Water, sanitation, hygiene (WASH) and waste management for the prevention of COVID-19

Updated Technical brief (2nd version)

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1. Introduction and background

In late 2019, an acute respiratory disease emerged, known as novel coronavirus disease 2019 (COVID-19). The pathogen responsible for COVID-19 is severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2, also referred to as the COVID-19 virus), a member of the coronavirus family. In response to the growing spread of COVID-19, WHO has published a number of technical guidance documents on specific topics, including infection prevention and control (IPC). These documents are available at https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/infection-prevention-and-control.

This technical brief supplements those IPC documents by referencing and summarizing the WHO guidance on water, sanitation, hygiene and health care waste that is relevant to contain and inactivate viruses, including coronaviruses. This technical brief is written, in particular, for water and sanitation practitioners and providers. It is also for 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 to protecting human health during all infectious disease outbreaks, including the COVID-19 outbreak. Ensuring good and consistently applied WASH and waste management practices in communities, homes, schools, marketplaces, prisons and health care facilities will further help to prevent human-to-human transmission of the COVID-19 virus.

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

- **Frequent and proper hand hygiene** is one of the most important measures to prevent infection with the COVID-19 virus. Safe hygiene measures will protect from transmission of the virus via surfaces, but also fecal-oral transmission. WASH practitioners should work to enable more frequent and regular hand hygiene by improving access to facilities and using proven behaviour change techniques. Conducting hand hygiene at the right time, using the right technique, with either alcohol based hand rub (ABHR) or soap and water is critical.

- **WHO guidance on the safe management of drinking-water and sanitation services applies** to the COVID-19 outbreak. Extra measures beyond what is recommended by existing guidance is not needed. Water disinfection and sanitation treatment can reduce viruses and sanitation workers, in particular, should have proper training and protective equipment.

- **Many co-benefits will be realized by safely managing water and sanitation services** and **applying good hygiene practices**. Such efforts will prevent many other infectious diseases, which cause millions of deaths each year and will enable health care facilities to provide safe, quality care.

Currently, there is no evidence about the survival of the COVID-19 virus in drinking-water or sewage. The morphology and chemical structure of the COVID-19 virus are similar to those of other coronaviruses[1] for which there are data about both survival in the environment and effective inactivation measures. Thus, this brief draws upon the existing evidence base and, more generally, existing WHO guidance on how to protect against viruses in sewage and drinking-water along with the role of hand hygiene in communities in preventing infectious disease. This document is based on the current knowledge of the COVID-19 virus and it will be updated as new information becomes available.

1.1 COVID-19 transmission

The main route of transmission is via droplets. Respiratory droplets are generated when an infected person coughs or sneezes. 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. Contact transmission can happen for the COVID-19 virus by direct contact with infected people and indirect contact with surfaces in the immediate environment or with objects used on the infected person (e.g. stethoscope or thermometer).

The risk of transmission of the COVID-19 virus from the faeces of an infected person appears to be low. The weight of 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 those with confirmed COVID-19 have diarrhoea (2-5) and several studies have detected COVID-19 viral RNA fragments in the faecal matter of COVID-19 patients throughout their illness and after recovery (6-8). However, to date only one study has cultured the COVID-19 virus from a single stool specimen (9). There have been no reports of faecal–oral transmission of the COVID-19 virus.

1.2 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 an enveloped virus. As such it has a fragile outer lipid membrane which makes it less stable, compared to non-enveloped viruses, in the environment. This membrane must be intact for enveloped viruses to attach to and infect host cells and the envelope can become easily damaged by oxidants, such as chlorine.

While there is no evidence to date about survival of the COVID-19 virus in water or sewage, the virus is likely to become inactivated significantly faster than non-enveloped human enteric viruses with known waterborne transmission (such as adenoviruses, norovirus, rotavirus and hepatitis A). For example, one study found that other human coronaviruses survived only 2 days in dechlorinated tap water and in hospital wastewater at 20° C (11). In comparison, in drinking water, after contact time of only 5 minutes and a chlorine residual of 0.3 mg/l, high removals (> 4 log) of influenza virus were

[1] 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).

found[2]. hypochlorite), the same human coronavirus was inactivated in 5 minutes or less(12). Other studies concur, noting that the coronaviruses, transmissible gastroenteritis coronavirus and mouse hepatitis virus, demonstrated a 99.9% reduction in 2 days (13) at 23° C to 2 weeks at 25° C (14). Heat, high or low pH and sunlight all facilitate virus reduction.

Recent evidence indicates that COVID-19 virus survival on surfaces is similar to the survival of severe acute respiratory syndrome (SARS) coronavirus (15). As such, the survival is consistent with previous data summarized in a recent review of the survival of human coronaviruses on surfaces, which found large variability, ranging from 2 hours to 9 days (16). The survival time depends on a number of factors, including the type of surface, temperature, relative humidity and specific strain of the virus. The same review also found that effective inactivation could be achieved within 1 minute using common disinfectants, such as 70% ethanol or sodium hypochlorite (for details, see Section 2.5 Cleaning practices).

1.3 Safely managing wastewater and faecal waste

Sewage or wastewater treatment workers should protect themselves to appropriate levels depending on their exposure and whether the water was treated since many infectious diseases may be transmitted through wastewater. Best practices for protecting the health of workers at sanitation treatment facilities should be followed. Workers should wear appropriate personal protective equipment (PPE), which includes protective outerwear, gloves, boots, goggles or a face shield, and a mask; they should perform hand hygiene frequently; and they should avoid touching eyes, nose and mouth with unwashed hands.

There is no evidence to date that the COVID-19 virus has been transmitted via sewerage systems with or without wastewater treatment. As part of an integrated public health policy, wastewater carried in sewerage systems 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, biological activity and other factors serve to accelerate pathogen destruction. A final disinfection step may be considered if existing wastewater treatment plants are not optimized to remove viruses.

1.4 Keeping water supplies safe

A number of measures can be taken to 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 regulated through the implementation of 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). As enveloped viruses are surrounded by a lipid host cell membrane~~,~~ which is not robust, the COVID-19 virus is likely to be more sensitive to chlorine and other oxidant disinfection processes than many other viruses, such as coxsackieviruses, which have a protein coat. 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.

[2] H5N1 avian influenza virus is also an enveloped virus.

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[3].

2. 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[4] and caregivers from infection risks (19). 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, including ensuring that no one comes into contact with excreta and that it is treated and disposed of correctly,
- safely managing health care waste.

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 bedsheets and patients' clothing; providing adequate and accessible toilets (including separate facilities for confirmed and suspected cases of COVID-19 infection); and segregating and safely disposing of health care waste. For details on these recommendations, please refer to *Essential environmental health standards in health care* (19).

2.1 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). Effective hand hygiene improvement strategies are multimodal and include the following integrated successful elements: 1) system change ensuring availability of alcohol-based hand rub products, as well as water, soap and disposable/clean towels; 2) training and education of all health workers on hand hygiene best practices and their importance; 3) evaluation and feedback of hand hygiene infrastructure, compliance and other indicators; 4) reminders and communications to prompt and remind health care workers as well as patients and visitors about hand hygiene; and 5) an institutional safety climate with visible commitment of senior managers and involvement of all staff.

In the context of the COVID-19 pandemic, all health care facilities should establish or strengthen their hand hygiene improvement programme and conduct rapid activities such as at a minimum procurement of adequate quantities of hand hygiene supplies and refresh of hand hygiene training and of reminders/communications about its importance to prevent the spread of the COVID-19 virus. Cleaning hands using an alcohol-based hand rub or with water and soap should be performed according to the instructions known as "My 5 moments for hand hygiene" (20). If hands are not visibly dirty, the preferred method is to perform hand hygiene with an alcohol-based hand rub for 20–30 seconds using the appropriate technique (21). When hands are visibly dirty, they should be washed with soap and water for 40–60 seconds using the appropriate technique (21). Hand hygiene should be performed at all five moments, including before putting on PPE and after removing it, when changing gloves, after any contact with a patient with suspected or confirmed COVID-19

[3] 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.

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

infection, their waste or the environment in the patient immediate surroundings, after contact with any respiratory secretions, before food preparation and eating and after using the toilet (22).

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 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) ASTM E-1174. These products are available from the market but can also be produced locally in pharmacies using the formula and instructions provided by WHO in the Guide to Local Production for the WHO-recommended Hand Rub Formulations (23).

2.2 Sanitation and plumbing

People with suspected or confirmed COVID-19 disease should be provided with their own flush toilet or latrine that has 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, the toilet should be cleaned and disinfected at least twice daily by a trained cleaner wearing PPE (that is, gown, gloves, boots, mask and googles or a face shield). Furthermore, and consistent with existing guidance, staff and health care workers 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 (24), together with standard wastewater treatment (25). Faulty plumbing and a poorly designed air ventilation system were implicated as contributing factors to the spread of the aerosolized SARS coronavirus in a high-rise apartment building in Hong Kong in 2003 (26). Similar concerns have been raised about the spread of the COVID-19 virus from faulty toilets in high-rise apartment buildings (27). If health care facilities are connected to sewers, a risk assessment should be conducted to confirm that wastewater is contained within the system (that is, the system does not leak) prior to its arrival at a functioning treatment or disposal site, or both. Risks pertaining to the adequacy of the collection system or to treatment and disposal methods should be assessed following a sanitation safety planning approach (28), with critical control points prioritized for mitigation.

If health care facilities have toilets that are not connected to sewers, hygienic on-site containers and treatment systems should be ensured. On-site containers can be designed either for containment, storage and on-site treatment of excreta (e.g. pit latrines and septic tanks) or for containment, storage and safe conveyance 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) (29).

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 favorable for infiltration, fully lined tanks can be used, however combined excreta and flushing water will necessitate frequent emptying. The material that accumulates in pits, septic tanks or lined tanks

need to be periodically emptied (see **section 2.4**), conveyed to treatment and disposed of properly. 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. For further information on safe management of excreta and wastewater see *WHO Guidelines on Sanitation and Health* (25)

In some countries there are few dedicated faecal sludge treatment plants and the authorities permit faecal sludge discharge into sewer manholes or discharge at municipal wastewater treatment plants. Treatment in conventional wastewater treatment plants is an incremental measure (before services are significantly improved) since significant amounts of faecal sludge undermines the performance of sewage networks and treatment plants and should be avoided where possible. Untreated sludge should not be disposed in landfill. However, landfill disposal is preferable to illegal dumping or use in agriculture as an incremental measure while treatment capacity is established.

All sanitation workers should wear appropriate PPE during pit emptying. Particular care should be taken to avoid splashing and the release of droplets while cleaning or emptying tanks. Faecal sludge and wastewater from health facilities should never be applied on land used for food production, aquaculture or disposed in recreational waters.

2.3 Toilets and the handling of faeces

It is critical to conduct hand hygiene when there is suspected or direct contact with faeces (if hands are dirty, then soap and water are preferred to the use of an alcohol-based hand rub). If the patient is unable to use a latrine, 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 cases of COVID-19. In all health care settings, including those with suspected or confirmed COVID-19 cases, faeces must be treated as a biohazard and handled as little as possible. Anyone handling faeces should follow WHO contact and droplet precautions (22) 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 they should be in all non-outbreak situations). Workers should be properly trained in how to put on, use and remove PPE so that these protective barriers are maintained and not breached (30). If PPE is not available or the supply is limited, hand hygiene should be regularly practiced, and workers should try to keep at least 1 m distance from any suspected or confirmed cases.

If a bedpan is used, after disposing of excreta from it, the bedpan 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 or a 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 ineffective for disinfecting media containing large amounts of solid and dissolved organic matter. Therefore, there is limited benefit to adding chlorine solution to fresh excreta and, possibly, this may introduce risks associated with splashing.

2.4 Emptying latrines and holding tanks, and transporting excreta off-site

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 (that is, a 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 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 Section 2.5, 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.

2.5 Cleaning practices

Existing recommended cleaning and disinfection procedures for health care facilities should be followed consistently and correctly (32) Laundry should be done and surfaces in all environments in which COVID-19 cases receive care (for example, treatment units, community care centres) should be cleaned, and disinfected frequently (at least once a day) and when a patient is discharged (22) 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 from 0.1% (1,000 ppm)[5] to 0.5% (5,000 ppm) (equivalent to 5000 ppm) for disinfecting surfaces (except metal surfaces and other surfaces that can be damaged by chlorine).
- All disinfectants efficacy is affected to different degrees, by organic material. Hence, it is essential to clean surfaces with a detergent and water before applying a disinfectant. The disinfectant concentration and exposure time are critical parameters for its efficacy. After applying a disinfectant in to a surface, it is necessary to wait for the required exposition time and drying to ensure its killing effect on surface microorganisms.

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) if risk of splash from organic material or chemicals, 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 with 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 in sunlight.

If excreta are on surfaces (such as linens or the floor), the excreta should be carefully removed with towels and immediately safely disposed of 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 (32).

2.6 Safely disposing of greywater or water from washing PPE, surfaces and floors

[5] The COVID-19 virus is more easily killed by chlorine that other pathogens and thus 0.1% chlorine solution is sufficient. However, there may be other, more robust pathogens in health care facilities such as vegetative bacteria or hepatitis A, which would require a stronger concentration (0.5%) to be inactivated.

Current WHO recommendations are to clean utility gloves or heavy duty, reusable plastic aprons with soap and water and then decontaminate them with 0.5% sodium hypochlorite solution after each use. Single-use gloves (that is, nitrile or latex) and gowns should be discarded 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 or 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.

2.7 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 dispose of such 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 the care of confirmed COVID-19 patients is considered as infectious (infectious, sharps and pathological waste) and should be collected safely in clearly marked lined containers and sharp 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 packed in strong black bags and closed properly before disposal by municipal waste services. All those who handle health care waste should wear appropriate PPE (that is, boots, long-sleeved gown, heavy-duty gloves, mask, and goggles or a face shield) and perform hand hygiene after removing it. For more information refer to the WHO guidance, *Safe management of wastes from health-care activities* (33).

2.8 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. Persons in close contact with the body must wear: a clean protective outer garment, such as a gown, overalls or jumpsuit, a clean pair of disposable or heavy duty reusable gloves and if there is risk of splashes, facial protection such as a disposable surgical mask and appropriate eye protection such as goggles or a face shield. After use, PPE should be carefully removed and decontaminated or disposed of as clinical 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). For more details see WHO guidance on safe management of dead bodies in context of COVID-19 (34).

3. Considerations for WASH practices in homes and communities

Upholding best WASH practices in the home and community is also important for preventing the spread of COVID-19 in the population and when caring for suspected, confirmed or recovering cases at home. Water service provision is an essential measure to allow for regular handwashing with soap, which is essential to protect individuals and reduce disease transmission in communities. It is especially important not to shut off water services because of inability to pay and governments should prioritize providing access to those without services through other immediate actions (e.g. protected boreholes, tanker trucks, extending piped supplies etc.). Furthermore, those individuals involved in providing water and sanitation services (e.g. treatment plant operators, sanitation workers, plumbers) should be designated as providing “essential services” and be allowed to continue their work during movement restrictions and have the needed resources to protect their health (e.g. PPE and hand hygiene facilities).

3.1 Hand hygiene general recommendations

Hand hygiene in non−health care settings is one of the most important measures that can be used to prevent COVID-19 infection. In addition to preventing diarrhoeal disease, hand hygiene has been shown to prevent respiratory illness(35). Handwashing is recommended after coughing and sneezing and/or disposing of a tissue, on entering 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. Prioritizing key times is a first step in areas with constrained WASH services.

In homes, schools, prisons and frequently visited public spaces − such as markets, shops, places of worship, and train or bus stations – hand hygiene facilities should be available and hand hygiene practices strongly encouraged through visual reminders and, where possible, considered as a requirement before entering buildings. In addition, and according to existing guidance, functioning handwashing facilities with water and soap should be available within 5 m of all toilets, both public and private.

The number or size of the hand hygiene stations should be adapted to the number and type of users (e.g. children, those with limited mobility, etc.) 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. Filling, supervising and maintaining supplies should be the responsibility of the manager of the building or store, transport provider, etc. or with a private entity.

3.2 Hand hygiene materials

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

- Water and soap OR ABHR
- Ash or mud
- Water alone

Hand hygiene stations can consist of either water[6] (e.g., 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. Soapy water, a water solution of powdered laundry detergent, can be a low-cost alternative to commercial soaps in bar or liquid form (36). Soap does not need to be antibacterial and evidence indicates normal soap is effective in inactivating enveloped viruses such as coronavirus(37, 38). Alcohol-based hand rub should contain at least 60% alcohol, should be certified and where supplies are limited or cost prohibitive can be made locally according to WHO recommended formulations (23). For details see **Section 2.1.**

When soap or ABHR are not available, use of ash or soil can be considered and has shown to be effective in some cases(39). Ash, in particular, may inactivate pathogens by raising the pH(40). 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(41). Finally, washing with water alone, although the least effective of the four options, can result in reductions in faecal contamination on hands and diarrhoea(42, 43). Regardless of the type of material, the washing of both hands, rubbing of hands, and the amount of rinsing water in particular, are important determinants in the reduction of pathogen contamination on hands(44).

3.3 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(45). However, efforts

[6] Water does not need to be drinking-water quality.

should be made to use and source water of the highest quality possible (e.g. an improved water source)[7]. Reported quantities of water used for handwashing that have enabled reduction of faecal contamination ranges from 0.5-2 liters per person(44). Furthermore, the quantity of water used has been associated with less viral contamination of hands(46). 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 turned on again to rinse. Water should always be allowed to flow to waste and hands should not be rinsed in a communal basin as this may increase contamination of the wash water and could possibly re-contaminate hands.

3.4 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 faucet 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 or clean cloths 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 those with limited mobility.

A number of handwashing designs have been implemented in households, schools and in public settings (e.g. bus and train stations, at store fronts) in both developed and developing countries[8]. In schools, a number of simple, easy to maintain, and durable low-cost designs have been successfully implemented (see the compendium of low-cost handwashing facilities for details (47). It is important that public facilities are regularly maintained and are managed so as to limit theft and vandalism and support proper handwashing technique.

3.5 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. Dishes should washed and dried after each use and cups and eating utensils 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 (22), and hand hygiene with soap and water or an alcohol-based hand rub should be performed after removing PPE.

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[77] 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: https://washdata.org/)

[8] 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)

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

3.6 Management of solid waste

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. Used 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.

Note on document development and background

The content in this technical brief is based on the information currently available about the COVID-19 virus and the persistence of other viruses in the coronavirus family. It reflects input and advice from microbiologists and virologists, infection control experts, and those with practical knowledge about WASH and IPC in emergencies and disease outbreaks.

Contributors

This technical brief was written by staff from WHO and UNICEF. In addition, a number of experts and WASH practitioners contributed. They include Matt Arduino, US Centers for Disease Control and Prevention, United States of America; David Berendes, US Centers for Disease Control and Prevention, United States of America; Lisa Casanova, Georgia State University, United States of America; David Cunliffe, SA Health, Australia; Rick Gelting, US Centers for Disease Control and Prevention, United States of America; Dr Thomas Handzel, US Centers for Disease Control and Prevention, United States of America; Paul Hunter, University of East Anglia, United Kingdom; Ana Maria de Roda Husman, National Institute for Public Health and the Environment, the Netherlands; Peter Maes, Médicins Sans Frontières, Belgium; Molly Patrick, US Centers for Disease Control and Prevention, United States of America; Mark Sobsey, University of North Carolina-Chapel Hill, United States of America.

References

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1. World Health Organization. Coronavirus disease (COVID-19) advice for the public Geneva: World Health Organization; 2020 [Available from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public.
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.
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.
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.

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. The Lancet Gastroenterology & Hepatology.
6. Xiao F, Tang M, Zheng X, Liu Y, Li X, Shan H. Evidence for gastrointestinal infection of SARS-CoV-2. Gastroenterology. 2020.
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.
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.
9. Zhang Y CC, Zhu S, Shu C, Wang D, Song J,, al. e. 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. World Health Organization. Guidelines on Drinking-quality, fourth edition, incorporating the first addendum. Geneva2017.
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. Journal of Virological Methods. 2005;126(1):171-7.
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 Research. 2010;44(8):2473-86.
13. Gundy PM, Gerba CP, Pepper IL. Survival of Coronaviruses in Water and Wastewater. Food and Environmental Virology. 2008;1(1):10.
14. Casanova L, Rutala WA, Weber DJ, Sobsey MD. Survival of surrogate coronaviruses in water. Water Res. 2009;43(7):1893-8.
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.
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.
17. World Health Organization. Water safety plans. Step by step risk management for water suppliers. Geneva: World Health Organization; 2009.
18. SARS-CoV-2-Water and Sanitation. Adelaide: Water Research Autralia; 2020.
19. World Health Organization. Essential environmental health standards in health care. Geneva: World Health Organization; 2008.
20. 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.
21. World Health Organization. WHO guidelines on hand hygiene in health care settings. Geneva: World Health Organization; 2009.
22. World Health Organization. Infection prevention and control during health care when novel coronavirus (nCoV) infection is suspected: interim guidance, 19 March 2020 Geneva: World Health Organization; 2020 [Available from: https://www.who.int/publications-detail/infection-prevention-and-control-during-health-care-when-novel-coronavirus-(ncov)-infection-is-suspected-20200125.
23. World Health Organization. Guide to local production: WHO recommended handrub formulations. Geneva: World Health Organization; 2010.
24. World Health Organization. Health aspects of plumbing. Geneva: World Health Organization; 2006.
25. World Health Organization. Guidelines on sanitation and health. Geneva: World Health Organization; 2018.
26. 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.
27. Regan H. How can the coronavirus spread through bathroom pipes? Experts are investigating in Hong Kong. CNN. 2020.

28. World Health Organization. Sanitation safety planning: manual for safe use and disposal of wastewater, greywater and excreta. Geneva: World Health Organization; 2015.
29. Tilley E, Ulrich L, Luthi C, Reymond P, Zurbrügg C. Compendium of Sanitation Systems and Technologies2014.
30. World Health Organization. How to put on and take off personal protective equipment (PPE) . Geneva :World Health Organization ;2008.
31. US Centers for Disease Control and Prevention. Chemical disinfectants: guideline for disinfection and sterilization in healthcare facilities Atlanta: US Centers for Disease Control and Prevention; 2008 [Available from: https://www.cdc.gov/infectioncontrol/guidelines/disinfection/disinfection-methods/chemical.html.
32. US Centers for Disease Control and Prevention. Best practices for environmental cleaning in healthcare facilities in resource-limited settings. Atlanta: US Centers for Disease Control and Prevention; 2019.
33. World Health Organization. Safe management of wastes from health care activities. 2nd Edition. ed. Geneva: World Health Organization; 2014.
34. World Health Organization. Infection Prevention and Control for the safe management of a dead body in the context of COVID-19. Geneva2020.
35. 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.
36. 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. Am J Trop Med Hyg. 2017;96(2):421-9.
37. 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. Am J Infect Control. 2005;33(2):67-77.
38. MONTVILLE R, SCHAFFNER DW. A Meta-Analysis of the Published Literature on the Effectiveness of Antimicrobial Soaps. Journal of Food Protection. 2011;74(11):1875-82.
39. Hoque BA, Briend A. A comparison of local handwashing agents in Bangladesh. J Trop Med Hyg. 1991;94(1):61-4.
40. 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. Am J Trop Med Hyg. 2014;91(1):181-9.
41. SF B, KJ N. Use of ash and mud for handwashing in low income communities. An IFH expert review. 2009.
42. 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.
43. 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.
44. Hoque BA. Handwashing practices and challenges in Bangladesh. Int J Environ Health Res. 2003;13 Suppl 1:S81-7.
45. 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.
46. Mattioli MC, Boehm AB, Davis J, Harris AR, Mrisho M, Pickering AJ.
47. GIZ & UNICEF. Scaling up group handwashing in schools. Compendium of group washing facilities across the globe. New York; Eschborn; 2016.