

Requirements and technical specifications of personal protective equipment (PPE) for the novel coronavirus (2019-nCoV) in healthcare settings

(interim recommendations, 2/6/2020)

Key considerations

- In December 2019 a novel coronavirus (2019-nCoV) was identified as the causative agent of a severe acute respiratory illness among people exposed in a seafood market in Wuhan, China*;
- Human-to-human transmission has been documented, including in healthcare workers, and **aerosol-generating procedures (AGP)**[†] may play a role in the spread of the disease (1, 2);
- There are uncertainties in the natural history of the 2019-nCoV, including source(s), transmissibility mechanisms, viral shedding, and persistence of the virus in the environment and on fomites;
- As of 6 February 2020, the following precautions are recommended for the care of patients with suspected or confirmed cases of 2019-nCoV[‡]:
 - For any suspected or confirmed cases of 2019-nCoV: **standard + contact + droplet precautions**
 - For any suspected or confirmed cases of 2019-nCoV and AGP: **standard + contact + airborne precautions**
- The use of personal protective equipment (PPE) by healthcare workers requires an evaluation of the risk related to healthcare-related activities;
- These recommendations are preliminary and subject to review as new evidence becomes available.

Estimates of personal protective equipment (PPE)

The figures presented in this technical recommendation are rough estimates and based upon simulation exercises on the use of PPE during previous outbreaks with similar transmission modes, such as Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS).

- The number of PPE units should vary according to disease severity and the number of aerosol-generating procedures per patient.
- Suspected and confirmed cases of 2019-nCoV should be isolated in adequately ventilated **single rooms**. When single rooms are not available, patients suspected of being infected with 2019-nCoV should be grouped together (**cohort**).
- For each patient/day it is recommended[§]:
 - Gown – 25 units
 - Medical mask – 25 units

* Updated information on the 2019-nCoV can be obtained at: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019>.

[†] Aerosol-generating procedures (AGP): it includes the following procedures: positive pressure ventilation (BiPAP and CPAP), endotracheal intubation, airway suction, high frequency oscillatory ventilation, tracheostomy, chest physiotherapy, nebulizer treatment, sputum induction, and bronchoscopy.

[‡] For the most update information available for infection prevention and control for the 2019-nCoV, please refer to <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance>.

[§] Phin, N.F. et al. Personal protective equipment in an influenza pandemic: a UK simulation exercise. Journal of Hospital Infection, Volume 71, Issue 1, 15 – 21.

- Particulate respirator (N95, FFP2 or equivalent) – 1 unit
- Gloves, non-sterile – 50 units
- Goggles OR face shield – 1 unit

Use of personal protective equipment (PPE) according to level of care

Table 1 presents the use of personal protective equipment (PPE) according to the level of care. These recommendations are based on the current evidence for transmission mechanisms of the 2019-nCoV. The following levels of care should be considered:

- Triage;
- Collection of specimens for laboratory diagnosis;
- Suspected or confirmed case of 2019-nCoV requiring healthcare facility admission and NO AGP;
- Suspected or confirmed case of 2019-nCoV requiring healthcare facility admission and AGP;

Table 1 – Use of personal protective equipment (PPE) according to level of care

Level of care	Hand hygiene	Gown	Medical mask	Respirator (N95 or FFP2)	Goggle (eye protection) OR Face shield (facial protection)	Gloves
Triage	X		X			
Collection of specimens for laboratory diagnosis	X	X		X	X	X
Suspected or confirmed case of 2019-nCoV requiring healthcare facility admission and NO aerosol-generating procedure	X	X	X		X	X
Suspected or confirmed case of 2019-nCoV requiring healthcare facility admission and WITH aerosol-generating procedure	X	X		X	X	X

References

1. Phan LT, Nguyen TV, Luong QC, Nguyen TV, Nguyen HT, Le HQ, et al. Importation and Human-to-Human Transmission of a Novel Coronavirus in Vietnam. *New England Journal of Medicine*. 2020.
2. Chan JF, Yuan S, Kok KH, To KK, Chu H, Yang J, et al. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. *Lancet*. 2020.

Technical description and specifications of personal protective equipment (PPE)

Table 2 presents the technical description and specifications of personal protective equipment (PPE) in the context of the 2019-nCoV. **

Table 2 – Technical description and specifications of personal protective equipment (PPE)

Item	Technical description and specifications
Alcohol-based hand rub solution	Bottle of 100ml & 500ml Hand rub formulations containing 75% isopropanol or 80% ethanol.
Apron	Polyester with PVC coating or 100% PVC or 100% rubber. Waterproof. Minimum basis weight: 250g/m ² . Adjustable neck strap (reusable). Covering size: 70-90 cm (width) X 120-150cm (height), or standard adult size.
Bags for medical waste	Disposal bag for bio-hazardous waste, 30x50cm, with "Biohazard" print, autoclavable polypropylene. 50 or 70 micra thickness
Body bag	Made of linear enforced, U-shape zipper and 2 zipper pulls with tie ribs. Adult size 250x120cm Protector Body Bag specifications: 6 handles Impermeable, linear reinforced LLDPE, LDPE, EVA, PEVA, (avoid PVC), minimum thickness 400 microns; Should be able to hold 100-125 kilos (200-250 lbs), Should contain no chlorides: burning of chlorides pollute the environment and can cause damage to retort chambers. Body bags should be non-carcinogenic to health of funeral workers when used for cremations. At least 6 handles included in the body bag to allow burial team to hand carry it safely Heat-sealed: insure superior strength and safety, Provide full containment of blood borne pathogens Cracking point of 25 - 32 degrees below zero Shelf life: minimum 10 years Bag and hands should be of white color
Disinfectant for surfaces – hypochlorite solution 0.05% (regular cleaning) or 0.5% (disinfection of spill)	NaDCC, granules, 1kg, 65 to 70% + dosage spoon
Disposable towel for hand drying (paper or tissue)	50 to 100m roll
Face shields	Made of clear plastic and provides good visibility to both the wearer and the patient, Adjustable band to attach firmly around the head and fit snugly against the forehead, Fog resistant (preferable), Completely cover the sides and length of the face, May be re-usable (made of robust material which can be

** This list is based upon the "Disease commodity package - Novel Coronavirus (nCoV)", WHO. Available at [https://www.who.int/publications-detail/disease-commodity-package---novel-coronavirus-\(ncov\)](https://www.who.int/publications-detail/disease-commodity-package---novel-coronavirus-(ncov)), access date Jan 31, 2020.

Item	Technical description and specifications
	cleaned and disinfected) or disposable. EU standard directive 86/686/EEC, EN 166/2002, ANSI/ISEA Z87.1-2010, or equivalent
Gloves, non-sterile	Gloves, examination, nitrile, powder-free, non-sterile. Cuff length preferably reach mid-forearm (eg. minimum 280mm total length. Different sizes EU standard directive 93/42/EEC Class I, EN 455, EU standard directive 89/686/EEC Category III, EN 374 ANSI/ISEA 105-2011, ASTM D6319-10 or equivalent
Gloves, sterile	Gloves, surgical, nitrile, powder-free, single use. Gloves should have long cuffs, reaching well above the wrist, ideally to mid-forearm. EU standard directive 93/42/EEC Class I, EN 455, ANSI/ISEA 105-2011, ASTM 6319-10 or equivalent
Goggles	Good seal with the skin of the face, Flexible PVC frame to easily fit with all face contours with even pressure, Enclose eyes and the surrounding areas, Accommodate wearers with prescription glasses, Clear plastic lens with fog and scratch resistant treatments, Adjustable band to secure firmly so as not to become loose during clinical activity, Indirect venting to avoid fogging, May be re-usable (provided appropriate arrangements for decontamination are in place) or disposable. EU standard directive 86/686/EEC, EN 166/2002, ANSI/ISEA Z87.1-2010, or equivalent
Gown	Single use, fluid resistant, disposable, length mid-calf to cover the top of the boots, light colors preferable to better detect possible contamination, thumb/finger loops or elastic cuff to anchor sleeves in place. Option 1: fluid penetration resistant: EN 13795 high performance, or AAMI PB70 level 3 performance or above, or equivalent Option 2: blood borne pathogens penetration resistant: AAMI PB70 level 4 performance, or (EN 14126-B) and partial body protection (EN 13034 or EN 14605), or equivalent
Liquid plain soap for hand hygiene	Liquid soap
Medical mask	Medical/surgical mask, high fluid resistance, good breathability, internal and external faces should be clearly identified, structured design that does not collapse against the mouth (e.g. duckbill, cup shaped) EN 14683 Type IIR performance ASTM F2100 level 2 or level 3 or equivalent; Fluid resistance at minimum 120 mmHg pressure based on ASTM F1862-07, ISO 22609, or equivalent Breathability: MIL-M-36945C, EN 14683 annex C, or equivalent Filtration efficiency: ASTM F2101, EN14683 annex B, or equivalent
Respirator (N95 / PPF2)	"N95" respirator according to US NIOSH, or "FFP2" according to EN 149N95 Good breathability with design that does not collapse against the mouth (e.g. duckbill, cup shaped)
Sharp container boxes	Puncture resistant container for collection and disposing of used, disposable and auto-disable syringes, needles. 5 L capacity accommodating approximately 100 syringes. Boxes prominently marked. WHO performance specification E10/IC.1 WHO/UNICEF standard E10/IC.2 or equivalent

Acronyms:

EVA – ethylene-vinyl acetate; LDPE – Low-density polyethylene; LLDPE – Linear Low-Density Polyethylene; NaDCC – Sodium Dichloroisocyanurate; PEVA - polyethylene vinyl acetate); PVC – polyvinyl chloride