4

HUMAN HEALTH

4.1 Introduction

Contaminated water and poor sanitation are linked to the transmission of many preventable diseases, the most common of which are diarrhoeal diseases. Diarrhoea is one of the leading causes of morbidity and mortality in children under the age of five, and the leading cause of death in sub-Saharan Africa (SSA) (Global Burden of Disease [GBD] 2016; Prüss-Ustün et al. 2014). Repeated childhood diarrhoeal infections have been associated with growth and cognitive impairment and early death (Mokomane et al. 2018). Research indicates that four pathogens are responsible for the majority of moderate-to-severe diarrhoea cases. These are Rotavirus, *Cryptosporidium* spp., *Shigella* spp. and *Escherichia coli*, all of which are largely preventable with improved water, sanitation and hygiene (Kotloff et al. 2013).

Figure 4.1. Sustainable Development Goals 6

Universal access to safe drinking water and adequate sanitation and hygiene (collectively referred to as WASH) are the focus of Sustainable Development Goal (SDG) targets 6.1 and 6.2 as Figure 4.1 shows. The ongoing disease burden in many parts of Africa is a major impediment to sustainable development. Poor WASH is acknowledged as the main cause of diarrhoeal infections (which are mainly spread by exposure to contaminated faeces) and is also strongly associated with other deadly or debilitating diseases, such as malaria, polio, guinea worm, schistosomiasis and trachoma (United Nations Children's Fund [UNICEF] 2016).

Improving WASH involves creating barriers to limit the spread of pathogens, especially those contained in human and animal faeces. These barriers include managing faeces with effective sanitation systems (the toilet barrier), improving or protecting water supplies to provide safe drinking water (the safe water barrier), establishing effective hygiene practices such as handwashing (the hygiene barrier) and the effectively treating and managing wastewater (the wastewater barrier) (Figure 4.2).

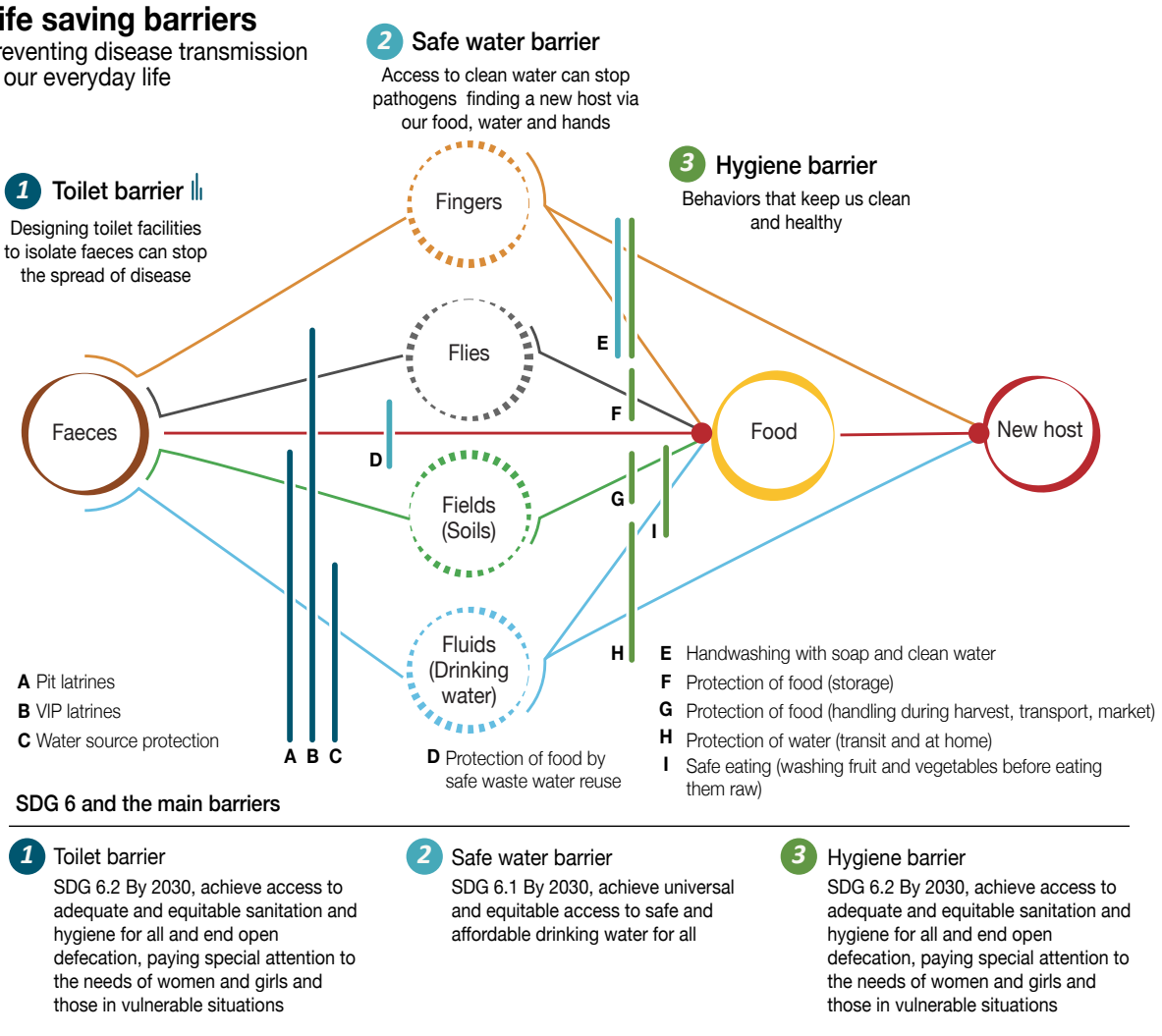
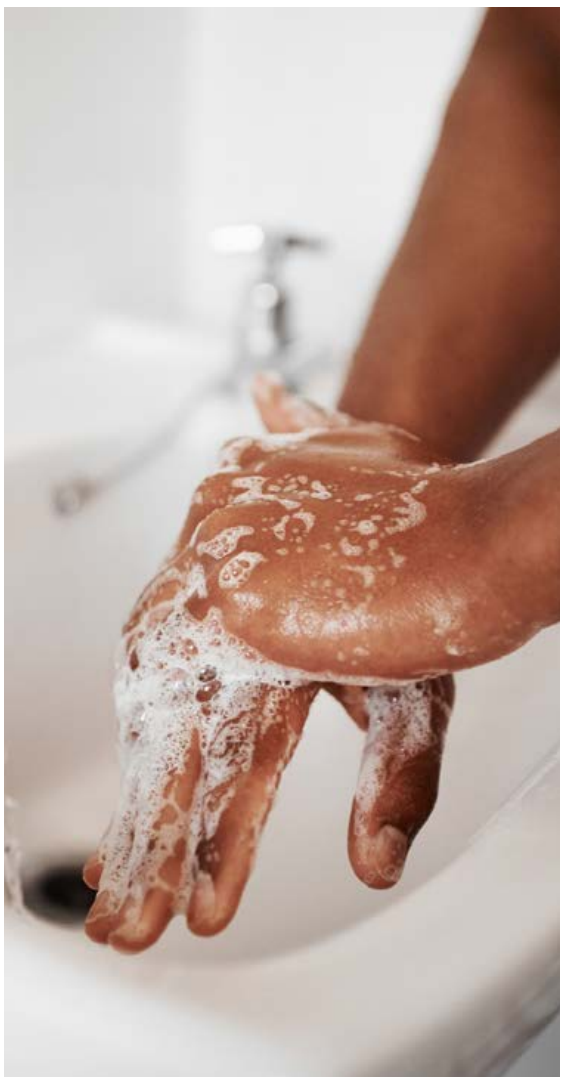


Figure 4.2. The pathways for faecal-oral disease transmission



Hand washing at all times is key to good health

4.2 Toilet Barrier: A Clean Functioning Toilet

Many people in parts of Africa have substandard toilets, toilets shared by many, or no toilet at all. For example, in Nigeria, 52 per cent of schools have no toilet (WaterAid 2018a). A good toilet provides a healthy, safe and dignified place for people to relieve themselves, as well as an environmentally sound method of waste disposal. The Joint Monitoring Programme (JMP) (UNICEF and World Health Organization [WHO] 2017) identifies five categories on a "best to worst" ladder of sanitation service – with 'safely managed' at the top and 'open defecation' on the lowest rung as Figure 4.3 shows.

The JMP ladder has open defecation (classified as 'unimproved sanitation') at the bottom rung, recognizing it as the least desirable option. Given that it facilitates the faecal contamination of water sources and provides breeding grounds for insects and worms that spread the disease-causing microbes contained in faeces, eliminating open defecation is a key action for stopping the spread of disease.

Open disposal of children's faeces from nappies and potties is also a common practice in areas with low latrine coverage and is considered the most important source of contamination in the household environment (Gil et al. 2004). A study in a rural village in Kenya found that the most common disposal method was to throw excreta on the ground adjacent to the house to dry (Okullo, Moturi and Ogendi 2017).

Pit latrines are the most basic form of improved sanitation and are widespread in both rural and urban areas of Africa. Improved latrine designs start with a pit dug into the ground, a simple concrete slab or floor and a cover over the hole to stop insects. These dry toilets only require water for cleaning the slab. More complex dry systems include ventilated and composting pits that are more costly and difficult to construct. In areas where there is a reliable source of water, a pour-flush pit latrine system that uses one to three litres of water per flush may be an option (WHO 1996).

Confining excreta to pit latrines is a positive step, but in many areas in Africa, a single pit latrine may be used by many people. If not properly designed and constructed, the pit latrine may leak or overflow during wet weather and contaminate water supplies or surrounding soil and crops. Latrines need to be constructed and maintained to prevent groundwater contamination. Determining an appropriate site to locate a latrine is often complicated by soil type, rainfall, drainage patterns, capacity requirements and local groundwater use (Graham and Polizzotto 2013). There are numerous guidelines for latrine construction, and most suggest that the latrine should not be located within six metres of a kitchen or house, nor within 15 metres of a well or spring that is used for drinking water (see Lifewater 2011; WASHplus 2015). While the availability of toilets often translates to use of the facilities, there are situations where toilets are hardly used for various reasons as Figure 4.4 explains. Where toilets are not available or not used, there are not only poor health implications but also economic costs (Figure 4.5).

Box 4.1. Accessible toilets

In many parts of Africa, disabled children, adults and the infirm are isolated by the lack of accessible toilets. Providing toilets for the able-bodied is often difficult enough, so making them accessible to the less mobile is often not a consideration. Disability disproportionately impacts women, girls and the poor (Disability Africa 2018). Data on disability in Africa is scarce, but a report in 2011 estimated that 6.4 per cent of children aged zero to 14 years in sub-Saharan Africa have a disability and 1.2 per cent are severely disabled (WHO and World Bank 2011). The inability to access facilities stops many disabled children from attending school (WHO 2015) or obtaining appropriate health care. Public toilets need to be built in accordance with good design principles and in emergencies, the disabled need to be located close to accessible WASH locations (UNICEF 2016).

Why isn´t there a toilet and why not use the toilet if it´s there?

Lack of funds - 75% cite this reason [1]	Long queues - many households may share a single facility [5]
Construction may be seen as a government responsibility [2]	Dilapidated (non maintained) facilities
Lack of space in household	Open defecation is a childhood practice that continues[6]
Lack of knowledge	Limited understanding of health and hygiene[7]
Cultural practices	Available open space for defecation[8]
Household latrine seen as reducing the purity of the home [3]	Pit latrine is full
A low-quality toilet is an embarrassment so better to have none [4]	Source: 1, 2 and 8 Okullo et al. 2017; 2 and 3 Coffey et al., 2014; 4 Flynn 2015; 5 Banerjee & Morella, 2011; 6 Galan et al. 2013, 7 Geetha et al., 2014.
Lack of water	

Figure 4.4. Availability and use of toilets

Improved versus Unimproved Sanitation

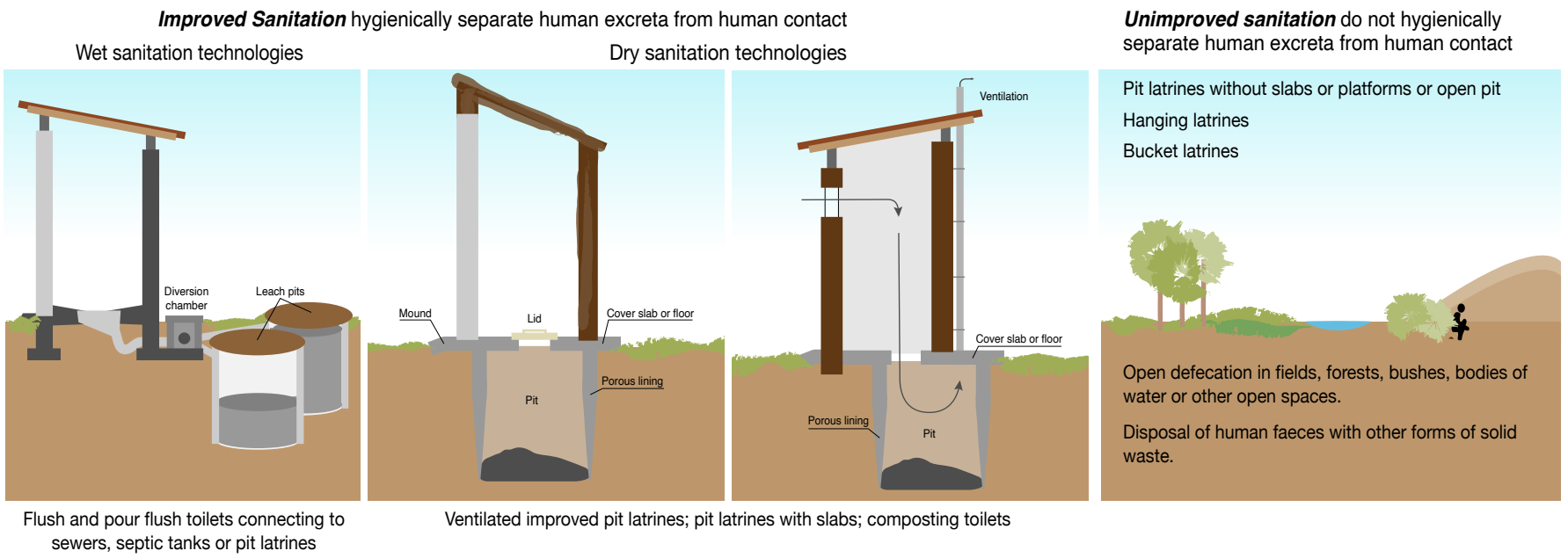


Figure 4.3. Improved versus unimproved sanitation

Source: OpenLearn, Stockholm Environment Institute, 2007; WHO and IRC, 2003; JMP, 2017.

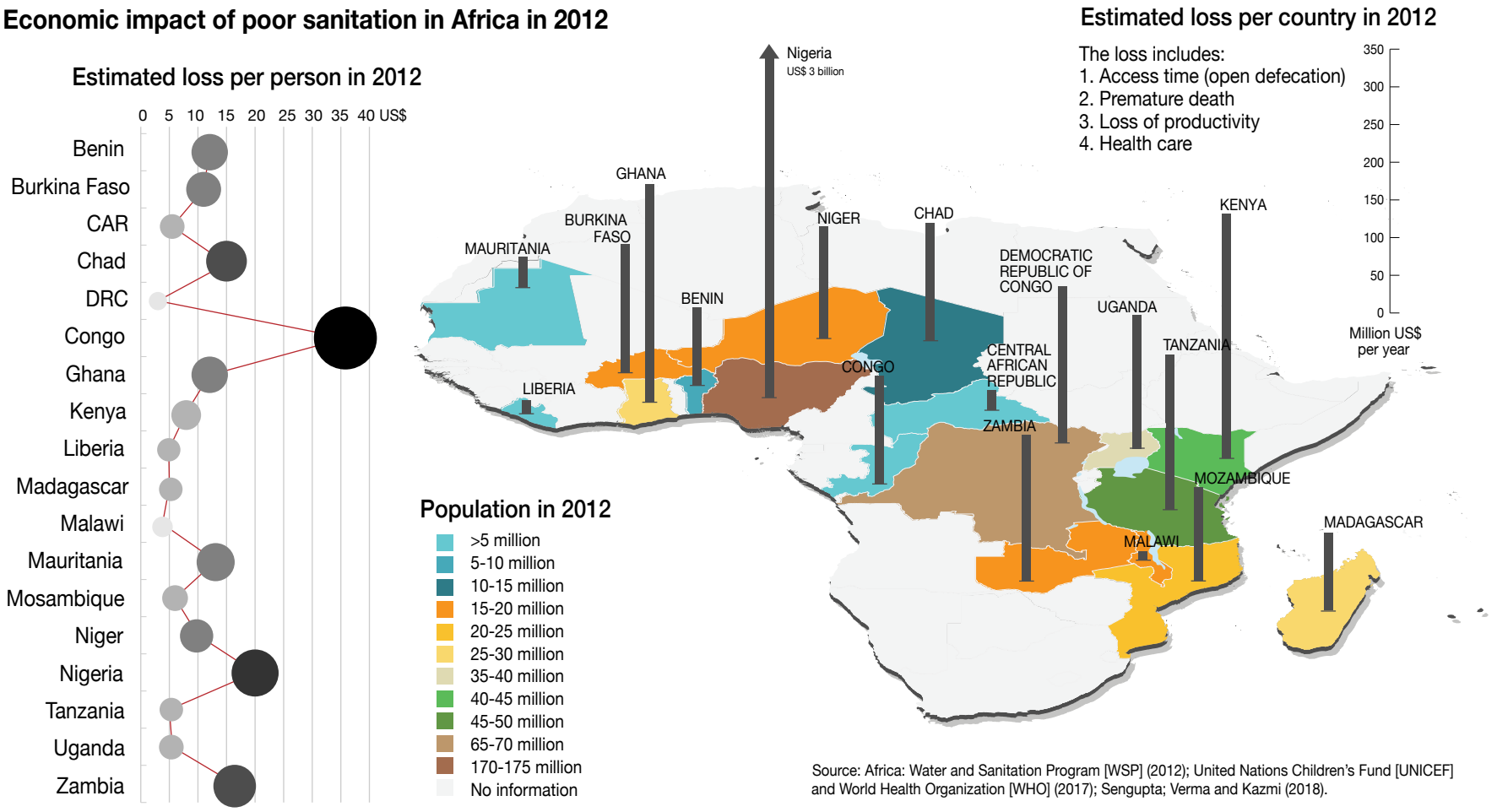


Figure 4.5. The cost of missing toilets

Box 4.2. Toilets for women and girls

Improving access to safe sanitation facilities can be especially beneficial to women and girls, as they are more vulnerable to violence when using public facilities or seeking privacy for open defecation. It can also increase school attendance, as without proper facilities, menstruating girls may stay home in order to more easily manage menstrual hygiene (Burt, Nelson and Ray 2016). The best toilets are the ones that people will use and maintain. Toilets for women will be most successful if, as shown in Figure 4.6, they consider:

Design – Responsive to the needs of women and girls. Apart from the universal requirement for cleanliness, odour control, water and soap and the disposal or reuse of menstrual hygiene products, among other needs, there may also be special culturally prescribed design requirements, such as a concealed entrance, or in the case of shared facilities, toilets separated by gender (Schmitt et al. 2018).

Privacy – Encourage daytime use. Cultural expectations regarding modesty may increase privacy requirements. Women and girls may restrict the intake of food and water during the day, possibly risking dehydration, so they can wait for the privacy of darkness. Holding on can lead to anxiety, increased urinary tract infections, constipation, reduced productivity and isolation.

Security – Safe and not too distant. Going off the beaten track or using public or shared facilities at night increases vulnerability to attack and sexual violence.

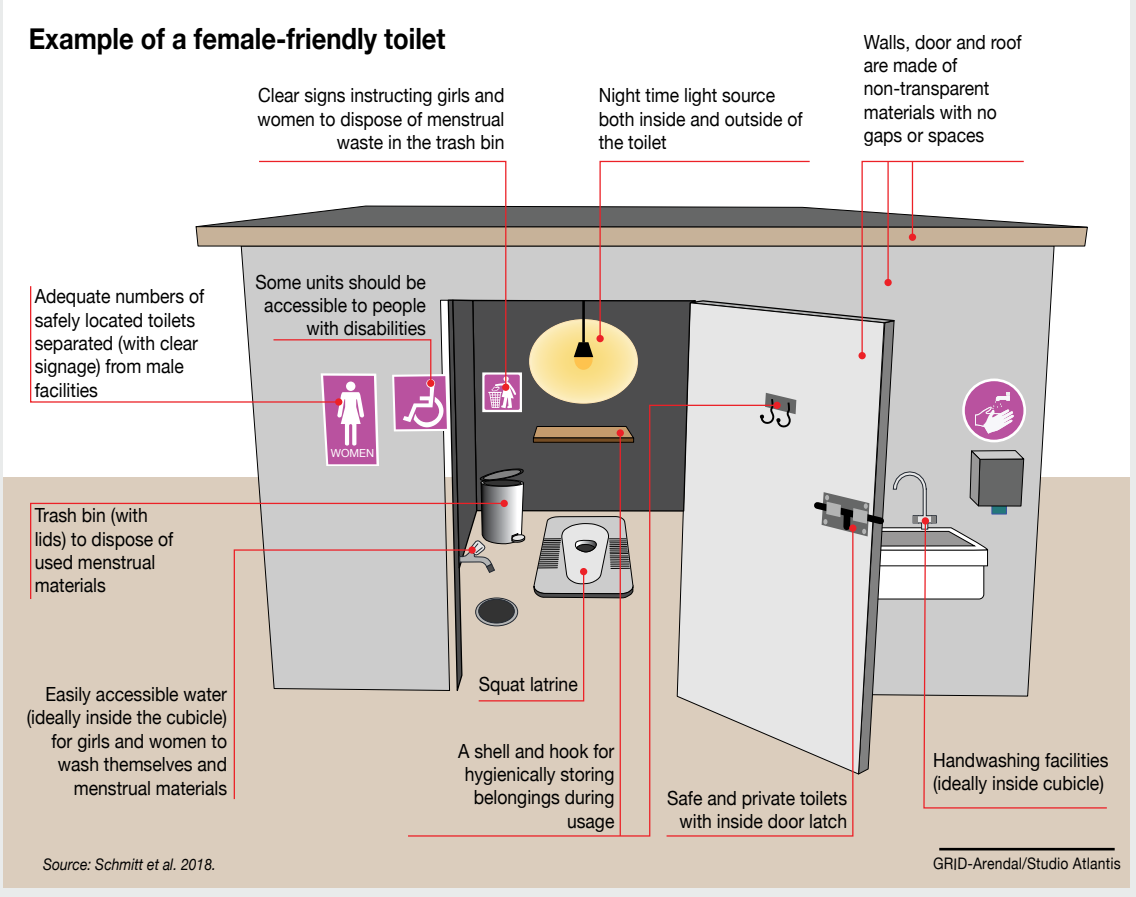


Figure 4.6. Improved versus unimproved sanitation

Affordable – Women are poorer than men (United Nations Entity for Gender Equality and the Empowerment of Women [UN Women] 2018) and having to pay to use the toilet can be an added financial burden that encourages open defecation.

Source: Schmitt et al. (2018).

4.3 Safe Water Barrier: Clean Water to Drink and Cook with

Improving health and halting the spread of infection requires access to safe water for drinking, cooking and washing. A contaminated water supply can cause acute and chronic diarrhoea and other non-diarrhoeal diseases. Water quality and quantity vary across Africa, with rural populations and slum residents generally the most disadvantaged (UNICEF and WHO 2017).

Most diarrhoeal diseases and many parasitic infections are spread by pathogens found in human faeces (some may also be spread in animal waste). The faecal-oral mechanism of transmission involves the faeces of an infected person coming into contact with the mouth of another person, and contaminated drinking water or food are common routes. Run-off from sites of open defecation, overflowing and poorly designed pit latrines and agricultural plots where excreta are used as fertilizer can spread faecal material into surface and groundwater supplies (Ngoran, Dogah and Xue 2015). Leachate from poorly managed solid waste and human and animal wastewater can also be a source of faecal pollution (Delahoy et al. 2018).

In many areas in Africa, water systems are under stress as a result of rapid population growth, increasing pollution and changing rainfall patterns. UNICEF and WHO (2017) classify sources of drinking water into improved – those that have the potential to provide safe drinking water – and unimproved – those that potentially have unsafe levels of disease-causing contamination (Figure 4.7). The most recent estimates from the JMP (UNICEF and WHO 2017) indicate that 7 per cent of urban dwellers and 27 per cent of people in rural areas of sub-Saharan Africa rely on an unimproved water source.

Unfortunately, access to an improved water source does not necessarily correlate with improved health outcomes and this has been recognized in the updated JMP ladder for drinking water. Water at the point of supply may be safe but additional factors, such as transport, storage and reliability can be important (Gundry et al. 2006; Chalchisa, Megersa and Beyene 2017). For example, survey results collected from an informal settlement in Burkina Faso during the rainy season found that despite residents having access to improved water sources, many children still suffered from frequent incidents of diarrhoea (Dos Santos, Ouédraogo and Soura 2015). Physical distance and time required to collect water is important, as water quality has been shown to deteriorate between collection at the source (even if it is an improved source) and storage in the home (Shields et al. 2015).

In households without running water, vessels are used to store water for drinking, cooking and washing. Numerous studies have shown that water stored in wide mouth containers can have higher microbial concentrations than the source water (see Mølbak et al. 1989). Deterioration in the quality of stored water can occur through contact with hands (Pickering et al. 2010), ladles and insects, so an appropriately sealed container is an essential step in preventing contamination after collection (Jensen et al. 2002).

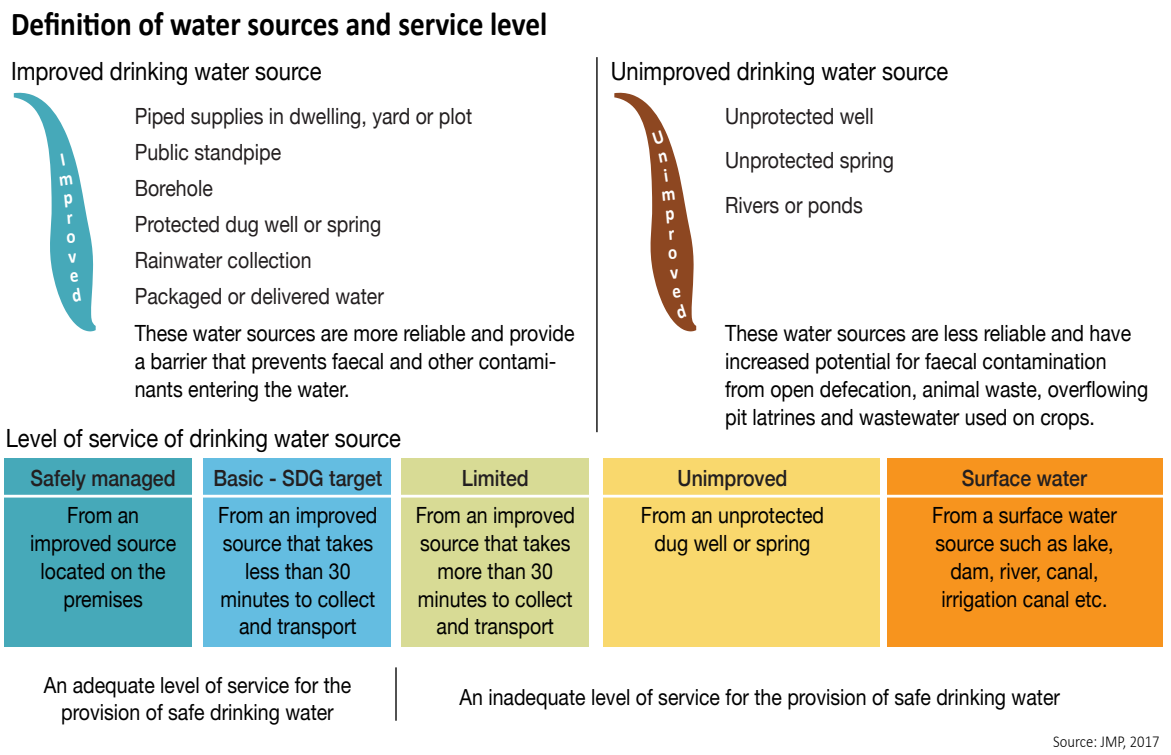


Figure 4.7. Definition of water sources and service level

Figure 4.8 shows examples of poor and good practices in handling and storage of water in the household.

Poor handling of water stored in the home can contaminate previously safe water (Shields et al. 2015). Studies have shown that stored water can contain more than 100 times the number of faecal indicator bacteria than the original waste source (Pickering et al. 2010).

Many pathogens in drinking water can be killed with disinfectant and residual disinfectant can limit the growth of bacteria during storage. However, not all disease-causing agents are eliminated by common treatments such as chlorine. WHO (2017) suggests that common bacteria such as *Cryptosporidium* spp. and some viruses can survive treatment and that murky water may require higher levels of disinfectant, as turbidity can protect microorganisms.

Poor handling of water can result in contamination

Figure 4.8. Handling and storage of water in the household

4.4 Hygiene Barrier: Water for Washing and Cleaning

The SDGs call for universal access to water and sanitation and have upgraded the Millennium Development Goals (MDGs) to include hygiene, recognizing the essential role that hygiene plays in the prevention of disease. People need an adequate supply of clean water for personal hygiene – a minimum of six to seven litres per person per day for handwashing and personal hygiene (excluding water necessary for consumption, laundry and bathing) (WHO 2017).

Handwashing with soap after going to the toilet or coming into contact with children's excreta is the most important barrier to the faecal-oral spread of disease (Pickering et al. 2010; Freeman et al. 2014). Handwashing before touching food and handling drinking water is also important in reducing the transmission of the pathogens that cause a significant number of deaths related to diarrhoea, such as Rotavirus and *Cryptosporidium*. Having access to enough water for washing the face and body also reduces the likelihood of contracting water access-related diseases, such as trachoma and schistosomiasis (Esrey et al. 1991).

It is estimated that entrenching handwashing habits in Sub-Saharan Africa could save the lives of up to 500,000 children each year (UNICEF 2018). However, only 15 per cent of homes in the region have handwashing facilities with soap (UNICEF and WHO 2017), and 42 per cent of African health care facilities such as clinics and hospitals lack access to improved water for hygiene (UNICEF and WHO 2015).

Studies have shown that handwashing with soap is a cost-effective mechanism for reducing the spread of faecal borne diseases – more effective than improving water quality or waste management (Cairncross et al. 2010).

The handwashing message – school toilet door in Kibera, Kenya.

Box 4.3. Water for childbirth – the 'six cleans'

WHO defines clean birth and postnatal practices as the 'six cleans' – handwashing of the birth attendant before birth, clean birth surface, clean perineum, cutting of the umbilical cord using a clean implement, clean cord tie, and a clean cloth for drying (WHO 1997).

In sub-Saharan Africa, significant progress has been made in reducing risk of death in children under five, but progress has been slower for newborns. The region accounts for 38 per cent of global neonatal deaths and has the highest newborn death rate (34 deaths per 1,000 live births in 2011). There are many causes of this high mortality rate, but poor hygiene during birthing could be responsible for up to 15 per cent of neonatal deaths (UNICEF 2017). Lack of access to water and sanitation is linked to neonatal infection and maternal mortality. It is estimated that clean childbirth practices could avert 6 to 9 per cent of the 1.16 million annual newborn deaths in countries in sub-Saharan Africa (Lawn and Kerber 2006).

Many women who give birth at home do not have access to clean water and sanitation (less than 10 per cent according to a study that examined data from 22 countries in west and central Africa (Gon et al. 2016). Even women who attend a health care facility may not be guaranteed acceptable hygiene standards. A WHO survey of health care facilities in a selection of low- and middle-income African states revealed that 42 per cent did not have an improved water source within 500 metres of the facility, 16 per cent did not have improved sanitary facilities and more than 45 per cent lacked adequate handwashing facilities (UNICEF and WHO 2015).

Box 4.4. Water and HIV/AIDS

HIV/AIDS is a major public health concern and one of the leading causes of death in Sub-Saharan Africa. It is estimated that more than 6 million people in the region were living with HIV and 75 per cent of new infections are among girls aged between 15 and 19 (UNAIDS 2018).

Providing clean water and sanitation is particularly important for people with compromised immune systems as they are susceptible to diarrhoeal diseases and skin infections (Obi et al. 2006). By reducing the risk factors for diarrhoeal diseases, people living with HIV experience better nutrition and can have an improved quality of life.

Evidence suggests that households that include people living with HIV/AIDS require and use more water than those without the infection, and therefore suffer most during periods of water scarcity (Mbereko, Scott and Chimbari 2016). Mothers with HIV/AIDS feed their infants with formula, which requires the addition of safe water, and antiretroviral drugs require at least 1.5 litres of clean water to be effective (WaterAid 2018b).

4.5 The Wastewater Barrier

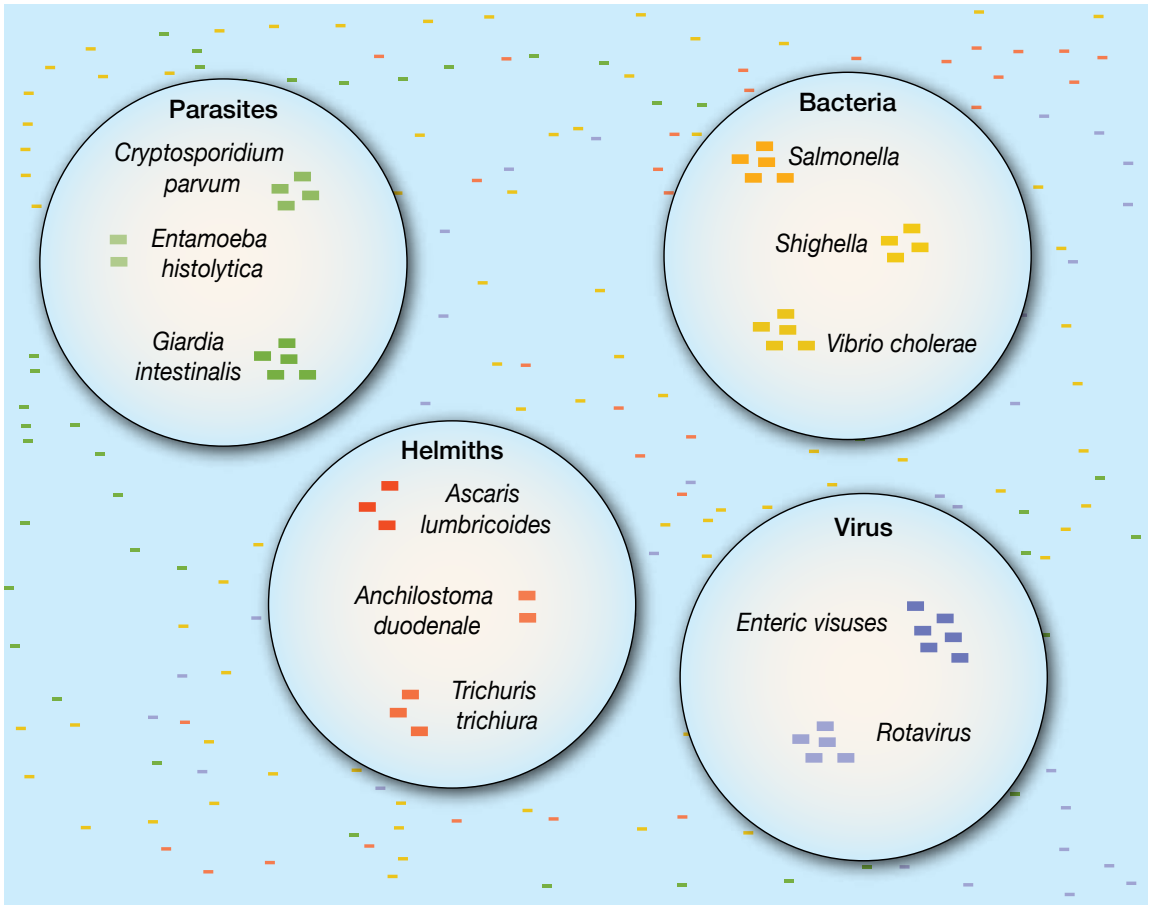
The use of wastewater in agriculture can have significant benefits, increasing yields and providing a year-round source of water in areas of water scarcity. However, there are potential risks to human health and the environment, as shown in Figure 4.9, need to be considered. Those at risk from disease include farmers who are exposed to wastewater and consumers of contaminated produce, as well as people living near wastewater-irrigated properties. The WHO guidelines for the use of wastewater, excreta and greywater in agriculture (2006) include a number of risk management approaches that acknowledge different technical and institutional capacities. In areas where there is no or inadequate wastewater treatment, options to decrease the risk of infection from pathogens include both cultivation and post-harvest actions (Amoah et al. 2011):

- Treating wastewater with sand filtration or pond networks
- Stopping irrigation before harvest to allow pathogens to die off
- Applying wastewater to roots rather than leaves
- Choosing crops that minimize the chance of infection, such as vegetables that need to be peeled and cooked
- Washing vegetables during preparation
- Washing salad vegetables with disinfectant
- Ensuring cooking temperatures and times are sufficient to kill pathogens

These interventions generally target risks from pathogens, but in areas of rapid urbanization and industrialization, there are also potential chemical and heavy metal risks associated with wastewater use (Dickin et al. 2016). Because these contaminants are less likely to cause acute illness compared to pathogens, they have not been significantly investigated. A recent study of long-term (more than 50 years) wastewater-irrigated vegetable plots in Addis Ababa found faecal contamination above safe levels but heavy metal concentrations in the vegetables were at levels that posed no risk to human health (Woldetsadik et al. 2017).

Always wash vegetables when preparing them for a meal

Concentrations of micro-organisms excreted in one litre of wastewater



Source: Corcoran et al. (2010).

Figure 4.9. Potential environmental and health risks of using wastewater

4.6 Disease Related to WASH

Poor access to WASH is devastating for communities, especially the young, pregnant women and the immune-compromised. Inadequate WASH has significant economic, environmental and social impacts. The most significant pathways for faecal-oral disease transmission are water, soil, flies, fingers and food. Contracting an illness from exposure to pathogens depends on the dose, the infectiousness of the pathogen, and the health of the exposed person. Table 4.1 lists the most common WASH-related diseases and exposure pathways.

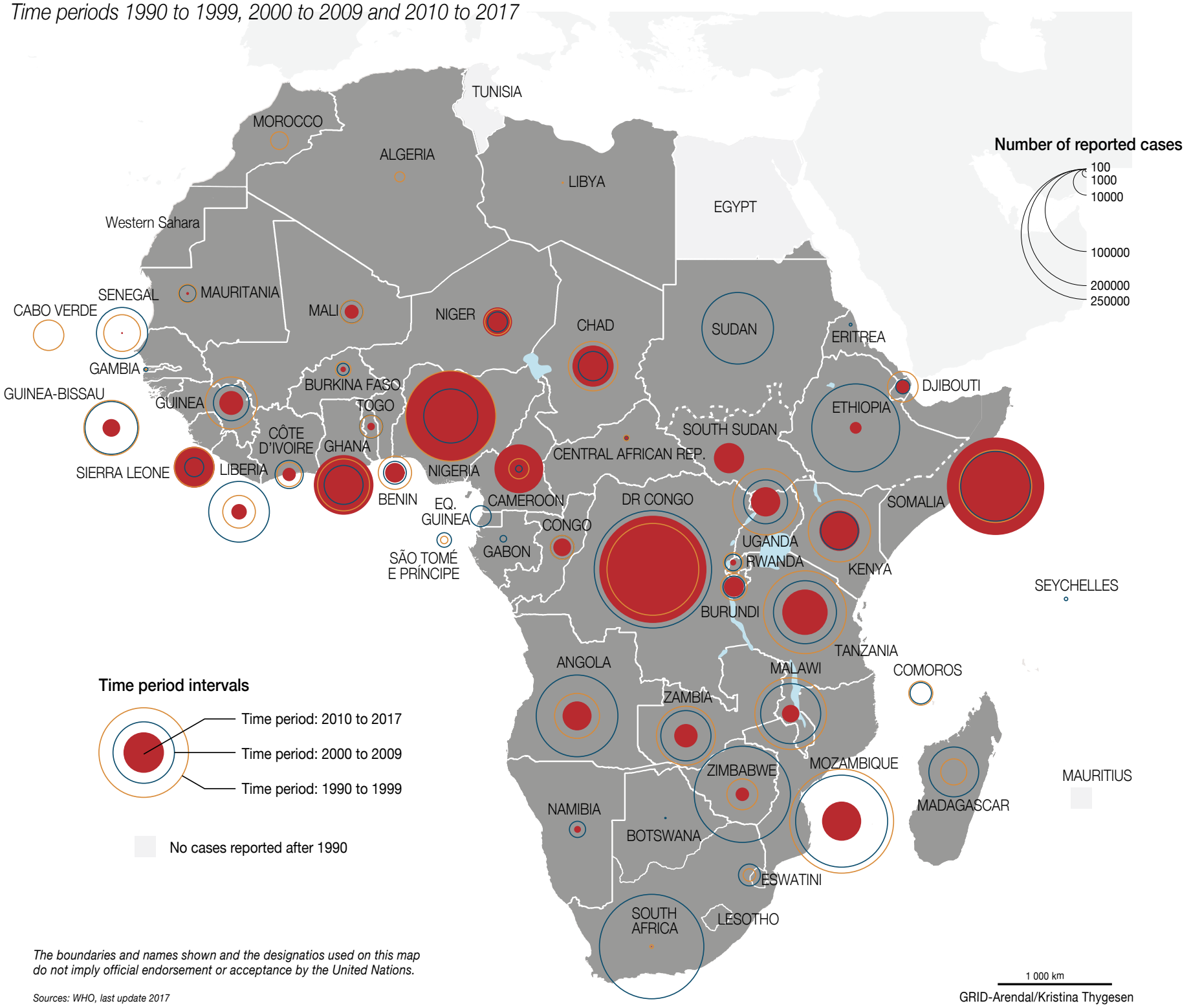
While the global incidence of many of the diseases listed in Table 4.1 is declining, many are still prevalent in Africa, where they overlap geographically and can be co-endemic (Hotez et al. 2018). Examples include:

Cholera cases are decreasing worldwide, but in Africa both endemic occurrences (continual cases) and periodic epidemics persist as Figure 4.10 shows. Sub-Saharan Africa bears the biggest cholera burden (Ali et al. 2015) and also has the highest mortality rate per case (WHO 2019c). The oral cholera vaccine (OCV) can be used to prevent outbreaks during crisis situations as it provides protection for approximately three years. However, long-term control involves a combination of vaccination and WASH (WHO 2019c). Focusing targeted interventions in countries with the highest incidences (Democratic Republic of the Congo, Ghana, Nigeria, Somalia and Sierra Leone) could reduce cases by almost 40 per cent across the region (Lessler et al. 2018).

Epidemics are often associated with natural disasters, most notably floods or periods of heavy rain, when sanitation systems overflow and contaminate water sources and the environment. Prolonged drought can also increase the risk of infection, as limited water availability reduces both water quality and hygiene (Rieckmann et al. 2018). Natural disasters are expected to increase in scale and frequency as a result of climate change and population growth in disaster-prone regions, which may further increase the risk of high-mortality cholera epidemics

Country reported cases of cholera by time intervals

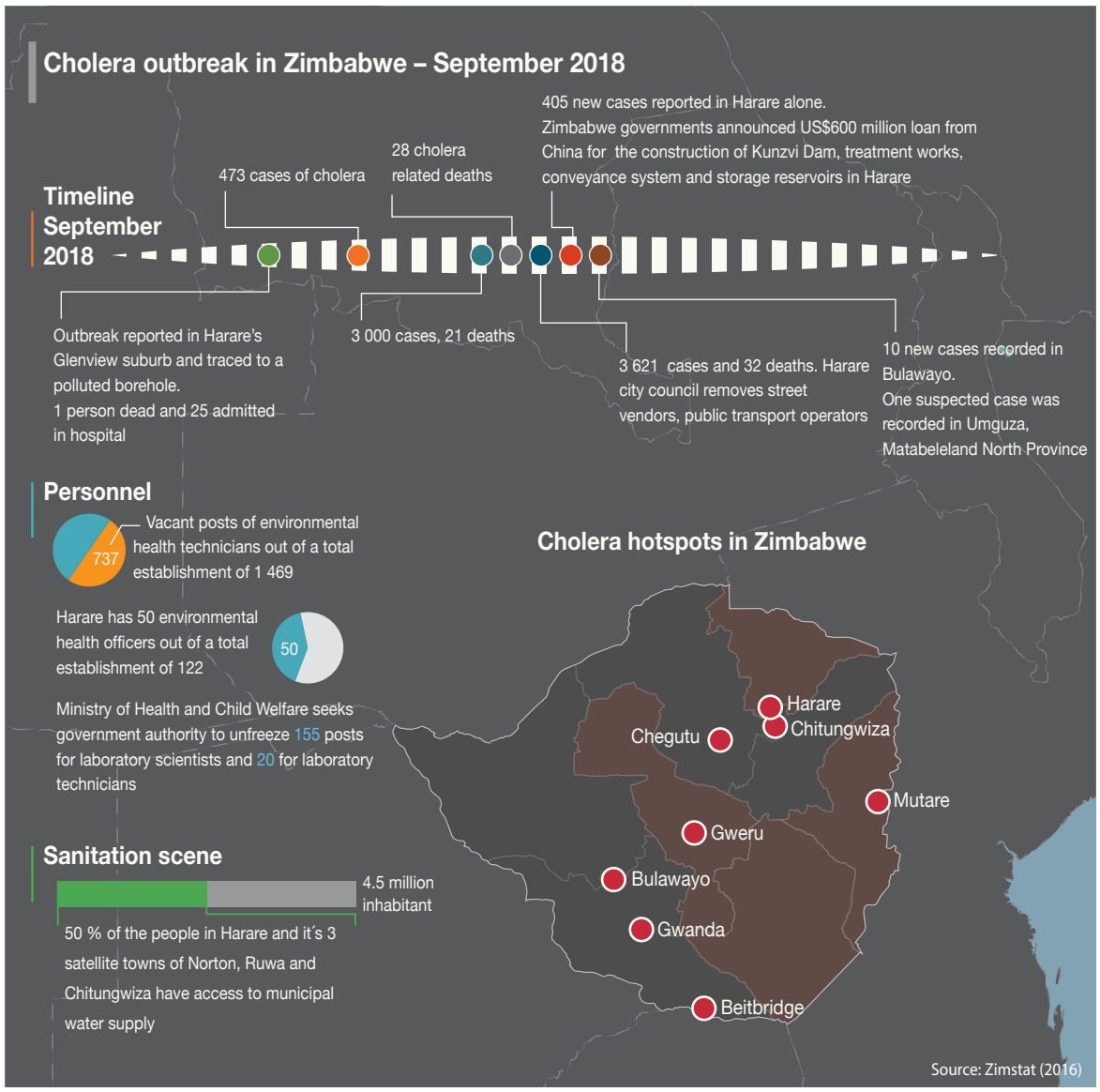
Time periods 1990 to 1999, 2000 to 2009 and 2010 to 2017



The boundaries and names shown and the designatios used on this map do not imply official endorsement or acceptance by the United Nations.

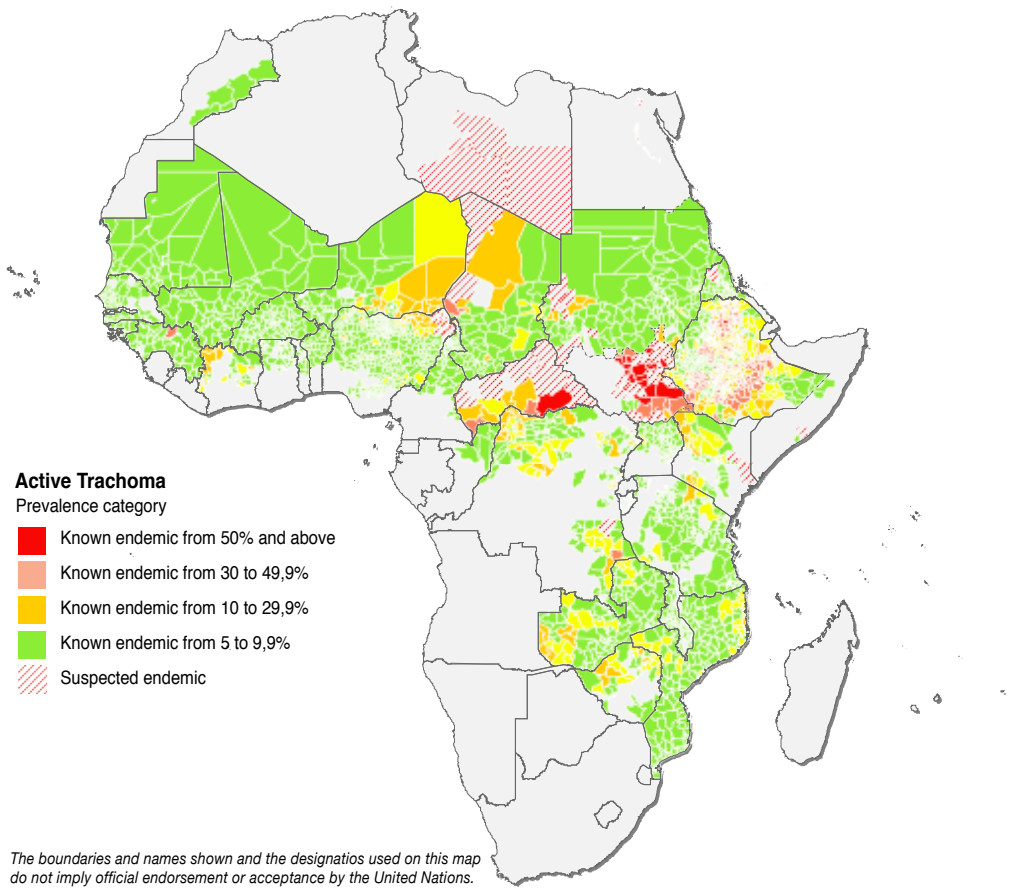
Sources: WHO, last update 2017

Figure 4.10. Cholera incidences in Africa



Cholera is a medieval disease that has been eradicated in many countries through good sanitation practices

Trachoma prevalence in children at the aged of 1 to 9 in 2019



The boundaries and names shown and the designatios used on this map do not imply official endorsement or acceptance by the United Nations.

Source: Trachoma Atlas (n.d.). See http://www.trachomaatlas.org/.

Figure 4.11. Trachoma prevalence in children aged 1-9

(Serdeczny et al. 2016). Cyclone Idai struck central Mozambique in March 2019. A second cyclone hit the northern region in late April. Both storms resulted in widespread flooding and contamination of water supplies. During the week following the first cyclone, officials in Mozambique declared a cholera outbreak, with more than 6,000 cases reported by the beginning of May 2019 (Reliefweb 2019). Thousands of people have received the OCV in an effort to halt the spread of the disease.

Trachoma is a bacterial eye infection that is responsible for vision impairment in about 1.9 million people globally (WHO 2018d). The global trend of vision impairment from the disease has fallen rapidly due to a concerted eradication programme, although Africa remains the most affected region, with the endemic disease evident in 26 countries as Figure 4.11 shows (WHO 2018d; Herricks et al. 2017). The disease typically infects children, but without treatment the most serious impacts begin around 30 years of age for both men and women, with women losing vision at a higher rate. The bacteria are present in discharge from the eyes and nose of infected people and are easily spread via hands, cloths and insects. Its transmission can be halted by treating the infection with antibiotics and through improved access to water for facewashing (Nwabor et al. 2016).

Table 4.1. Water-related diseases

Waterborne pathogens

- improve water quality

Class	Pathogen name	Shape	Disease	Infection source	Control strategy
Virus - a small infectious agent that replicates only inside the living cells of an organism.	Hepatitis A & E		Viral hepatitis - liver inflammation and damage	Faeces	Vaccination; safe drinking water and food; handwashing
	Rotavirus		Diarrhoea	Faeces	Handwashing; vaccination
	Adenovirus		Diarrhoea	Faeces Respiratory secretions	Handwashing
Bacteria - are microscopic, single-celled organisms that thrive in diverse environments. These organisms can live in soil, the ocean and inside the human gut.	*Campylobacter*		Diarrhoea	Intestinal tract of warm-blooded animals	Thoroughly cooking food Handwashing
	Vibrio cholerae		Cholera Diarrhoea	Faeces	Safe drinking water and food
	Shigella dysenteriae		Shigellosis Diarrhoea	Faeces	Handwashing
	Salmonella enterica		Diarrhoea	Faeces	Thoroughly cooking food Handwashing
	Escherichia coli		Diarrhoea	Faeces	Handwashing Safe drinking water and food
Protozoa - are single celled organisms. They live in a wide variety of moist habitats including freshwater, marine environments and the soil.	*Entamoeba*		Amoebic dysentery	Faeces	Handwashing
	Crytosporidium		Watery diarrhoea	Faeces	Handwashing Safe drinking water and food
	Cyclospora cayetanensis		Diarrhoea	Faeces	Safe drinking water and food
	Enterocytozoon bieneusi		Diarrhoea	Animal faeces; human faeces; inhalation	Handwashing Safe food
	Giardia		Watery diarrhoea	Faeces	Handwashing Safe food
	Isospora belli		Mild diarrhoea; abdominal discomfort; low-grade fever	Faeces	Safe drinking water and food
Helminths - are worm-like parasites that survive by feeding on a living host to gain nourishment and protection, sometimes resulting in illness of the host.	*Ascaris lumbricoides* (roundworm)		Intestinal worm infection	Faeces	Handwashing
	Enterobius vermicularis (pin worm)		Intestinal worm infection	Faeces	Handwashing
	Hymenolepis (tape worm)		Intestinal worm infection	Faeces	Handwashing

Table 4.1. Water-related diseases *(continued)*

Water - access related pathogens

- increase water accessibility and reliability; improve hygiene practices

Class	Pathogen name	Shape	Disease	Infection source	Control strategy
Mite Mites are very small, ranging from 0.5 to 2.0 mm in length; there are thousands of species.	*Sarcoptes scabiei*		Scabies – itchy rash	Skin-to-skin contact	Thorough cleaning
Bacteria - are microscopic, single-celled organisms that thrive in diverse environments. These organisms can live in soil, the ocean and inside the human gut.	*Treponema pertenue*		Yaws – skin, bone and joint infection	Faeces	Improve cleanliness and sanitation
	Chlamydia trachomatis		Trachoma – roughening of inner surface of eyelids, blindness	Contact with secretions; spread by flies	Improve personal hygiene

Water-based: contact with water, for example, bathing or swimming

-control vector populations; reduce surface water contamination

Class	Pathogen name	Shape	Disease	Infection source	Control strategy
Helminths - are worm-like parasites that survive by feeding on a living host to gain nourishment and protection, sometimes resulting in illness of the host.	*Schistosoma*		Bilharzia	Contaminated water (snails)	Clean drinking water
	Dracunculus medinensis		Guinea-worm disease	Urine, faeces	Clean drinking water

Water - related vector diseases from biting insects that breed in water

- control breeding sites and use preventative measures such as mosquito netting

Class	Pathogen name	Shape	Disease	Infection source	Control strategy
Virus - a small infectious agent that replicates only inside the living cells of an organism.	Flaviviridae Flavivirus		Yellow fever – fever, Liver damage; Dengue fever; West Nile fever	Mosquito bite	Insect control
Protozoa - are single celled organisms. They live in a wide variety of moist habitats including freshwater, marine environments and the soil.	*Plasmodium falciparum*		Malaria – fever	Mosquito bite	Insect control; reduce uncovered stagnant water
	Trypanosoma brucei		African sleeping illness – fever; Joint pain; later stage neurological symptoms	Tsetse fly bite	Insect control
Helminths - are worm-like parasites that survive by feeding on a living host to gain nourishment and protection, sometimes resulting in illness of the host.	*Onchocerca volvulus* (oarasitic worm)		River blindness	Black fly bite	Insect control
	Wuchereria bancrofti (round worm)		Lymphatic filariasis – painful lymph nodes; Lymphedema; Elephantiasis	Faeces	Insect control; improve personal hygiene

Source: Adapted from White, Bradley and White (1972); Mara and Feachem (1999) and WHO (2017).

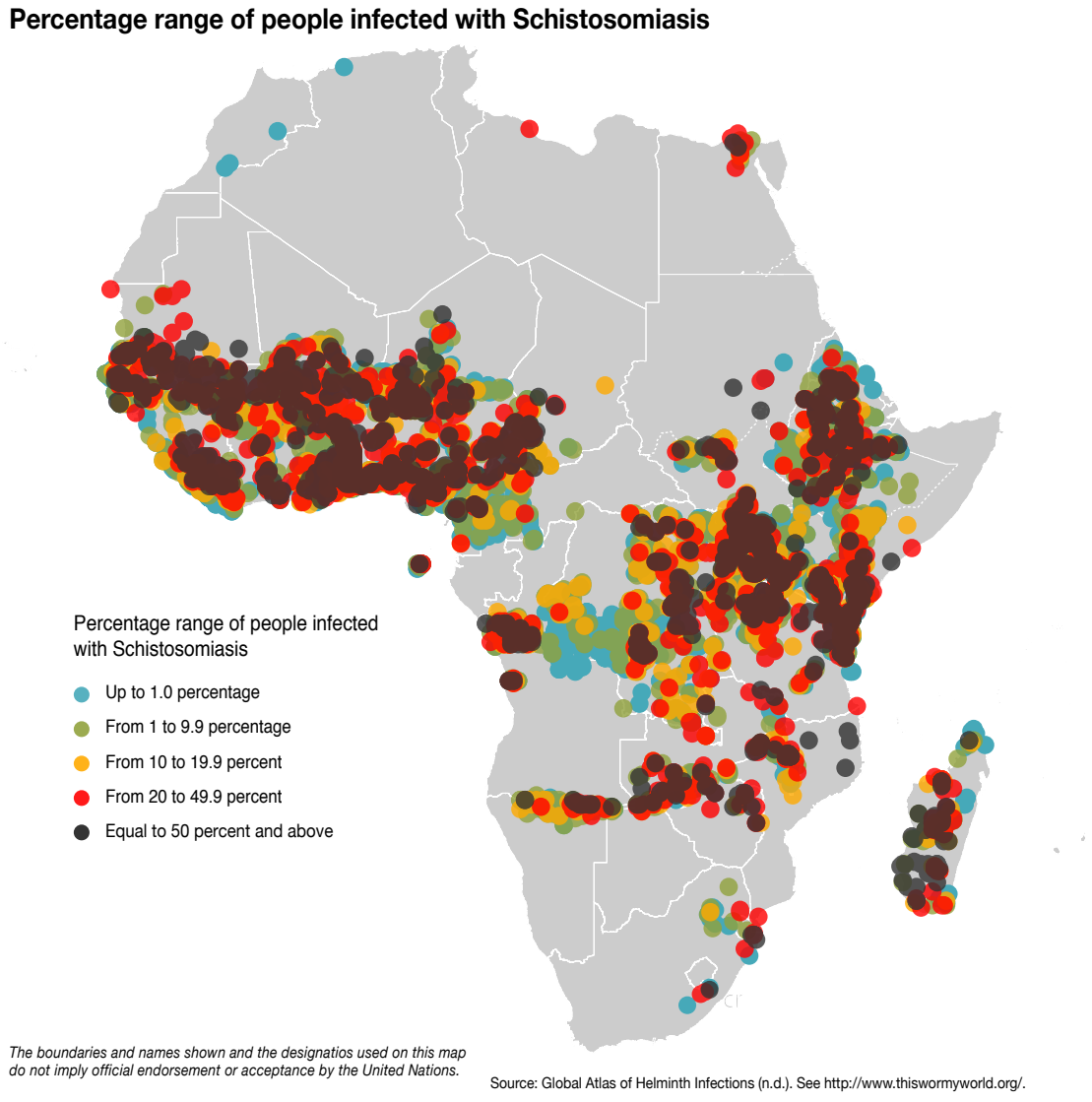


Figure 4.12. Schistosomiasis prevalence in Africa

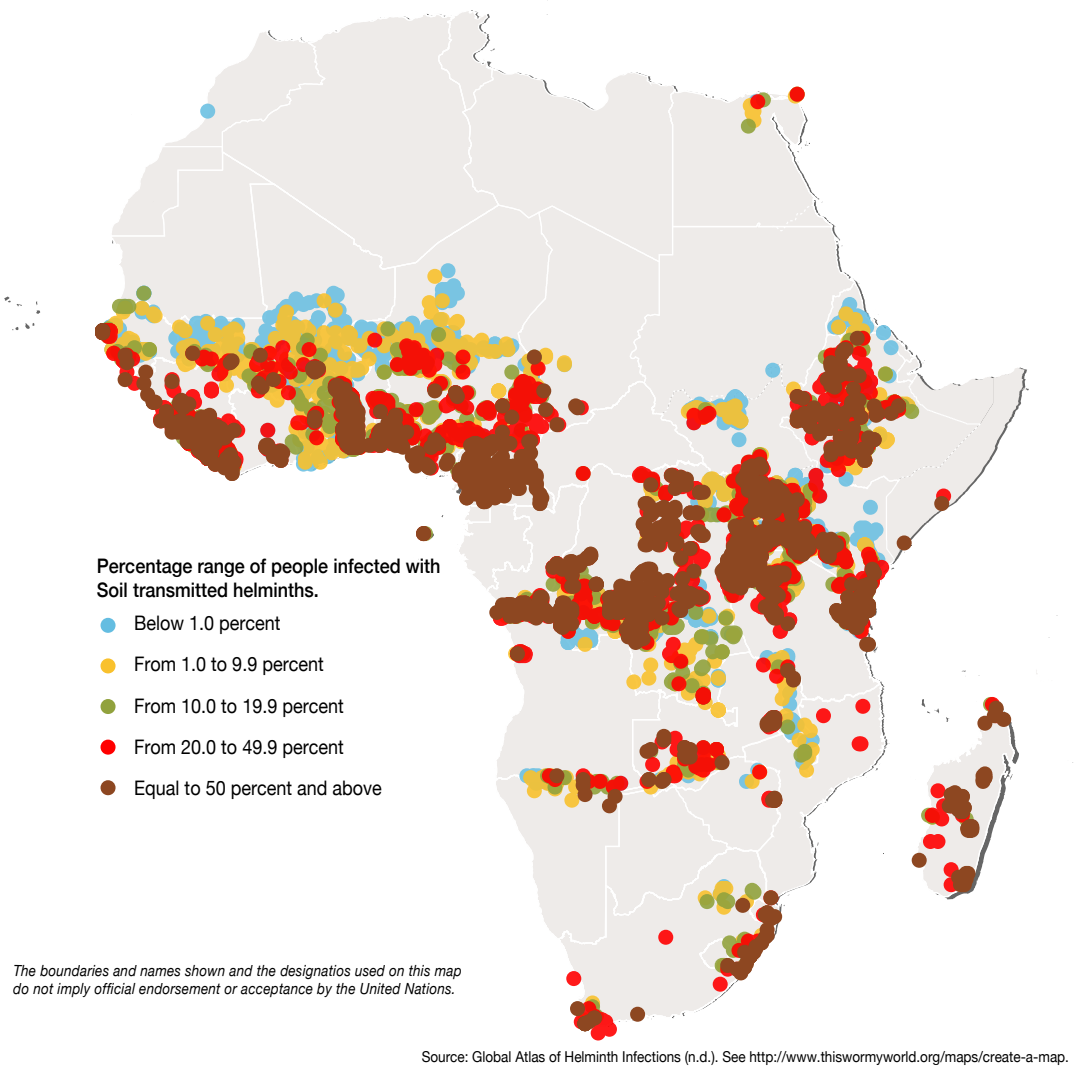


Figure 4.13. Ratio of people infected with soil transmitted helminths (STHs)

Schistosomiasis, also referred to as 'bilharzia' and 'snail fever', affects more than 200 million people, the majority of whom live in sub-Saharan Africa as Figure 4.12 shows (Lai et al. 2015). Infection in humans is caused by contact with water that is infested with trematode flukes carried by freshwater snails. The larvae penetrate the skin of people who come into contact with infested water. The larvae then develop into adult worms in the body, colonizing the blood vessels, where they effectively invade the immune system. They can release hundreds of thousands of eggs a day, some of which are excreted in faeces or urine, while others are trapped in nearby tissues (Colley et al. 2014). The trapped eggs produce an immune response, causing chronic diseases such as anaemia, stunted growth, impaired cognition and heart, liver, urinary and gastrointestinal complications.

Bilharzia is more prevalent among children

Soil transmitted helminths (STHs) are parasites that live in soil. Infection is caused by the ingestion of the parasitic eggs from four main species of roundworm, whipworm and hookworm (Tchuenté 2011). Infected individuals excrete parasite eggs in their faeces. In areas where open defecation occurs, pit latrines overflow and children's faeces is disposed, the soil and water become contaminated with faeces containing worm eggs.

It is estimated that more than 1.5 billion people are infected with STHs worldwide, with the greatest number of infections in sub-Saharan Africa in areas shown in Figure 4.13 (WHO 2019d). Heavy infestations can cause diarrhoea and abdominal pain, malnutrition, general malaise and weakness, as well as impaired growth and physical development in children (WHO 2019d). Control of STHs includes periodic treatment of at-risk populations with deworming medicines. The global target is to eliminate illness due to STHs in children by 2020 and this requires treatment of least 75 per cent of the children in endemic areas, estimated at 836 million in 2016 (WHO 2019d).

Box 4.5. WASH and disease

Waterborne diseases are intestinal diseases that spread through faecal contamination of drinking water. Examples include typhoid, giardiasis, cholera and rotavirus. The symptoms of intestinal diseases are typically watery diarrhoea, which when severe and not properly treated, can rapidly lead to dehydration and death.

Rotavirus *– the leading cause of hospitalization and death of children in Africa (ROTA Council 2016).*

Water access-related diseases are sometimes called 'water-washed diseases' and are related to availability and use of water. These diseases can be prevented if people have adequate supplies of clean water available for personal hygiene, such as hand and face washing (White, Bradley and White 1972). Water access-related diseases can be divided into two groups – faecal-oral intestinal diseases such as Shigella and superficial skin and eye infections such as trachoma.

Trachoma *– almost 83 million people in Africa were treated with antibiotics for trachoma in 2016 (WHO 2018a).*

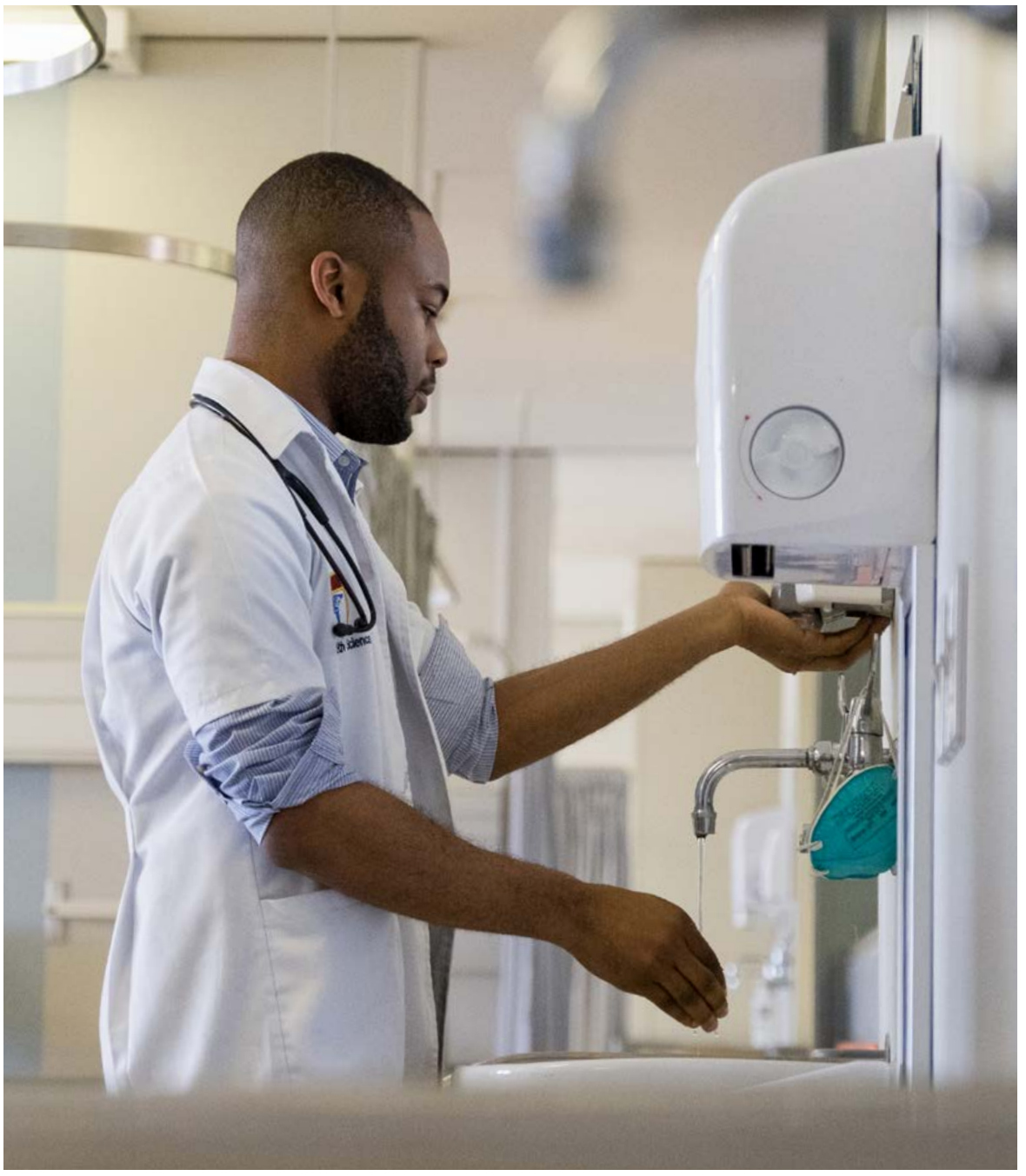
Water-based diseases are those where the disease-causing organism spends part of its life cycle in water. Examples include parasitic worm (helminth) infections like schistosomiasis and bacterial infections like leptospirosis. Infection occurs when people are exposed to water infested with the disease-causing organisms, often during water collection or bathing.

Schistosomiasis *– it is estimated that nearly 200 million people in Africa require treatment (WHO 2019a).*

Water-related vector diseases are those caused by biting insects that breed in water, such as mosquitos and black flies. Examples include malaria and onchocerciasis ('river blindness').

Onchocerciasis *('river blindness') – more than 99 per cent of the estimated 20 million people infected globally live in 31 African countries (2019b).*

Source: Adapted from White, Bradley and White 1972.



Africa needs to invest more in hand washing facilities

Box 4.6. Antimicrobial resistance: A growing problem facing the treatment of WASH-related diseases

Many WASH-related diseases are treated with antibiotics. However, there is growing antimicrobial resistance (AMR) to the drugs used to control infectious outbreaks (UNICEF and WHO 2017; Serdeczny et al. 2017). Recent studies have highlighted the problem in antibiotics commonly prescribed in Africa, which tend to be older, first-line antibiotics (Tadesse et al. 2017). For example, *E. coli* infection circulating in children in Sub-Saharan Africa has been found to be multidrug-resistant (Ingle et al. 2017).

The choice of antibiotics is often quite limited, and decisions are not based on knowledge of bacterial susceptibility, but rather on cost and availability (Bernabé et al. 2017). Information on the local and regional antimicrobial resistance of specific drugs is important when choosing effective treatment options, but this information is generally not collected as it is an expensive and time-consuming task (Ampaire et al. 2016). The appropriate drugs may also be unavailable. The use of ineffective antimicrobial resistant drugs, coupled with poor infection-control practices can spread community and/or hospital-acquired drug-resistant pathogens, making disease control even more difficult.

Due to the high incidence of infections in both humans and livestock, and the common use of antibiotics in treatment, excreted antibiotics can find their way into the aquatic environment. Although information is sparse, elevated concentrations of commonly used antibiotics have been measured in potable water, treated wastewater, groundwater and surface water in a number of locations in Africa (Faleye et al. 2018). The increased concentrations of antibiotics circulating through the environment fuel the increase in drug-resistant pathogens – a global trend not confined to Africa

Imagery: March 25, 2019

The damage due to cyclone Idai was felt beyond Mozambique. According to Chatiza (2019), when cyclone Idai struck Zimbabwe in March 2019, it affected about 270,000 people, causing 340 deaths and displacing 51,000 others. Infrastructure such as roads and bridges was damaged in the country's Chimanimani and Chipinge areas.

A network of about 1,500 km of roads was made unusable. Lives were affected as 140 schools were either damaged or made inaccessible. Homes were lost, while health facilities such as clinics were also damaged. As much as homes were damaged, toilets and deep wells for clean water were also damaged, thus reversing gains made in the rural areas towards improved sanitation and safe drinking water services. Water sources were contaminated as a result of the floods and overflow of toilets and sewerage systems. The affected 270,000 people were exposed to water-borne and water-based diseases, including diarrhea.

Landslides

Imagery: March 25, 2019

Buildings destroyed by flood

Flow direction

Flow direction

Landslide

4.7 Conclusion: Stopping the Spread of Disease

Safe toilets and access to clean water are a human right, a right that must be extended to everyone if we are to achieve the SDGs. However, stopping the spread of infectious disease involves more than just access to a toilet or a bar of soap. Maintaining hygiene in areas without access to clean water is difficult and time-consuming. Governments need to develop effective strategies that include targeted investment, awareness-raising and improved monitoring and reporting. Hospitals, schools, families and farmers all need to understand and be involved in the effort to effectively separate people from disease-carrying human and animal waste. Table 4.2 shows some interventions to ensure proper sanitation for good health.

Table 4.2. Suggested interventions for proper sanitation for good health

Intervention	Actions
1. Behavioural change, communication and social media	• Provide hygiene education for school children, mothers with babies and the general community; • Provide education on food and water storage and handling; • Provide education for farmers on best practices for wastewater usage; • Increase community health outreach

2. Remove faecal pathogens from hands, food and surfaces	• Wash hands with soap:
	  • After going to the toilet
	  • Before preparing or eating food
	  • After cleaning and changing babies;
	• Wash food and cook it to kill pathogens;
	• Wash raw food (such as lettuce grown with wastewater) with disinfectant

3. Safe drinking water	• Best option is an improved source located on-site; • Store water in narrow-mouthed containers with lids or taps; • Avoid touching the opening of the containers; • Boil or disinfect water before use; • Disinfect storage containers regularly
4. Clean toilets	• Best option is a sanitary single-household facility; • Ensure dry-pit toilets do not leak into groundwater and have handwashing facilities; • Ensure wet-pit toilets do not overflow or leak into groundwater and have handwashing facilities; • Regularly clean the toilet floor; • Ensure that insects cannot access the pit – i.e. place a cover on the toilet
5. Safe food irrigated with wastewater	• Limit contamination of produce; • Choose appropriate crops, irrigation methods and post-harvest treatment
6. Treatment of infections	• Use appropriate antibiotics and other drugs; • Make practitioners aware of antimicrobial resistance
7. Government policies that support WASH	• Develop improved sanitation services and wastewater treatment; • Improve healthcare and education
8. Strong legislation	• Work on legislation regarding prescription drug use, farming practices, commercial food handling
9. Infrastructure development	• Introduce piped water to homes, sewage treatment systems, safe water reuse, healthcare services