Surface sampling of coronavirus disease (COVID-19): A practical “how to” protocol for health care and public health professionals

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Protocol summary

Surface sampling of COVID-19: A practical "how to" protocol for health care and public health professionals	
Objectives	To assess the extent and persistence of surface contamination with COVID-19 To identify environmental surfaces which may play a role in onwards transmission of COVID-19
Minimum information and specimens to be obtained from participants	Daily environmental samples of high-touch surfaces linked to where COVID-19 infected patient is receiving care in a health care setting or is in isolation in a closed setting (household, hotel room etc.)
Study duration	Up to 7 days after patient has left sampling location
Potential output and analysis	Identification of COVID-19 contaminated surfaces and possible routes of transmission

1 Background

The detection and spread of an emerging respiratory pathogen are accompanied by uncertainty over, among other factors, key virological characteristics of the novel pathogen and particularly its persistence in certain environments. This is the case for the coronavirus disease (COVID-19), for which the virus was first detected in Wuhan city, China in December 2019 (1).

During past coronavirus outbreaks, a number of studies evaluating virus persistence and stability have been carried out. For example, the role of environmental contamination has been evaluated in a number of hospitals following the 2015 MERS-CoV outbreak in the Republic of Korea, as well as experimental studies on viability and persistence of MERS-CoV on surfaces and in the air (2-4). In these settings, MERS-CoV environmental contamination has been identified, but the extent of environmental contamination, the amount of viable virus that can be isolated and therefore the role of environmental contamination in transmission are not clear. These virological characteristics also need to be determined for COVID-19. This information will then be able to inform risk assessments and infection prevention and control measures, with an aim of limiting onwards transmission.

This protocol has been designed to determine (viable) virus presence and persistence on fomites in various locations where a patient infected with COVID-19 is currently receiving care or being isolated, and to understand how this may relate to COVID-19 transmission events in these settings. It is therefore important that it is done as part of a comprehensive outbreak investigation and that information obtained by environmental studies is combined with the results of epidemiological, laboratory and sequence data from COVID-19 patient investigations. COVID-19 investigation protocols currently under development include:

- Household transmission investigation protocol for COVID-19
- Assessment of potential risk factors for COVID-19 infection among health care workers in a health care setting.
- First Few X (FFX): Cases and contact investigation protocol for COVID-19 infection.

These protocols are available on the WHO website.

With any novel pathogen, it is particularly important that such information can be gathered quickly and in a way that enables the results to be easily aggregated, tabulated and analyzed across many different settings globally to inform public health responses and policy decisions. For this reason, the following protocol has been designed to conduct surface sampling for COVID-19. Each country may need to tailor some aspects of this protocol to align with public health, laboratory and clinical systems, according to capacity, availability of resources and cultural appropriateness.

Comments for the user's consideration are provided in purple text throughout the document as the user may need to modify methods slightly because of the local context in which this study will be carried out.

1.1 Objectives

The specific objectives of this protocol are to:

- Assess the extent and persistence of surface contamination of COVID-19
- Identify environmental surfaces and fomites which may play a role in onwards transmission of COVID-19.

This investigation can permit evaluation of secondary objectives such as, but not limited to:

- Characterize the sequence diversity of COVID-19 in environmental samples, as capacity and resources permit.

2 Study procedures

2.1 Study setting

Once a case of COVID-19 has been identified, the patient should be isolated. This investigation should be conducted in any setting in which the patient is receiving care, such as a health care facility, or is isolated in a closed setting, such as a household, hotel room, cruise ship etc.

In order to link data from environmental sampling to outbreak investigations, and to identify risk factors for environmental contamination and for onwards transmission to other individuals, it is important to collect background information, including:

1. Link with COVID-19 outbreak investigation: environmental sampling data provide supplementary information, which need to be interpreted in the context of the outbreak dynamics and characteristics, patient sampling and sequencing, and testing of contacts.
2. A detailed plan of the location layout, including ventilation inlets, doors, placement of major furniture and beds, etc. For health care settings this includes: area function (Emergency Department, Intensive Care Unit, ward, primary health clinic etc.), hospital equipment and the location of other COVID-19 patient(s). The layout should be detailed as a map and the exact sampling locations can be determined using the information on the maps.
3. The movements of the COVID-19 patient and/or the locations that the patient visited prior to being isolated. Each room or location where the patient stayed should be noted, with a list of activities done there, and an estimate of the amount of time spent. This information should be known when developing the sampling plan.
4. In health care settings: information on the routes, patients and treatment procedures that healthcare workers in the affected hospital were involved in. For each health care worker, the rooms and patients that were visited and treatments that were given, including dates and time, should be recorded.

COMMENT: Patients in an Intensive Care Unit may remain hospitalized for extended periods of time and, as such daily sampling may not be possible, particularly if there are multiple COVID-19 cases within the same health care facility. Feasibility and the outbreak context will determine the frequency and duration of repeated sampling.

2.2 COVID-19 case data collection

As previously mentioned, environmental sampling should be done as part of a comprehensive outbreak investigation and combined with the results of from COVID-19 patient investigations. For reference, a questionnaire covering patient and clinical information from the COVID-19 infected patient can be found in the Appendix.

2.3 Environmental sampling collection sites

The following sampling sites have been recommended based on 1) possible disease transmission routes and 2) current literature of high-touch surfaces (5-8). Moreover, standardizing the sampling sites across COVID-19 surface sampling studies will improve the comparability of results of multiple studies.

Recommended sampling sites based on location in a health care setting (9-12)

Possible route of COVID-19 hospital transmission	**Essential sampling sites**		**Other sampling sites**	
1. Patient (entry) routing	Ambulance	Medic bag handle, inside of blood pressure cuff, wall next to the patient stretcher	Ambulance	Front of defibrillator, handlebar ambulance ceiling,
	Entrance	Ventilation exits or air purifier filters, guardrails	Entrance, corridor, waiting room	Doorknob, light switch, sink, faucet handles
	Corridor	Ventilation exits or air purifier filters, guardrails	Elevator	Buttons, Ventilation exits or air purifier filters, guardrails
	Waiting room	Ventilation exits or air purifier filters, guardrails	X-ray room	Ventilation exits or air purifier filters, doorknob, light switch, X-ray table, sink, faucet handles
2. Hospital staff	Staff room	Doorknob, key board, clothes, ventilation exits or air purifier filters	Staff room, anteroom	Sink, faucet handles, desk/table, light switch, chairs
	Ante room	Doorknob, light switch, ventilation exits or air purifier filters	Patient room	Monitor controls, monitor touch screen, charts
3. Patient handling and care/patient virus excretion and risk procedures	Patient room	Doorknob, bed rails, bedside table, bed controller, call button, floor (<1meter from the patient, 2m, 3m, etc.), tubing, masks and filters of aerosol generating procedures, control panels	Patient room	Bedding, IV pole, telephone, chair, curtain, clothes , light switch, stethoscope, thermometer, hand soap dispenser, garbage bin, cup, curtains, oxygen flow meter
	Patient bathroom	Doorknob, faucet handles, sink, toilet/bed pan	Patient bathroom	Light switch, bed pan cleaner, guard rails
4. Air flow*	Patient room	Ventilation exits or air purifier filters	Patient room	Wall (<1meter from the patient, 2m, 3m, etc. if possible)
	Patient bathroom	Ventilation exits or air purifier filters	Patient bathroom	Wall (<1meter from the patient, 2m, 3m, etc. if possible)

Recommended sampling sites in a closed setting outside health care settings (household, hotel room, cruise ship etc.)

Possible route of COVID-19 transmission	**Essential sampling sites**		**Other sampling sites**	
1. Patient virus excretion	Patient room	Doorknob, bed rails, bedside table, floor (<1meter from the patient, 2m, 3m, etc.).	Patient room	Bedding, telephone, chair, curtain, clothes, light switch, hand soap dispenser, garbage bin, cup, curtains, oxygen flow meter (if applicable).
	Patient bathroom	Doorknob, faucet handles, sink, toilet/bed pan	Patient bathroom	Light switch, bed pan cleaner, guard rails
2. Air flow*	Patient room	Ventilation exits or air purifier filters	Patient room	Wall (<1meter from the patient, 2m, 3m, etc. if possible)
	Patient bathroom	Ventilation exits or air purifier filters	Patient bathroom	Wall (<1meter from the patient, 2m, 3m, etc. if possible)

Information on the timing and details of factors that can influence the outcomes of environmental sampling need to be systematically collected alongside the environmental samples:

- The time, frequency and details (e.g. disinfectant) of the cleaning and disinfection activities should be collected for all sampling locations.
- In health care settings, the place, time and duration of aerosol generating procedures, if any, should be indicated, including: positive pressure ventilation (bi-level positive airway pressure [BiPAP] and continuous positive airway pressure [CPAP]), endotracheal intubation, high flow nasal cannula, open airway suction, high frequency oscillatory ventilation, tracheostomy, chest physiotherapy, nebulizer treatment, sputum suction and bronchoscopy.

2.3 Timing of environmental sampling collection

Ideally, sampling should take place in patient rooms each day, from the day COVID-19 was suspected and/or diagnosed in a patient until at least 7 days after the discharge or passing of the patient. In case of aerosol generating procedures (listed above) in health care facilities, the environment should be sampled before and after (within 1 hour and 24h later) each procedure. Ideally, the temperature and humidity of the sampled rooms should be measured and noted daily, as well as the time the bed of the patient was made.

In the case of an extensive outbreak, the number of samples and the work that is associated with sampling may be too extensive. In this case, the sampling interval may be increased from 1 day to sampling every 2-3 days starting on day 1. Moreover, high quality sampling of sufficiently high frequency of one or two patients would have priority over sampling all patients involved in the outbreak.

2.4 Environmental sampling methods and procedures

Environmental samples need to be taken using a swab with a synthetic tip and a plastic shaft (2,3,9-12). The swab specimen collection vials should contain 1-3ml of viral transport medium (e.g. protein stabilizer, antibiotics and buffer solution) including neutralizing buffer to counteract the effects of any residual disinfectant (e.g. Tween 80). Viral transport medium is required for virus

isolation. However, viral transport medium is not always efficient in case of long shipping times, uncontrolled storage temperature and minute virus concentrations. The use of chaotropic lysis buffers will stabilize viral genomes which is recommended in situations in which storage and transport conditions are not optimal and concentrations of viable virus are expected to be low.

The first step of the sampling procedure is to put sterile, non-powdered nitrile or vinyl examination gloves over the gloves that are part of standard PPE and clothing (see 2.6.4 Prevention of COVID-19 infection in investigation personnel). Then, remove the swab from the package. Wet the swab with viral transport medium. When applying pressure with the wet swab onto the surface, move in at least two different directions while rotating the swab stick. Avoid letting the swab dry completely. The recommended swab surface area is 25cm^2. To increase the positive predictive value of the environmental sampling process, each sampling area may require multiple swabs.

After labelling the vial, place in a self-sealing bag and clean the outside of the sealed bag with a 60-80% ethanol, 80% isopropyl alcohol or 5% hypochlorite solution just prior to leaving the contaminated area. Then, place the cleaned sealed bag in another unused similar self-sealing bag.

In each sampling round, a set of control samples also need to be collected. The first set of control samples are handled in the same way as the environmental samples from the potentially contaminated area, including opening the package and removing the swab from the tube, but without sampling any surfaces. The second set of control samples remain sealed, but will be shipped, stored and tested with the surface samples, to exclude contamination later on.

COMMENT: If only a single patient is involved, it would be ideal to include an additional control sample from the room of patient within the same health care facility without COVID-19 infection. This would strengthen evidence that any positive specimens from the COVID-19 patient's room are true positives, and not laboratory or other contamination. However, inclusion of this additional control will need to be determined by feasibility and the outbreak context.

COMMENT: Wipes can also be used for larger surfaces.

2.5 Labeling, shipment and storage of samples

All those involved in collection and transporting specimens should be trained in safe handling practices and spill decontamination procedures. For details regarding the transport of samples collected and infection control advice, please refer to case management algorithm and laboratory guidance in the country or WHO laboratory guidance, available on the WHO website.

For each sample, the date and time of sampling and the exact location should be noted, as well as the conditions for transportation and the time of arrival at the laboratory. At least two aliquots of viral transport medium (VTM) should be made before the specimens are stored or shipped. One of two aliquots should be stored at -70°C or -80°C as soon as possible. Specimens should reach the laboratory as soon as possible after collection. If the specimen is not likely to reach the laboratory within 72 hours, specimens should be frozen, preferably at -80°C, and shipped on dry ice. It is, however, important to avoid repeated freezing and thawing of specimens. The storage of respiratory and serum specimens in domestic frost-free freezers should be avoided, owing to their wide temperature fluctuations. Serum should be separated from whole blood and can be stored and shipped at 4°C or frozen to -20°C or lower and shipped on dry ice.

Transport of specimens within national borders should comply with applicable national regulations. International transport of specimens should follow applicable international regulations as described in the WHO Guidance on regulations for the transport of infectious substances 2019–2020.

2.6 Ethical considerations

Ethical requirements will vary by country. In some countries, this investigation may fall under public health surveillance (emergency response) acts and may not require ethical approval from an Institutional Review Board.

2.6.1 Informed consent

The purpose of the investigation will be explained to the confirmed COVID-19 infected patient and informed consent will be obtained if the patient is willing to participate in the investigation before any procedure is performed as part of the investigation by a trained member of the investigation team. Each participant must be informed that participation in the investigation is voluntary and that s/he is free to withdraw, without justification, from the investigation at any time without consequences and without affecting professional responsibilities.

COMMENT: The age of consent may vary by country. Check the requirements of local, regional or national authorities.

Informed consent will seek approval to collect epidemiological data and clinical information for the intended purpose of this investigation.

2.6.2 Risks and benefits for subjects

This investigation poses no risk to participants, as no collection of biological specimens is involved. The primary benefit of the study is indirect in that data collected will help improve and guide efforts to understand the role of environmental contamination in the transmission of COVID-19 and prevent further spread of COVID-19.

2.6.3 Confidentiality

Participant confidentiality will be maintained throughout the investigation. All subjects who participate in the investigation will be assigned a study identification number by the investigation team for the labelling of questionnaires. The link of this identification number to individuals will be maintained by the investigation team and the Ministry of Health (or equivalent) and will not be disclosed elsewhere.
If the data is shared by the implementing organization to WHO or any agency or institution providing support for data analysis, data shared will include only the study identification number and not any personably identifiable information.

Article 45 of the IHR (2005) describes the "treatment of personal data".[1] Person identifiable data collected under the IHR should be kept confidential and processed anonymously, as required by national law. However, such data may be disclosed for assessments and management of public health risks, provided the data are processed fairly and lawfully.

2.6.4 Prevention of COVID-19 infection in investigation personnel

All personnel involved in the investigation need to be trained in infection prevention and control procedures (standard contact, droplet or airborne precautions, as determined by national or local guidelines). These procedures should include proper hand hygiene and the correct use of surgical or respiratory face masks, if necessary, to minimize their own risk of infection when in close contact with COVID-19 infected patients. All personnel involved in the environmental sampling should use personal protective equipment (PPE).

[1] https://www.who.int/ihr/publications/9789241580496/en/

WHO technical guidance on infection prevention and control specific to COVID-19 can be found on the WHO website.

3 Laboratory evaluations

Any testing for the presence of COVID-19 should be performed in appropriately equipped laboratories by staff trained in the relevant technical and safety procedures. Laboratory guidance for COVID-19 can be found on the WHO website.

Several assays that detect COVID-19 have been recently developed and the protocols or SOPs can also be found on the WHO website.

COMMENT: It is important to note that negative environmental testing results cannot exclude the presence of virus within the setting where the investigation has been conducted.

COMMENT: Genome sequencing of COVID-19 isolates may provide further details on transmission. Full genomes obtained by NGS using sets of specific primers to amplify the full genome for instance delivers a detailed picture of genetic differences between viruses but sequencing of environmental samples may be challenging and may need to be discussed with laboratories with coronavirus sequencing expertise.

COMMENT: Genetic information acquired from viral sequencing should be shared and reported via publicly available databases such as GenBank/GISAID.

4 Reporting of findings

4.1 Reporting

Any investigation of this nature should include reporting on the following information:

(1) the number of COVID-19 patients included

(2) the number of sampling sites included, location and description of the sites in relation to each patient;

(3) the number of samples collected, the number of samples with detectable RNA and the number of samples with viable virus identified.

It is also important to fully document the study design, including the definition of the sampling sites, the frequency and timing of sampling, storage and shipping conditions, and the laboratory methods used to ensure that data can be pooled.

Ideally, information would be collected in a standardized format according to the questionnaires and tools in this generic protocol to assist with data harmonization and comparison of results (see forms in the Appendix).

If the data is shared by the implementing organization to WHO or any agency or institution providing support for data analysis, data shared will include only the study identification number and not any personably identifiable information.

5 References

5.1 References

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5.2 Further references for COVID-19

WHO Disease Outbreak News
https://www.who.int/csr/don/en/

Surveillance and case definitions
https://www.who.int/publications-detail/global-surveillance-for-human-infection-with-novel-coronavirus-(2019-ncov)

Laboratory guidance
https://www.who.int/publications-detail/laboratory-testing-for-2019-novel-coronavirus-in-suspected-human-cases-20200117

Clinical management
https://www.who.int/publications-detail/clinical-management-of-severe-acute-respiratory-infection-when-novel-coronavirus-(ncov)-infection-is-suspected

Infection prevention and control
https://www.who.int/publications-detail/infection-prevention-and-control-during-health-care-when-novel-coronavirus-(ncov)-infection-is-suspected

Risk communication
https://www.who.int/publications-detail/risk-communication-and-community-engagement-readiness-and-initial-response-for-novel-coronaviruses-(-ncov)

6 Acknowledgements

This protocol has been adapted from the previously published WHO protocol for Middle East respiratory syndrome coronavirus (MERS-CoV), entitled 'Surface sampling of MERS-CoV in health care settings: A practical "how to" protocol for health care and public health professionals'. Both protocols were developed by Reina Sikkema, Bart Haagmans and Marion Koopmans from Erasmus Medical Center, Rotterdam, the Netherlands, with input and review by WHO.

Appendices

Appendix A: Sample questionnaire - Surface sampling of COVID-19: A practical “how to” protocol for health care and public health professionals.

Form 1: Environmental sampling of COVID-19

Form 2: Environmental sampling of COVID-19 – further sampling information

Form 3: Laboratory results of environmental samples

Form 4: Epidemiological and clinical information from COVID-19 patient (if necessary)

Form 5: Laboratory results of biological specimens from COVID-19 patient (if necessary)

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Form 1: Environmental sampling of COVID-19

This table will need to be completed every time a room in which the COVID-19 infected patient has been/is currently in is sampled, as described by the sampling schedule (e.g. daily until at least 7 days after discharge). A second table (Form 2) covers further detail on locations and type of samples collected within each room.

1. Sample location information (complete new table for each sampling collection):	
Identification number	
Date sample collected (DD/MM/YYYY)	(DD/MM/YYYY)___/___/___ Time:
Room temperature at time of sampling (°C)	
Room humidity at time of sampling (%)	
Location of room in which sample was collected	(options to be defined by investigators: consider including a map of layout of rooms the patient has entered to help identify where samples were collected) □ Patient's bedroom □ Patient's bathroom □ Entry routing □ Other:
When was the room last cleaned?	(DD/MM/YYYY)___/___/___ Time:
When was the room last disinfected?	(DD/MM/YYYY)___/___/___ Time:
Was the sample collected after an aerosolizing procedure or other high-risk procedure?	□ Yes □ No □ Unknown
- If yes, when was the last aerosolizing procedure or high-risk procedure performed?	(DD/MM/YYYY)___/___/___ Time:
- If yes, which procedure?	□ Positive pressure ventilation (bi-level positive airway pressure and continuous positive airway pressure) □ Endotracheal intubation □ High flow nasal cannula □ Open airway suction □ High frequency oscillatory ventilation □ Tracheostomy □ Chest physiotherapy □ Nebulizer treatment □ Sputum suction □ Bronchoscopy □ Other:

2. Sampling information :	
If yes, were multiple swabs taken?	□ Yes □ No □ Unknown
What storage medium was used?	□ Viral transport medium □ Tryzol □ RNAlater □ Other:

3. Storage and transport information :	
When were the samples stored at the laboratory?	(DD/MM/YYYY)___/___/___ Time:
How were the samples stored at the laboratory?	□ 4°C □ -20°C □ -80°C □ Other:
When were the samples transported to the laboratory?	(DD/MM/YYYY)___/___/___ Time:
How were the samples transported to the laboratory?	□ 4°C □ -20°C □ -80°C □ Other:

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Form 2: Environmental sampling of COVID-19 – further sampling information

Environmental sampling usually involves the collection of a large number of samples. This form covers further detail on locations and type of samples collected within each room. This should be completed alongside Form 1 at the frequency with which environmental sampling is conducted, as described by the sampling schedule (e.g. daily until at least 7 days after discharge). As an example, the first five sampling collections are shown below:

Sample collection 1

Identification of samples collected	**Patient's bedroom**	**Patient's bathroom**	**Entry routing**	**Other room:**
(enter as many as collected)	□ Bed □ Linen □ Clothes □ Medical equipment: □ Doorknob □ Bedside table □ Light switch □ Ventilation exits □ Wall □ Other:	□ Toilet/ bed pan □ Faucet handles □ Hand soap dispenser □ Doorknob □ Light switch □ Ventilation exits □ Wall □ Other:	□ Medic bag handle □ Medical equipment: □ Corridor □ Ventilation exits □ Wall □ Light switch □ Elevator buttons □ Other:	(enter options as appropriate) □ □ □
Remarks, other rooms sampled:				
Identification of samples collected	**Patient's bedroom**	**Patient's bathroom**	**Entry routing**	**Other room:**
(enter as many as collected)	□ Bed □ Linen □ Clothes □ Medical equipment: □ Doorknob □ Bedside table □ Light switch □ Ventilation exits □ Wall □ Other:	□ Toilet/ bed pan □ Faucet handles □ Hand soap dispenser □ Doorknob □ Light switch □ Ventilation exits □ Wall □ Other:	□ Medic bag handle □ Medical equipment: □ Corridor □ Ventilation exits □ Wall □ Light switch □ Elevator buttons □ Other:	(enter options as appropriate) □ □ □
Remarks, other rooms sampled:				
Identification of samples collected	**Patient's bedroom**	**Patient's bathroom**	**Entry routing**	**Other room:**
(enter as many as collected)	□ Bed □ Linen □ Clothes □ Medical equipment: □ Doorknob □ Bedside table	□ Toilet/ bed pan □ Faucet handles □ Hand soap dispenser □ Doorknob □ Light switch □ Ventilation exits	□ Medic bag handle □ Medical equipment: □ Corridor □ Ventilation exits □ Wall	(enter options as appropriate) □ □ □

	□ Light switch □ Ventilation exits □ Wall □ Other:	□ Wall □ Other:	□ Light switch □ Elevator buttons □ Other:	
Remarks, other rooms sampled:				
Identification of samples collected	**Patient's bedroom**	**Patient's bathroom**	**Entry routing**	**Other room:**
(enter as many as collected)	□ Bed □ Linen □ Clothes □ Medical equipment: □ Doorknob □ Bedside table □ Light switch □ Ventilation exits □ Wall □ Other:	□ Toilet/ bed pan □ Faucet handles □ Hand soap dispenser □ Doorknob □ Light switch □ Ventilation exits □ Wall □ Other:	□ Medic bag handle □ Medical equipment: □ Corridor □ Ventilation exits □ Wall □ Light switch □ Elevator buttons □ Other:	(enter options as appropriate) □ □ □
Remarks, other rooms sampled:				
Identification of samples collected	**Patient's bedroom**	**Patient's bathroom**	**Entry routing**	**Other room:**
(enter as many as collected)	□ Bed □ Linen □ Clothes □ Medical equipment: □ Doorknob □ Bedside table □ Light switch □ Ventilation exits □ Wall □ Other:	□ Toilet/ bed pan □ Faucet handles □ Hand soap dispenser □ Doorknob □ Light switch □ Ventilation exits □ Wall □ Other:	□ Medic bag handle □ Medical equipment: □ Corridor □ Ventilation exits □ Wall □ Light switch □ Elevator buttons □ Other:	(enter options as appropriate) □ □ □
Remarks, other rooms sampled:				
Identification of samples collected	**Patient's bedroom**	**Patient's bathroom**	**Entry routing**	**Other room:**
(enter as many as collected)	□ Bed □ Linen □ Clothes □ Medical equipment: □ Doorknob □ Bedside table □ Light switch □ Ventilation exits □ Wall □ Other:	□ Toilet/ bed pan □ Faucet handles □ Hand soap dispenser □ Doorknob □ Light switch □ Ventilation exits □ Wall □ Other:	□ Medic bag handle □ Medical equipment: □ Corridor □ Ventilation exits □ Wall □ Light switch □ Elevator buttons □ Other:	(enter options as appropriate) □ □ □
Remarks, other rooms sampled:				

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Form 3: Laboratory results of environmental samples

This table will need to be completed for every environmental sample collected, as described by the sampling schedule.

4. Molecular testing methods and results (complete new table for each environmental sample collected):	
Identification of samples	
Date sample collected (DD/MM/YYYY)	(DD/MM/YYYY)___/___/___ Time:
Date sample received (DD/MM/YYYY)	(DD/MM/YYYY)___/___/___ Time:
Location of sample collected	(options to be defined by investigators) □ Patient's bedroom □ Patient's bathroom □ Entry routing □ Other:
Type of test	□ PCR □ Whole genome sequencing □ Partial genome sequencing □ Other, specify Method used:
Result	□ COVID-19 detectable RNA □ COVID-19 viable virus □ Other, specify:
Date of result (DD/MM/YYYY)	___/___/___
Specimen shipped to other laboratory for confirmation - Date (DD/MM/YYYY)	□ Yes □ No (DD/MM/YYYY)___/___/___

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Form 4: Epidemiological and clinical information from COVID-19 patient (if necessary)

The following information should be collected as part of an outbreak investigation. The following forms are here for reference and cover the information needed to help with interpretation of the environmental sampling results.

Patient identification number	
1. Current Status	□ Alive □ Dead

2. Data Collector Information	
Name of data collector	
Data collector Institution	
Data collector telephone number	
Mobile number	
Email	
Form completion date (DD/MM/YYYY)	___/___/___
Date of interview with informant (DD/MM/YYYY)	___/___/___

3. COVID-19 patient information	
First name	
Surname	
Sex	□ Male □ Female □ Not known
Date of birth (DD/MM/YYYY)	___/___/___
Telephone (mobile) number	
Country of residence	
Nationality	
Ethnicity (optional)	
Responsible Health Centre	
Nursery/School/College if appropriate Work/ Stay home etc	
Have you travelled within the last 14 days domestically?	□ Yes □ No □ Unknown If Yes, dates of travel (DD/MM/YYYY): ___/___/___ to ___/___/___ Regions: Cities visited:
Have you travelled within the last 14 days internationally?	□ Yes □ No □ Unknown If Yes, dates of travel (DD/MM/YYYY): ___/___/___ to ___/___/___ Countries visited: Cities visited:
In the past 14 days, have you had contact with a anyone with suspect or confirmed COVID-19 infection?	□ Yes □ No □ Unknown If Yes, dates of last contact (DD/MM/YYYY): ___/___/___

4a. Primary case symptoms from onset of illness	
Date of first symptom onset* (DD/MM/YYYY)	___/___/___ □ Asymptomatic □ Unknown
Fever (≥38 °C) or history of fever*	□ Yes □ No □ Unknown If yes, specify maximum temperature from onset of illness:
Date of first health facility visit (including traditional care)* (DD/MM/YYYY)	___/___/___ □ NA □ Unknown
Total number of visits to health facilities since onset of illness	
Total number of health facilities visited since onset of illness	□ NA □ Unknown Specify:
4b. Respiratory symptoms	
Sore throat*	□ Yes □ No □ Unknown If Yes, date (DD/MM/YYYY): ___/___/___
Cough*	□ Yes □ No □ Unknown If Yes, date (DD/MM/YYYY): ___/___/___
Runny nose*	□ Yes □ No □ Unknown
Shortness of breath*	□ Yes □ No □ Unknown If Yes, date (DD/MM/YYYY): ___/___/___
4c. Other symptoms	
Chills	□ Yes □ No □ Unknown
Vomiting	□ Yes □ No □ Unknown
Nausea	□ Yes □ No □ Unknown
Diarrhoea	□ Yes □ No □ Unknown
Headache	□ Yes □ No □ Unknown
Neurological signs If Yes, specify	□ Yes □ No □ Unknown
Rash	□ Yes □ No □ Unknown
Conjunctivitis	□ Yes □ No □ Unknown
Muscle ache	□ Yes □ No □ Unknown
Joint ache	□ Yes □ No □ Unknown
Loss of appetite	□ Yes □ No □ Unknown
Nose bleed	□ Yes □ No □ Unknown
Fatigue	□ Yes □ No □ Unknown
General malaise	□ Yes □ No □ Unknown
Seizures	□ Yes □ No □ Unknown
Altered consciousness	□ Yes □ No □ Unknown
Other symptoms	□ Yes □ No □ Unknown If yes, specify:

5. Primary case pre-existing condition(s)	
Obesity	□ Yes □ No □ Unknown
Cancer	□ Yes □ No □ Unknown
Diabetes	□ Yes □ No □ Unknown

HIV/other immune deficiency	□ Yes □ No □ Unknown
Heart disease	□ Yes □ No □ Unknown
Asthma (requiring medication)	□ Yes □ No □ Unknown
Chronic lung disease (non-asthma)	□ Yes □ No □ Unknown
Chronic liver disease	□ Yes □ No □ Unknown
Chronic haematological disorder	□ Yes □ No □ Unknown
Pregnancy	□ Yes □ No □ Unknown If yes, specify trimester: □ First □ Second □ Third □ NA Estimated delivery date (DD/MM/YYYY) ___/___/___
Chronic kidney disease	□ Yes □ No □ Unknown
Chronic neurological impairment/disease	□ Yes □ No □ Unknown
Organ or bone marrow recipient	□ Yes □ No □ Unknown
Other pre-existing condition(s)	□ Yes □ No □ Unknown If yes, specify:

6. Case specimen collection (Day 1- baseline)	
Date baseline respiratory sample collected (DD/MM/YYYY)	(DD/MM/YYYY) ___/___/___ □ NA
What type of respiratory sample was collected?	□ Nasal swab □ Throat swab □ Nasopharyngeal swab □ Other:
Has baseline serum been taken?	□ Yes □ No □ Unknown If yes, specify date (DD/MM/YYYY):
Were other samples collected?	□ Yes □ No □ Unknown If yes: □ Stool □ Urine □ Other:
Which laboratory was the specimen sent to?	
Date sent to other laboratory with coronavirus expertise (if applicable) (DD/MM/YYYY)	___/___/___
7. Laboratory results reporting	
Please impute laboratory results once they become available in the "Laboratory results report"	

Surface sampling of COVID-19: A practical "how to" protocol for health care and public health professionals

Form 5: Laboratory results of biological specimens from COVID-19 patient (if necessary)

This table will need to be completed for every specimen collection from the COVID-19 patient, depending on the chosen specimen collection schedule.

8. Molecular testing methods and results (complete new table for each specimen collected):	
Lab identification number	
Date sample collected (DD/MM/YYYY)	(DD/MM/YYYY)___/___/___
Date sample received (DD/MM/YYYY)	(DD/MM/YYYY)___/___/___
Type of sample	□ Nasal swab □ Throat swab □ Nasopharyngeal swab □ Others, specify:
Type of test	□ PCR □ Whole genome sequencing □ Partial genome sequencing □ Other, specify
Result	□ COVID-19 □ Others, specify:
Date of result (DD/MM/YYYY)	___/___/___
Specimen shipped to other laboratory for confirmation - Date (DD/MM/YYYY)	□ Yes □ No (DD/MM/YYYY)___/___/___

WHO reference number: WHO/2019-nCoV/Environment_protocol/2020.1