (lower respiratory tract sample if the patient is producing sputum or is intubated). One negative test is acceptable for step-down

https://www.gov.uk/government/publications/covid-19-guidance-for-stepdown-of-infection-control-precautions-within-hospitals-and-discharging-covid-19-patients-from-hospital-to-home-settings/guidance-for-stepdown-of-infection-control-precautions-and-discharging-covid-19-patients