Water, sanitation, hygiene, and waste management for the COVID-19 virus

Interim guidance
23 April 2020

Background

This interim guidance supplements the infection prevention and control (IPC) documents by summarizing WHO guidance on water, sanitation and health-care waste relevant to viruses, including coronaviruses. It is intended for water and sanitation practitioners and providers, and health-care providers who want to know more about water, sanitation and hygiene (WASH) risks and practices.

The provision of safe water, sanitation and hygienic conditions is essential for protecting human health during all infectious disease outbreaks, including of coronavirus disease 2019 (COVID-19). Ensuring evidenced-based and consistently applied WASH and waste management practices in communities, homes, schools, marketplaces, and health-care facilities will help prevent human-to-human transmission of, the virus that causes COVID-19.

This guidance was originally published in March 2020. This first update provides details on hand hygiene, sanitation, protecting WASH workers and supporting the continuation and strengthening of WASH services, especially in underserved areas. This additional information has been prepared in response to the many questions that WHO received about the prevention and control of COVID-19 in settings where WASH services are limited and where there is emerging evidence on the presence of viral fragments in excreta and untreated sewage.

The most important information concerning WASH and the COVID-19 virus is summarized here.

- Frequent and correct hand hygiene is one of the most important measures to prevent infection with the COVID-19 virus. WASH practitioners should work to enable more frequent and regular hand hygiene by improving access to hand hygiene facilities and using multimodal approaches (refer to Hand hygiene practices) to support good hand hygiene behaviour. Performing hand hygiene at the right time, using the right technique with either alcohol-based hand rub or soap and water is critical.

- Existing WHO guidance on the safe management of drinking-water and sanitation services applies to the COVID-19 outbreak. Water disinfection and sanitation treatment can reduce viruses. Sanitation workers should have proper training and access to personal protective equipment (PPE) and in many scenarios, a specific combination of PPE elements is recommended.

- Many health co-benefits can be realized by safely managing water and sanitation services, and by applying good hygiene practices.

Currently, there are no studies on the survival of the COVID-19 virus in drinking-water or sewage. The morphology and chemical structure of this virus are similar to those of other coronaviruses[a] for which there are data about both survival in the environment and effective inactivation measures. This guidance draws on the existing evidence base and current WHO guidance on how to protect against viruses in sewage and drinking-water.

1. COVID-19 transmission

The main routes of transmission are respiratory droplets and direct contact. Any person who is in close contact with an infected individual is at risk of being exposed to potentially infective respiratory droplets.[1] Droplets may also land on surfaces where the virus could remain viable; thus, the immediate environment of an infected individual can serve as a source of transmission.

The risk of transmission of the COVID-19 virus from the faeces of an infected person appears to be low. Current evidence suggests that infectious COVID-19 virus may be excreted in faeces, regardless of diarrhoea or signs of intestinal infection. Approximately 2–27% of people with confirmed COVID-19 have diarrhoea[2-5] and several studies

[a] These coronaviruses include: human coronavirus 229E (HCoV), human coronavirus HKU1, human coronavirus OC43, severe acute respiratory syndrome coronavirus (SARS). In addition, evidence is drawn from transmissible gastroenteritis virus (TGEV) and mouse hepatitis virus (MHV).

have detected COVID-19 viral RNA fragments in the faecal matter of these patients throughout their illness and after recovery.[6-8] However, to date, only one study has cultured the COVID-19 virus from a stool specimen.[9] There have been no reports of faecal–oral transmission of the COVIs-19 virus.

2. Persistence of the COVID-19 virus in drinking-water, faeces and sewage and on surfaces

While the presence of the COVID-19 virus in untreated drinking-water is possible, it has not been detected in drinking-water supplies. Furthermore, other coronaviruses have not been detected in surface or groundwater sources and thus the risk of coronaviruses to water supplies is low.[10]

The COVID-19 virus is enveloped and thus less stable in the environment compared to non-enveloped human enteric viruses with known waterborne transmission (such as adenoviruses, norovirus, rotavirus and hepatitis A). One study found that other human coronaviruses[b] survived only two days in dechlorinated tap water and in hospital wastewater at 20°C.[11] In comparison, high levels of removal (> 4 log) of the influenza virus were found in drinking-water[c] after contact time of only five minutes and a chlorine residual of 0.3 mg/l.[12] Other studies find similar removals in days to weeks. Significant (99.9% removal) of coronaviruses was observed in two days in primary sewage effluent[d] at 23°C, two weeks in pasteurized settled sewage at 25 °C and four weeks in reagent grade water [e] at 25°C.[13,14] Higher temperature, high or low pH and sunlight all facilitate virus reduction.

Recent evidence indicates that COVID-19 virus (SARS-CoV-2) survival on surfaces is similar to that of SARS-CoV-1, the virus that causes severe acute respiratory syndrome (SARS),[15] with survival on surfaces ranging from 2 hours to 9 days.[16] The survival time depends on several factors, including the type of surface, temperature, relative humidity and the strain of the virus. The same study also found that effective inactivation could be achieved within 1 minute using common disinfectants, such as 70% ethanol or 0.1% sodium hypochlorite (see Cleaning practices).

3. Safely managing wastewater and faecal waste

There is no evidence to date that the COVID-19 virus has been transmitted via sewerage systems with or without wastewater treatment. However, as viral fragments have been found in excreta and because of other potential infectious disease risks from excreta, wastewater should be treated in well-designed and well-managed centralized wastewater treatment works. Each stage of treatment (as well as retention time and dilution) results in a further reduction of the potential risk. A waste stabilization pond (that is, an oxidation pond or lagoon) is generally considered to be a practical and simple wastewater treatment technology that is particularly well suited to destroying pathogens, as relatively long retention times (20 days or longer) combined with sunlight, elevated pH levels and biological activity serve to accelerate pathogen destruction. A final disinfection step may be considered if existing wastewater treatment plants are not optimized to remove viruses.

Best practices for protecting the health of sanitation workers should be followed. Workers should wear appropriate PPE, which includes protective outerwear, heavy-duty gloves, boots, goggles or a face shield, and a mask; they should perform hand hygiene frequently; they should avoid touching their eyes, nose or mouth with unwashed hands, and they should practise social distancing while working.

4. Keeping water supplies safe

Several measures can improve water safety, starting with protecting the source water; treating water at the point of distribution, collection or consumption; and ensuring that treated water is safely stored at home in regularly cleaned and covered containers. Such measures can be effectively planned, implemented and monitored using water safety plans.[17]

Conventional, centralized water treatment methods that utilize filtration and disinfection should inactivate the COVID-19 virus. Other human coronaviruses have been shown to be sensitive to chlorination and disinfection with ultraviolet (UV) light.[18,19] For effective centralized disinfection, there should be a residual concentration of free chlorine of ≥0.5 mg/L after at least 30 minutes of contact time at pH < 8.0.[10] A chlorine residual should be maintained throughout the distribution system.

In addition to effective water treatment, water utility managers can adopt several other preventive measures, as part of a broader water-safety planning approach. These measures include: ensuring adequate stocks of chemical additives and consumable reagents for water-quality testing, ensuring that critical spare parts, fuel and contractors can still be accessed and that there are contingency plans for staff and training to maintain the required supply of safe drinking-water.

In places where centralized water treatment and safe piped-water supplies are not available, a number of household water treatment technologies are effective in removing or destroying viruses, including boiling or using high-performing ultrafiltration or nanomembrane filters, solar irradiation and, in non-turbid waters, UV irradiation and appropriately dosed free chlorine.[f]

[b] Observed inactivation of severe acute respiratory-associated coronavirus (SARS-CoV).
[c] H5N1 avian influenza virus is also an enveloped virus.
[d] Observed inactivation of human coronavirus 229E (HCoV) and feline peritonitis virus (FIPV).
[e] Observed inactivation of transmissible gastroenteritis (TGEV) and mouse hepatitis (MHV).
[f] Generally, the listed technologies are effective in inactivating viruses, but performance can vary widely depending on the manufacturing process, type of materials, design and use. It is important to verify the performance of a specific technology.

WASH in health care settings

Existing recommendations for water, sanitation and hygiene measures in health-care settings are important for providing adequate care for patients and protecting patients, staff[g] and caregivers from infection risks.[20] The following WASH-related actions are particularly important:

- engaging in frequent hand hygiene using appropriate techniques;
- implementing regular environmental cleaning and disinfection practices;
- managing excreta (faeces and urine) safely;
- safely managing health-care waste produced by COVID-19 cases.

Other important and recommended measures include providing sufficient and safe drinking-water to staff, caregivers and patients; ensuring that personal hygiene can be maintained, including hand hygiene for patients, staff and caregivers; regularly laundering bedlinen and patients' clothing; providing adequate and accessible toilets (including separate facilities for confirmed and suspected COVID-19 cases); and segregating and safely disposing of health-care waste.[20]

1. Hand hygiene practices

Hand hygiene is extremely important to prevent the spread of the COVID-19 virus. All health-care facilities should have regular programmes aimed at promoting best hand hygiene practices and ensuring the availability of the necessary infrastructure (equipment and supplies).

All health-care facilities should establish hand hygiene programmes, if they do not have them already, or strengthen existing ones. In addition, rapid activities to prevent the spread of the COVID-19 virus are needed, such as procurement of adequate quantities of hand hygiene supplies; hand hygiene refresher courses and communications campaigns. Cleaning hands using an alcohol-based hand rub or with water and soap should be done according to the instructions known as "My 5 moments for hand hygiene".[21] These are (1) before touching a patient, (2) before clean/aseptic procedures, (3) after body fluid exposure/risk, (4) after touching a patient, and (5) after touching patient surroundings.[h] If hands are not visibly dirty, the preferred method is using an alcohol-based hand rub for 20–30 seconds using the appropriate technique.[22] When hands are visibly dirty, they should be washed with soap and water for 40–60 seconds using the appropriate technique. In addition to performing hand hygiene at all five moments, it should be performed in the following situations: before putting on PPE and after removing it; when changing gloves; after any contact with a patient with suspected or confirmed COVID-19 infection, their waste or the environment in that patient's immediate surroundings; after contact with any respiratory secretions; before food preparation and eating; and after using the toilet.[23]

Functional hand hygiene facilities should be present for all health-care workers at all points of care, in areas where PPE is put on or taken off, and where health-care waste is handled. In addition, functional hand hygiene facilities should be available for all patients, family members and visitors, and should be available within 5 m of toilets, as well as at the entry/exit of the facility, in waiting and dining rooms and other public areas.

An effective alcohol-based hand rub product should contain between 60% and 80% of alcohol and its efficacy should be proven according to the European Norm 1500 or the standards of the ASTM International (formerly, the American Society for Testing and Materials) known as ASTM E-1174. These products can be purchased on the market, but can also be produced locally in pharmacies using the formula and instructions provided by WHO.[24]

2. Sanitation and plumbing

People with suspected or confirmed COVID-19 disease should be provided with their own flush toilet or latrine. Where this is not possible, patients sharing the same ward should have access to toilets that are not used by patients in other wards. Each toilet cubicle should have a door that closes, to separate it from the patient's room. Flush toilets should operate properly and have functioning drain traps. When possible, the toilet should be flushed with the lid down to prevent droplet splatter and aerosol clouds. If it is not possible to provide separate toilets for COVID-19 patients, then the toilets they share with other non-COVID-19 patients should be cleaned and disinfected at least twice daily by a trained cleaner wearing PPE (impermeable gown, of if not available, an apron, heavy-duty gloves, boots, mask and googles or a face shield). Health-care staff should have toilet facilities that are separate from those used by all patients.

WHO recommends the use of standard, well-maintained plumbing, such as sealed bathroom drains, and backflow valves on sprayers and faucets to prevent aerosolized faecal matter from entering the plumbing or ventilation system,[25] together with standard wastewater treatment.[26] Faulty plumbing and a poorly designed air ventilation system were among the contributing factors for the spread of the aerosolized SARS-CoV-1 coronavirus in a high-rise apartment building in Hong Kong Special Administrative Region in 2003.[27] Similar concerns have been raised about the spread of the COVID-19 virus from faulty toilets in high-rise apartment buildings.[28] If health-care facilities are connected to sewers, a risk assessment should be conducted to confirm whether wastewater is contained and does not leak from the system before it reaches a functioning treatment and/or disposal site. Risks related to the adequacy of the collection system or to treatment and disposal methods should be assessed following a sanitation safety planning approach.[29]

[g] Staff includes not only health-care staff but also ancillary staff, such as cleaning staff, hygienists, laundry staff and waste workers.

[h] Further resources are available at https://www.who.int/infection-prevention/campaigns/clean-hands/5moments/en/

If health-care facility toilets are not connected to sewers, hygienic on-site treatment systems should be ensured such as pit latrines and septic tanks, or excreta should be safely stored and transported for off-site treatment. For unlined pits, precautions should be taken to prevent contamination of the environment, ensuring that at least 1.5 m exist between the bottom of the pit and the groundwater table (more space should be allowed in coarse sands, gravels and fissured formations) and that the latrines are located at least 30 m horizontally from any groundwater source (including both shallow wells and boreholes).[30]

A properly-designed septic tank will remove most solids from sewage, and the liquid effluent can infiltrate into the ground through a leachfield or soakpit. If soil conditions are not favourable for infiltration, fully lined tanks can be used, however combined excreta and flushing water will necessitate frequent emptying. Latrines or holding tanks should be designed to meet patient demand, considering potential sudden increases in cases, and there should be a regular schedule for emptying them based on the wastewater volumes generated. There is no reason to empty latrines and holding tanks of excreta from suspected or confirmed COVID-19 cases unless they are at capacity. Faecal sludge can be treated in a faecal sludge treatment plant, either located off-site or on the premises of the health-care facility. Municipal authorities may position faecal sludge transfer stations near health facilities to reduce the time, cost and potential for uncontrolled dumping of sludge in drains and agricultural areas.[26]

For those working with untreated sewage for which there are considerable infectious risks, in addition to standard PPE (heavy-duty gloves, boots, masks, and goggles or a face shield, a that is, a long-sleeved impermeable gown or if not available, an apron, is needed). It should be worn at all times when handling or transporting excreta offsite, and great care should be taken to avoid splashing and release of droplets. For sanitation workers, this includes pumping out tanks or unloading pumper trucks. After handling the waste and once there is no risk of further exposure, individuals should safely remove their PPE and perform hand hygiene before entering the transport vehicle. Soiled PPE should be put in a sealed bag for later safe laundering (see Environmental cleaning and laundry). Faecal sludge and wastewater from health facilities should never be released on land used for food production, aquaculture or disposed of in recreational waters.

3. Toilets and the handling of faeces

It is critical to perform hand hygiene (see Hand hygiene general recommendations) when there is suspected or known contact with faeces. If the patient is unable to use a toilet, excreta should be collected in either a diaper or a clean bedpan and immediately and carefully disposed of into a separate toilet or latrine used only by suspected or confirmed COVID-19 cases. In all health-care settings, including those with suspected or confirmed COVID-19 cases, faeces must be treated as a biohazard.

After disposing of excreta, bedpans should be cleaned with a neutral detergent and water, disinfected with a 0.5% chlorine solution, and then rinsed with clean water. The rinse water should be disposed of in a drain, toilet or latrine. Other effective disinfectants include commercially available quaternary ammonium compounds, such as cetylpyridinium chloride, used according to manufacturer's instructions, and peracetic or peroxyacetic acid at concentrations of 500–2000 mg/L.[31]

Chlorine is not effective for disinfecting matter containing large amounts of solid and dissolved organic matter. Therefore, there is limited benefit to adding chlorine solution to fresh excreta and, possibly, such addition can introduce risks associated with splashing.

Anyone handling faeces should follow existing WHO contact and droplet precautions[23] and use PPE to prevent exposure, including long-sleeved gowns, gloves, boots, masks, and goggles or a face shield. If diapers are used, they should be disposed of as infectious waste, as in all non-outbreak situations. Workers should be properly trained in how to put on and remove PPE, so that these protective barriers are not breached.[32] If PPE is not available or the supply is limited, the frequency of correct hand hygiene should increase, and workers should keep at least 1m distance from suspected or confirmed cases.

4. Safe management of health care waste

Best practices for safely managing health-care waste should be followed, including assigning responsibility and sufficient human and material resources to segregate and dispose of waste safely. There is no evidence that direct, unprotected human contact during the handling of health-care waste has resulted in the transmission of the COVID-19 virus. All health-care waste produced during patient care, including those with confirmed COVID-19 infection, is considered to be infectious (infectious, sharps and pathological waste) and should be collected safely in clearly marked lined containers and sharpsafe boxes. This waste should be treated, preferably on-site, and then safely disposed. If waste is moved off-site, it is critical to understand where and how it will be treated and disposed. Waste generated in waiting areas of health-care facilities can be classified as non-hazardous and should be disposed in strong black bags and closed completely before collection and disposal by municipal waste services. All those who handle health-care waste should wear appropriate PPE (boots, long-sleeved gown, heavy-duty gloves, mask, and goggles or a face shield) and perform hand hygiene after removing it. The volume of infectious waste during the COVID 19 outbreak is expected to increase, especially through the use of PPE. Therefore, it is important to increase capacity to handle and treat this health-care waste. Additional waste treatment capacity, preferably through alternative treatment technologies, such as autoclaving or high temperature burn incinerators, may need to be procured and systems may need to be put in place to ensure their sustained operation.[33]

There is no reason to empty latrines and holding tanks of excreta from suspected or confirmed COVID-19 cases unless they are at capacity. In general, the best practices for safely managing excreta should be followed. Latrines or holding tanks should be designed to meet patient demand, considering potential sudden increases in cases, and there should be a regular schedule for emptying them based on the wastewater volumes generated. PPE (long-sleeved gown, gloves, boots, masks, and goggles or a face shield) should be worn at all times when handling or transporting excreta offsite, and great care should be taken to avoid splashing. For crews, this includes pumping out tanks or unloading pumper

trucks. After handling the waste and once there is no risk of further exposure, individuals should safely remove their PPE and perform hand hygiene before entering the transport vehicle. Soiled PPE should be put in a sealed bag for later safe laundering (see Cleaning practices). Where there is no off-site treatment, in-situ treatment can be done using lime. Such treatment involves using a 10% lime slurry added at 1-part lime slurry per 10 parts of waste.

5. Environmental cleaning and laundry

Existing recommended cleaning and disinfection procedures for health-care facilities should be followed consistently and correctly.[34] Linen should be laundered and the surfaces where COVID-19 patients receive care should be cleaned and disinfected frequently (at least once a day), and after a patient is discharged.[23] Many disinfectants are active against enveloped viruses, such as the COVID-19 virus, including commonly-used hospital disinfectants. Currently, WHO recommends using:

- 70% ethyl alcohol to disinfect small surface areas and equipment between uses, such as reusable dedicated equipment (for example, thermometers);
- sodium hypochlorite at 0.1% (1000 ppm) for disinfecting surfaces[35] and 0.5% (5000 ppm) for disinfection of blood or bodily fluids spills in health-care facilities.

The efficacy of all disinfectants is affected, to different degrees, by organic material. Thus, it is essential to clean surfaces with a detergent and water before applying a disinfectant. The concentration and exposure time of any disinfectant are critical parameters for its efficacy. After applying disinfectant to a surface, it is necessary to wait for the required exposure time and drying to ensure that surface microorganisms are killed.

All individuals in charge of environmental cleaning, laundry and dealing with soiled bedding, towels and clothes from patients with COVID-19 infection should wear appropriate PPE, including heavy-duty gloves, a mask, eye protection (goggles or a face shield), a long-sleeved gown, and boots or closed shoes. They should perform hand hygiene after exposure to blood or body fluids and after removing PPE. Soiled linen should be placed in clearly labelled, leak-proof bags or containers, after carefully removing any solid excrement and putting it in a covered bucket to be disposed of in a toilet or latrine. Machine washing with warm water at 60–90°C and laundry detergent is recommended. The laundry can then be dried according to routine procedures. If machine washing is not possible, linens can be soaked in hot water and soap in a large drum using a stick to stir, taking care to avoid splashing. The drum should then be emptied, and the linens soaked in 0.05% chlorine for approximately 30 minutes. Finally, the laundry should be rinsed with clean water and the linens allowed to dry fully, if possible in sunlight.

Excreta found on surfaces such as linen or the floor should be carefully removed with towels and immediately disposed of safely in a toilet or latrine. If the towels are single use, they should be treated as infectious waste; if they are reusable, they should be treated as soiled linens. The area should then be cleaned and disinfected following published guidance on cleaning and disinfection procedures for spilled body fluids.[34]

6. Safe disposal of greywater or water from washing PPE, surfaces and floors

WHO recommends that utility gloves or heavy-duty, reusable plastic aprons are cleaned with soap and water, and then decontaminated with 0.5% sodium hypochlorite solution each time they are used. Single-use gloves made of nitrile or latex, and gowns should be discarded as infectious waste after each use and not reused; hand hygiene should be performed after PPE is removed. If greywater includes disinfectant used in prior cleaning, it does not need to be chlorinated or treated again. However, it is important that such water is disposed of in drains connected to a septic system, a sewer or in a soak-away pit. If greywater is disposed of in a soakaway pit, the pit should be fenced off within the health facility grounds to prevent tampering and to avoid possible exposure in the case of overflow.

7. Safe management of dead bodies

While the risk of transmission of COVID-19 from handling the body of a deceased person is low, health care workers and others handling dead bodies should apply standard precautions at all times. Health care workers or mortuary staff preparing the body should wear: scrub suit, impermeable disposable gown (or disposable gown with impermeable apron), gloves, mask, face shield (preferably) or goggles, and boots. After use, PPE should be carefully removed and decontaminated or disposed as infectious waste as soon as practicable and hand hygiene should be performed. The body of a deceased person confirmed or suspected to have COVID-19 should be wrapped in cloth or fabric and transferred as soon as possible to the mortuary area. Body bags are not necessary for COVID-19 virus although they may be used for other reasons (e.g. excessive body fluid leakage).[36]

Considerations for WASH practices in homes and communities

Upholding recommended water, sanitation and health-care waste practices in the home and in the community is important for reducing the spread of COVID-19. The provision of water enables regular hand hygiene and cleaning. Water services should not be cut off because of consumers' inability to pay, and governments should prioritize providing access to people without access to water services, through other immediate actions such as. protected boreholes, tanker trucks, extending piped supplies etc.).

Individuals and organizations involved in providing water and sanitation services such as treatment plant operators, sanitation workers and plumbers as well as those promoting hand hygiene in the community should be designated as providing essential services and be allowed to continue their work during movement restrictions and have access to PPE and hand hygiene facilities to protect their health.

1. Hand hygiene general recommendations

Hand hygiene has been shown to prevent respiratory illness.[37] Handwashing is recommended after coughing and sneezing and/or disposing of a tissue, on entering the home having come from public places, before preparing food, before and after eating and feeding/breastfeeding, after using the toilet

or changing a child's diaper and after touching animals. For people with limited WASH services it is vital to prioritize the key times for hand hygiene.

As part of a new hand hygiene campaign, WHO recommends that universal access to hand hygiene facilities should be provided in front of all public buildings and transport hubs – such as markets, shops, places of worship, schools and train or bus stations.[38] In addition, functioning handwashing facilities with water and soap should be available within 5m of all toilets, both public and private.

The number or size of these hand hygiene stations should be adapted to the number and type of users such as children or those with limited mobility, to encourage use and reduce waiting times. The installation, supervision and maintenance of equipment, including where necessary, regular refilling of water and soap and/or alcohol-based hand rub should be under the overall leadership of the public health authorities. Maintaining supplies should be the responsibility of the manager of the building or store, transport provider etc. Civil society and the private sector can be engaged to support the functioning and correct use of such facilities and to prevent vandalism.

2. Hand hygiene materials

The ideal hand hygiene materials for communities and homes in order of effectiveness are:

- Water and soap **or** alcohol-based hand rub
- Ash or mud
- Water alone

Hand hygiene stations can consist of either water,[i] such as sinks attached to a piped-water supply, refillable water reservoir or clean, covered buckets with taps equipped with plain soap or alcohol-based hand rub dispensers. Where alcohol-based hand rub or bar soap is not feasible, a liquid soap solution, mixing detergent with water can be used[j]. The ratio of detergent to water will depend on types and strengths of locally available product.[39] Soap does not need to be antibacterial and evidence indicates that normal soap is effective in inactivating enveloped viruses, such as coronaviruses.[40,41] Alcohol-based hand rub should contain at least 60% alcohol. Such products should be certified and, where supplies are limited or prohibitively expensive, can be produced locally according to WHO-recommended formulations.[24]

When soap or alcohol-based hand rub are not available, the use of ash or soil can be considered and has shown to be effective in some cases.[22,42] Ash, in particular, may inactivate pathogens by raising the pH.[43] However, in communities with limited sanitation services, soil may be faecally contaminated, and thus it is important to weigh the benefits against the risk of contaminating hands.[44] Finally, washing with water alone, although the least effective of the four options, this can result in reductions in faecal contamination on hands and in diarrhoea.[45,46] Regardless of the type of material, the washing and rubbing of hands, and the amount of rinsing water in particular, are important determinants in the reduction of pathogen contamination on hands.[47]

3. Water quality and quantity requirements for handwashing

The quality of water used for handwashing does not need to meet drinking-water standards. Evidence suggests that even water with moderate faecal contamination when used with soap and the correct technique can be effective in removing pathogens from hands.[48] However, efforts should be made to use and source water of the highest quality possible (e.g. an improved water source)[k]. Reported quantities of water used for handwashing that have enabled reduction of faecal contamination ranges from 0.5-2 litres per person.[47] Furthermore, the quantity of water used has been associated with less viral contamination of hands.[49] Where water is limited, hands can be wetted with water, the water then turned off while lathering with soap and scrubbing for at least 20 seconds, and then the water can be turned on again to rinse. Water should always be allowed to flow to a drainage area or receptacle, and hands should not be rinsed in a communal basin, as this may increase contamination.

4. Handwashing facility options

A number of design features should be considered in selecting and/or innovating on existing handwashing facility options. These features include:

- Turning the tap on/off: either a sensor, foot pump, or large handle so the tap can be turned off with the arm or elbow
- Soap dispenser: for liquid soap either sensor-controlled or large enough to operate with the lower arm; for a bar of soap, the soap dish should be well-draining, so the soap doesn't get soggy
- Grey water: ensure the grey water is directed to, and collected in, a covered container if not connected to a piped system
- Drying hands: paper towels and a bin provided; if not possible encourage air drying for several seconds
- Materials: generally, the materials should be easily cleanable and repair/replacement parts can be sourced locally
- Accessible: should be accessible to all users, including children and those with limited mobility.

A number of handwashing designs have been implemented in households, schools and in public settings in both

[i] Water does not need to be drinking-water quality.
[j] If alcohol-based hand rubs or soap and water are not available or feasible, then using chlorinated water (0.05%) for handwashing is an option as a short-term measure.
[k] An improved water source is one that is protected from faecal contamination and included piped water, public tap, boreholes, protected dug wells, protected springs and rainwater (source: WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene: https://washdata.org/)

developed and developing countries[1]. In schools, a number of simple, easy to maintain, and durable low-cost designs have been successfully implemented.[50]

5. Treatment and handling requirements for excreta

When there are suspected or confirmed cases of COVID-19 in the home setting, immediate action must be taken to protect caregivers and other family members from the risk of contact with respiratory secretions and excreta that may contain the COVID-19 virus. Frequently touched surfaces throughout the patient's care area should be cleaned regularly, such as tables and other bedroom furniture. Cutlery and crockery should washed and dried after each use and not shared with others. Bathrooms should be cleaned and disinfected at least once a day. Regular household soap or detergent should be used for cleaning first and then, after rinsing, regular household disinfectant containing 0.1% sodium hypochlorite (that is, equivalent to 1000 ppm or 1 part household bleach with 5% sodium hypochlorite to 50 parts water) should be applied. PPE should be worn while cleaning, including mask, goggles, a fluid-resistant apron and gloves,[23] and hand hygiene should be performed after removing PPE. Consideration should be given to safely managing human excreta throughout the entire sanitation chain, starting with ensuring access to regularly cleaned, accessible and functioning toilets or latrines and to the safe containment, conveyance, treatment and eventual disposal of sewage.

6. Management of waste generated at home

Waste generated at home during quarantine, while caring for a sick family member or during the recovery period should be packed in strong black bags and closed completely before disposal and eventual collection by municipal waste services. Tissues or other materials used when sneezing or coughing should immediately be thrown in a waste bin. After such disposal, correct hand hygiene should be performed.

References

1. Coronavirus disease (COVID-19) advice for the public Geneva [website]. Geneva: World Health Organization; 2020. (https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public, accessed 22 April 2020.)
2. Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. Lancet. 2020;395(10223):507-13. doi: 10.1016/s0140-6736(20)30211-7.
3. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet. 2020;395(10223):497-506. doi: 10.1016/s0140-6736(20)30183-5.
4. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. JAMA. 2020. doi: 10.1001/jama.2020.1585.
5. Wu Y, Guo C, Tang L, Hong Z, Zhou J, Dong X, et al. Prolonged presence of SARS-CoV-2 viral RNA in faecal samples. Lancet Gastroenterol Hepatol. doi: 10.1016/S2468-1253(20)30083-2.
6. Xiao F, Tang M, Zheng X, Liu Y, Li X, Shan H. Evidence for gastrointestinal infection of SARS-CoV-2. Gastroenterology. 2020. doi: 10.1053/j.gastro.2020.02.055.
7. Holshue ML, DeBolt C, Lindquist S, Lofy KH, Wiesman J, Bruce H, et al. First case of 2019 novel coronavirus in the United States. N Engl J Med. 2020;382(10):929-36. doi: 10.1056/NEJMoa2001191.
8. Woelfel R, Corman VM, Guggemos W, Seilmaier M, Zange S, Mueller MA, et al. Clinical presentation and virological assessment of hospitalized cases of coronavirus disease 2019 in a travel-associated transmission cluster. medRxiv. 2020:2020.03.05.20030502. doi: 10.1101/2020.03.05.20030502.
9. Zhang Y, Chen C, Zhu S, Shu C, Wang D, Song J, et al. Isolation of 2019-nCoV from a stool specimen of a laboratory-confirmed case of the coronavirus disease 2019 (COVID-19). China CDC Weekly. 2020;2(8):123-4.
10. Guidelines on drinking-quality, fourth edition, incorporating the first addendum. Geneva: World Health Organization; 2017. (https://www.who.int/water_sanitation_health/publications/drinking-water-quality-guidelines-4-including-1st-addendum/en/).
11. Wang X-W, Li J-S, Jin M, Zhen B, Kong Q-X, Song N, et al. Study on the resistance of severe acute respiratory syndrome-associated coronavirus. J Virol Methods. 2005;126(1):171-7. doi.org/10.1016/j.jviromet.2005.02.005.
12. Lénès D, Deboosere N, Ménard-Szczebara F, Jossent J, Alexandre V, Machinal C, et al. Assessment of the removal and inactivation of influenza viruses H5N1 and H1N1 by drinking water treatment. Water Res. 2010;44(8):2473-86. doi.org/10.1016/j.watres.2010.01.013.
13. Gundy PM, Gerba CP, Pepper IL. Survival of coronaviruses in water and wastewater. Food Environ Virol. 2008;1(1):10. doi: 10.1007/s12560-008-9001-6.
14. Casanova L, Rutala WA, Weber DJ, Sobsey MD. Survival of surrogate coronaviruses in water. Water res. 2009;43(7):1893-8. doi: 10.1016/j.watres.2009.02.002.
15. Van Doremalen N, Bushmaker T, Morris DH, Holbrook MG, Gamble A, Williamson BN, et al. Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1. N Engl J Med. 2020. doi: 10.1056/NEJMc2004973.
16. Kampf G, Todt D, Pfaender S, Steinmann E. Persistence of coronaviruses on inanimate surfaces and their inactivation with biocidal agents. J Hosp Infect. 2020;104(3):246-51. doi: 10.1016/j.jhin.2020.01.022.

[1] Examples include Happy Taps in Southeast Asia (https://happytap.net/en/home-2/), Mrembo in East Africa (https://ifworlddesignguide.com/entry/126933-mrembo) and handwashing stations in San Francisco (https://www.businessinsider.com/coronavirus-san-francisco-hand-washing-station-2020-3?r=US&IR=T)

17. Water safety plans. Step by step risk management for water suppliers. Geneva: World Health Organization; 2009. (https://www.who.int/water_sanitation_health/publications/publication_9789241562638/en/).
18. Lai MYY, Cheng PKC, Lim WWL. Survival of severe acute respiratory syndrome coronavirus. Clin Infect Dis. 2005;41(7):e67-e71. doi: 10.1086/433186.
19. Darnell MER, Subbarao K, Feinstone SM, Taylor DR. Inactivation of the coronavirus that induces severe acute respiratory syndrome, SARS-CoV. J Virol Methods. 2004;121(1):85-91. doi.org/10.1016/j.jviromet.2004.06.006.
20. Essential environmental health standards in health care. Geneva: World Health Organization; 2008. (http://www.who.int/water_sanitation_health/publications/ehs_hc/en/).
21. Sax H, Allegranzi B, Uçkay I, Larson E, Boyce J, Pittet D. 'My five moments for hand hygiene': a user-centred design approach to understand, train, monitor and report hand hygiene. J Hosp Infect. 2007;67(1):9-21. doi: 10.1016/j.jhin.2007.06.004.
22. WHO guidelines on hand hygiene in health care. Geneva: World Health Organization; 2009. (https://www.who.int/gpsc/5may/tools/9789241597906/en/).
23. Infection prevention and control during health care when novel coronavirus (nCoV) infection is suspected: interim guidance, 19 March 2020 Geneva: World Health Organization; 2020 [cited 2020 24 March]. Available from: https://www.who.int/publications-detail/infection-prevention-and-control-during-health-care-when-novel-coronavirus-(ncov)-infection-is-suspected-20200125.
24. Guide to local production: WHO recommended handrub formulations. Geneva: World Health Organization; 2010. (http://www.who.int/gpsc/5may/Guide_to_Local_Production.pdf).
25. Health aspects of plumbing. Geneva: World Health Organization; 2006. (https://apps.who.int/iris/handle/10665/43423).
26. Guidelines on sanitation and health. Geneva: World Health Organization; 2018. (https://www.who.int/water_sanitation_health/publications/guidelines-on-sanitation-and-health/en/).
27. Yu IT, Li Y, Wong TW, Tam W, Chan AT, Lee JH, et al. Evidence of airborne transmission of the severe acute respiratory syndrome virus. N Engl J Med. 2004;350(17):1731-9. doi: 10.1056/NEJMoa032867.
28. Regan H. How can the coronavirus spread through bathroom pipes? Experts are investigating in Hong Kong. CNN. 12 February 2020. (https://edition.cnn.com/2020/02/12/asia/hong-kong-coronavirus-pipes-intl-hnk/index.html, accessed 22 April 2020).
29. Sanitation safety planning: manual for safe use and disposal of wastewater, greywater and excreta. Geneva; World Health Organization; 2015.
30. Tilley E, Ulrich L, Luthi C, Reymond P, Zurbrügg C. Compendium of sanitation systems and technologies, 2nd revised edition. Dübendorf, Switzerland: Swiss Federal Institute of Aquatic Science and Technology (Eawag); 2014. (https://www.eawag.ch/en/department/sandec/publications/compendium/, accessed 22 April 2020).
31. Chemical disinfectants: guideline for disinfection and sterilization in healthcare facilities. Atlanta; United States of America: US Centers for Disease Control and Prevention; 2008. (https://www.cdc.gov/infectioncontrol/guidelines/disinfection/disinfection-methods/chemical.html accessed 22 April 2020).
32. How to put on and take off personal protective equipment (PPE). Geneva; World Health Organization; 2008. (https://apps.who.int/iris/handle/10665/70066).
33. Safe management of wastes from health-care activities. Geneva; World Health Organization; 2014. (https://apps.who.int/iris/bitstream/handle/10665/42175/9241545259.pdf?sequence=1).
34. Best practices for environmental cleaning in healthcare facilities in resource-limited settings. Atlanta; United States of America: US Centers for Disease Control and Prevention; 2019. (https://www.cdc.gov/hai/pdfs/resource-limited/environmental-cleaning-508.pdf, accessed 22 April 2020).
35. Decontamination and reprocessing of medical devices for health-care facilities. Geneva: World Health Organization; 2016. (https://apps.who.int/iris/bitstream/handle/10665/250232/9789241549851-eng.pdf?sequence=1).
36. Infection Prevention and Control for the safe management of a dead body in the context of COVID-19. Geneva: World Health Organization; 2020. (https://apps.who.int/iris/bitstream/handle/10665/331538/WHO-COVID-19-IPC_DBMgmt-2020.1-eng.pdf).
37. Jefferson T, Foxlee R, Mar CD, Dooley L, Ferroni E, Hewak B, et al. Physical interventions to interrupt or reduce the spread of respiratory viruses: systematic review. BMJ. 2008;336(7635):77. doi: 10.1136/bmj.39393.510347.BE.
38. Interim recommendations on obligatory hand hygiene against transmission of COVID-19. Geneva: World Health Organization; 2020. (https://www.who.int/who-documents-detail/interim-recommendations-on-obligatory-hand-hygiene-against-transmission-of-covid-19).
39. Ashraf S, Nizame FA, Islam M, Dutta NC, Yeasmin D, Akhter S, et al. Nonrandomized Trial of Feasibility and Acceptability of Strategies for Promotion of Soapy Water as a Handwashing Agent in Rural Bangladesh. The American journal of tropical medicine and hygiene. 2017;96(2):421-9. doi: 10.4269/ajtmh.16-0304.
40. Montville R, Schaffner DW. A meta-analysis of the published literature on the effectiveness of antimicrobial soaps. J Food Prot. 2011;74(11):1875-82. doi: 10.4315/0362-028X.JFP-11-122.
41. Sickbert-Bennett EE, Weber DJ, Gergen-Teague MF, Sobsey MD, Samsa GP, Rutala WA. Comparative efficacy of hand hygiene agents in the reduction of bacteria and viruses. American journal of infection control. 2005;33(2):67-77. doi: doi.org/10.1016/j.ajic.2004.08.005.
42. Hoque BA, Briend A. A comparison of local handwashing agents in Bangladesh. J Trop Med Hyg. 1991;94(1):61-4.
43. Baker KK, Dil Farzana F, Ferdous F, Ahmed S, Kumar Das S, Faruque ASG, et al. Association between moderate-to-severe diarrhea in young children in the global enteric multicenter study (GEMS) and types of handwashing materials used by caretakers in Mirzapur, Bangladesh. The American journal of tropical medicine and hygiene. 2014;91(1):181-9. doi: 10.4269/ajtmh.13-0509.

44. Bloomfield SF, Nath KJ. Use of ash and mud for handwashing in low income communities. An IFH expert review. 2009. (https://www.ifh-homehygiene.org/review-best-practice/use-ash-and-mud-handwashing-low-income-communities).
45. Burton M, Cobb E, Donachie P, Judah G, Curtis V, Schmidt WP. The effect of handwashing with water or soap on bacterial contamination of hands. Int J Environ Res Public Health. 2011;8(1):97-104. doi: 10.3390/ijerph8010097.
46. Luby SP, Halder AK, Huda T, Unicomb L, Johnston RB. The effect of handwashing at recommended times with water alone and with soap on child diarrhea in rural Bangladesh: an observational study. PLoS Med. 2011;8(6):e1001052. doi: 10.1371/journal.pmed.1001052.
47. Hoque BA. Handwashing practices and challenges in Bangladesh. Int J Environ Health Res. 2003;13 Suppl 1:S81-7. doi: 10.1080/0960312031000102831.
48. Verbyla ME, Pitol AK, Navab-Daneshmand T, Marks SJ, Julian TR. Safely Managed Hygiene: A Risk-Based Assessment of Handwashing Water Quality. Environmental Science & Technology. 2019;53(5):2852-61. doi: 10.1021/acs.est.8b06156.
49. Mattioli MC, Boehm AB, Davis J, Harris AR, Mrisho M, Pickering AJ. Enteric pathogens in stored drinking water and on caregiver's hands in Tanzanian households with and without reported cases of child diarrhea. Plos One 9(1), e84939. 2014
50. GIZ, UNICEF. Scaling up group handwashing in schools. Compendium of group washing facilities across the globe. New York, USA; Eschborn, Germany 2016. (https://www.susana.org/_resources/documents/default/3-2641-7-1475236606.pdf).

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WHO and UNICEF continue to monitor the situation closely for any changes that may affect this interim guidance. Should any factors change, WHO and UNICEF will issue a further update. Otherwise, this interim guidance document will expire 2 years after the date of publication.

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