

Ebola virus disease: Key questions and answers concerning water, sanitation and hygiene

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Introduction

Provision of water and sanitation plays an essential role in protecting human health during all disease outbreaks, including the current Ebola Virus Disease (EVD) outbreak. Good and consistently applied water, sanitation and hygiene (WASH) practices, both in health-care settings and the community will further help to prevent human-to-human transmission of EVD and many other infectious diseases.

How do people become infected with the Ebola virus?

The Ebola virus spreads in the human population by human-to-human transmission through direct contact of broken skin and mucous membranes with blood or other body fluids (e.g. faeces and urine, vomit, semen and sweat) of those infected (WHO, 2014). Transmission can occur through direct contact with these body fluids, as described above, or through touching fomites (inanimate objects), such as the floor, utensils and bed linens that have recently been contaminated with infected body fluids. Transmission through intact skin has not been documented, but infection can be transmitted through penetrating injuries of the skin, such as needle-stick injuries.

What do we know about the survival of the virus in the environment?

The characteristics of the Ebola virus suggest that it is likely to be relatively fragile in the environment in comparison with the enteric viruses that commonly cause diarrhoeal disease. To date, there is no evidence for transmission of Ebola viruses via drinking-water contaminated by faeces or urine. The virus is unlikely to survive for extended periods outside of the body. Higher temperatures (room temperature or above) are likely to increase the speed at which the virus dies off in the environment.

What are the minimum requirements for water, sanitation and hygiene in health care settings?

Existing recommended water, sanitation and hygiene measures in health care settings are important for providing adequate care for patients and protecting patients, staff and carers from infection risks (WHO, 2008). Of particular importance are the following actions: 1) keeping excreta (faeces and urine) separated from drinking-water sources; 2) handwashing with soap; and 3) containment of excreta such that they are effectively separated from human contact. Other important recommended measures include providing sufficient provision of drinking-water to staff, carers and patients, personal hygiene, laundry and cleaning, adequate and accessible toilets (including separate facilities for confirmed and suspected cases) and the segregation and safe disposal of health-care waste. For details refer to Essential Environmental Health Standards in Health Care (WHO, 2008).

What are recommended handwashing practices?

Basic hand hygiene is extremely important. This can be best achieved by handwashing with adequate quantities of clean (ideally running) water and soap or handrubbing with an alcohol-based hand rub solution. To be effective, handwashing should last 40-60 seconds and handrubbing (with an alcohol-based solution) for 20-30 seconds and the action should follow the recommended steps (WHO, 2014). Hands should be washed at all critical moments, including before and after putting on personal protective equipment (PPE), after any contact with someone infected with Ebola or their waste, before eating, after using the toilet and

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after removing PPE. Handwashing with soap and water should always be used, even when hands are not visibly soiled. Chlorinated water can be used but it is not ideal because this may lead to skin lesions, which could increase risk of infection, and because prepared dilutions might be inaccurate. However, if other options are not available or feasible, using chlorinated water for handwashing should be continued.

What kind of sanitation facilities should be provided in health facilities treating Ebola cases?

Suspected or confirmed Ebola cases should be provided with separate flush toilets or latrines that are not used by other individuals. If flush toilets are used it is important that standard procedures for wastewater treatment are followed, including at a minimum, on-site septic tank treatment with later controlled removal for further treatment (WHO, 2002). Containing the wastewater for a period of time prior to secondary biological treatment, will allow for natural die-off of the Ebola virus and will significantly reduce the concentration of Ebola virus along, with other pathogens, that may be found in the wastewater. If health care facilities are connected to sewers, a risk assessment should be conducted to confirm that wastewater is contained within the system (i.e. does not leak) prior to its arrival at a functioning treatment and/or disposal site. Risks pertaining to the adequacy of the collection system, or to treatment and disposal methods, should be assessed according to a “safety planning” approach, with critical control points prioritized for mitigation.

For smaller facilities, if space and local conditions allow, pit latrines may be the preferred option. Standard precautions should be taken to prevent contamination of the environment by faeces and urine. These precautions include ensuring that, at least, 1.5 metres exist between the bottom of the pit and the groundwater table (more in coarse sands, gravels and fissured formations), and that the latrine(s) are located at least 30 metres horizontally from any groundwater source (including both shallow wells and boreholes) (WHO 2008). Given what is known about the virus and its die-off in the environment such recommendations are applicable in the specific case of Ebola. If there is a high groundwater table and/or lack of space to dig pits, excreta (faeces and urine) should be retained in impermeable storage containers and left as long as is feasibly possible to allow for reduction in virus levels before moving such waste off-site for additional treatment and/or safe disposal. However, consideration of Ebola virus characteristics and evidence on the fate of other viruses in sewage offers important insights. For example, in settled sewage at 25 C, approximately 99% of a similar structured virus (enveloped), coronavirus, was removed in 7 days. Ebola is likely to inactivate significantly faster in the environment than enteric viruses with known waterborne transmission (e.g., norovirus, Hepatitis A).

Two tank systems with parallel tanks would help to facilitate this, as one tank could be used until full, then allowed to sit while the next tank is being filled.

What are the handling and treatment requirements of faeces and urine within health facilities?

The key to controlling the hazard associated with the presence of the virus in the body fluids of infected individuals lies in the rigorous enforcement of protocols to separate and contain ALL body fluids (including faeces and urine). Faeces from suspected or confirmed Ebola cases must be treated as a biohazard and handled at a minimum. All direct human contact with excreta should be avoided and full PPE should be worn by all workers handling faeces. Such equipment includes heavy duty rubber gloves, impermeable gown, impermeable apron, closed shoes (e.g., boots), facial protection (mask and goggle or face shield) and ideally a head cover. Workers should be properly trained in putting on, using and removing PPE so that these protective barriers are maintained and not breached (WHO, 2014). Refer to WHO Guidance on PPE for further details (WHO, 2014).

If the patient is unable to use a latrine, excreta should be collected in a clean bedpan and immediately and carefully disposed of into a separate toilet or latrine used only by Ebola cases or suspected cases. Full PPE should be worn at all times when handling fresh excreta from Ebola cases and great care should be taken to avoid splashing. See details above for latrines.

After collection and disposal of the excreta from the bedpan, the bedpan should be rinsed with 0.5% chlorine solution to disinfect the pan, disposing of the rinse water in drains or a toilet/latrine. Depending on the dirtiness of the pan, it may need to be rinsed twice.

If it is not possible to dispose of the excreta immediately, the following procedure can be used to accelerate the inactivation of the Ebola virus and to contain the faeces temporarily.

Assuming a 10-litre covered bucket, first add approximately 600 ml (three cups) of a 10% (i.e., 100 g of lime powder in 1 litre of water) slurry (suspension) of hydrated (slaked) lime to the bucket. Then, carefully add the excreta from the bedpan into the bucket, leaving sufficient space in the bucket to add safely at least an additional 400 ml (two cups) of lime slurry. Rinse and disinfect the bedpan as described above. The final product should continue to be treated with caution and be carefully disposed of in a toilet or latrine by a person wearing full PPE.

If excreta are on surfaces (linens, floor, etc.) they should be carefully removed and immediately disposed of in a toilet/latrine. If this is not possible immediately, temporary containment using a bucket and lime as detailed above is recommended. All surfaces in contact with excreta should be disinfected (see details below).

Chlorine is an ineffective means to disinfect media containing large amounts of solid and dissolved organic matter. Therefore, there will be limited benefit to adding chlorine solution to fresh excreta, and possibly, may introduce risks associated with splashing.

What are the recommendations for emptying latrines and septic tanks and the off-site transportation of excreta?

Septic or holding tanks should be designed to hold wastewater for as long as feasibly possible (see above for details) with a regular emptying schedule based on generated wastewater volumes. Full PPE should be worn at all times when handling or transporting excreta off-site and great care should be taken to avoid splashing. For crews, this includes pumping out tanks or unloading pumper trucks.

After handling, and once there is no risk of further exposure, individuals should safely remove PPE before entering the transport vehicle.

What about wastewater treatment? What are possible effective treatment processes and how effective are they in removing viruses in general and Ebola specifically?

There is no evidence to date that Ebola 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 ideally be treated in well-designed and well-managed centralised wastewater treatment works. Each stage of treatment (as well as retention time and dilution) results in further reduction of potential risk. Waste stabilisation ponds (oxidation ponds or lagoons) are generally considered to be a wastewater treatment technology that is particularly well-suited to the destruction of pathogens as relatively long retention times (20 days or more) combined with sunlight, elevated pH levels and other factors serve to accelerate pathogen destruction.

What should be done to dispose of greywater, or water from washing of PPE, surfaces, etc. safely?

Current WHO recommendations advise to use chlorinated water (0.5%) to wash any reusable PPE (all disposable items should NOT be reused but disposed of safely), as well as surfaces that may have come into contact with bodily fluids (WHO, 2014). This concentration of chlorine is sufficient to inactivate the Ebola virus in water that is relatively free of solids (less than 10 mg/l). As such, this greywater, which has already been chlorinated does not need to be chlorinated or treated again. It is important however, that such water is disposed of in drains connected to a septic system, 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

What are the hygiene considerations for surfaces, bedding, etc.?

All individuals dealing with soiled bedding, etc., should wear full PPE. Laundry and surfaces in all environments in which Ebola cases receive care (treatment units, community care centres, and homes) should be regularly (at least once a day and when a patient is discharged) cleaned (WHO, 2008 and 2014). Any areas contaminated with blood or other body fluids (including faeces and urine) should be cleaned and disinfected with a 0.5% chlorine solution of as soon as possible (WHO, 2014).

Soiled linen should be placed in clearly labelled, leak-proof bags or containers, carefully removing any solid excrement, such as faeces or vomit and putting in covered bucket to dispose of in the toilet or latrine. Washing by machine with warm water and detergent is recommended followed by soaking in 0.05% chlorine

for approximately 30 minutes and dried according to routine procedures. If machine washing is not possible, linens can be soaked in warm water and soap in a large drum, using a stick to stir, avoiding splashing. The drum should then be emptied and refilled with clean water and adding bleach (1000 ppm) and allowing to soak for 15-20 min and finally rinsed with clean water. For more details, refer to the WHO Interim Infection Prevention and Control Guidance (WHO, 2014).

What are the key elements for safe disposal of health-care waste?

Direct, unprotected human contact during handling of health-care waste could result in transmission of pathogens, including the Ebola virus. Therefore, responsibility should be assigned, and sufficient human and material resources allocated to dispose of such waste safely. All health-care waste produced during the care of Ebola cases, should be collected safely in designated containers and bags, treated and then safely disposed of and/or destroyed, preferably on-site. If waste is moved offsite, it is critical to understand where and how it will be treated and destroyed. All those handling health-care waste should wear full PPE. For more information refer to Safe Management of Wastes from Health-Care Activities (WHO, 2014).

Are there any additional considerations in the treatment and handling requirements of faeces and urine within communities?

Best WASH practices, particularly handwashing with soap, should be strictly applied and maintained as these form an important additional barrier to Ebola virus transmission, and to the transmission of infectious diseases in general (WHO, 2002). All human excreta must be contained in a way that separates it from human contact – at a minimum covered with soil - pending construction of latrines, as detailed elsewhere.

When there are suspected cases of Ebola, immediate action must be taken within the home setting to protect carers and other family members from the risk of contact with body fluids (including urine and faeces). Family members should avoid all direct exposure to body fluids through use of gloves and other PPE and should contain and dispose of such fluids in closed buckets. The same advice applies to the use of latrines: separate latrines should be used by suspected and confirmed Ebola cases. Where there are insufficient latrines to allow for separate use or where suspected and/or confirmed cases are not physically able to use a separate latrine, their body fluids should be contained in a covered bucket and disposed of in a separate latrine, avoiding splashing. Any handling of the excreta should be kept to an absolute minimum and should only be undertaken by individuals wearing, at a minimum, heavy duty gloves, and ideally using full PPE, as detailed above. All disposable protective equipment and/or health-care waste should be put in designated bags and collected by the appropriate service providers or buried. After handling any excreta, handwashing with soap procedures should be followed.

Note on document development and background

The content in this Q&A is based on literature searches of the survival of Ebola in various media and the persistence of other viruses in the environment. It reflects input and advice from microbiologists and virologist with expertise in the environment, environmental engineers, and those with practical knowledge about WASH in emergencies and disease outbreaks. Existing protocols and methods addressing management of excreta in Ebola care facilities as well as excreta handling and treatment were reviewed in conjunction with expert opinion.

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