

# **WATERBORNE OUTBREAKS OF HEPATITIS E:**

**RECOGNITION, INVESTIGATION AND CONTROL**

**TECHNICAL REPORT**



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RECOGNITION, INVESTIGATION AND CONTROL

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Waterborne Outbreaks of Hepatitis E: Recognition, Investigation and Control

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# ACRONYMS AND ABBREVIATIONS

<b>ALT</b>	alanine aminotransferase
<b>anti-HBc</b>	antibody to hepatitis B core antigen
<b>AST</b>	aspartate aminotransferase
<b>CFR</b>	case-fatality rate
<b>ELISA</b>	enzyme-linked immunosorbent assay
<b>HBsAg</b>	hepatitis B surface antigen
<b>HBV</b>	hepatitis B virus
<b>HCV</b>	hepatitis C virus
<b>HEV</b>	hepatitis E virus
<b>IDP</b>	internally displaced population
<b>Ig</b>	immunoglobulin
<b>IPC</b>	infection prevention and control
<b>MSF</b>	Médecins Sans Frontières
<b>PCR</b>	polymerase chain reaction
<b>PoUWT&amp;SS</b>	point-of-use water treatment and safe storage
<b>PPE</b>	personal protective equipment
<b>SAGE</b>	Strategic Advisory Group of Experts (on Immunization)
<b>UN</b>	United Nations
<b>UNHCR</b>	United Nations High Commissioner for Refugees
<b>WASH</b>	water, sanitation and hygiene
<b>WHO</b>	World Health Organization



# 1. INTRODUCTION

Hepatitis E occurs around the world both as outbreaks and as sporadic cases.<sup>1</sup> Outbreaks of this disease frequently occur in countries with limited access to essential water, sanitation, hygiene and health services, and may affect several hundred to several thousand persons.<sup>2,3</sup> In recent years, some outbreaks have occurred in areas of conflict and humanitarian emergencies, such as war zones, and in camps for refugees or internally displaced populations (IDP).<sup>4-6</sup> An estimated 20 million infections and 3.3 million symptomatic cases of hepatitis E occur annually worldwide with an estimated 56 600 deaths.<sup>7</sup>

Cases and outbreaks of this disease often go undiagnosed or are mistaken for other forms of viral hepatitis because of the similarity of this disease with other forms of acute viral hepatitis, and limited availability and use of specific diagnostic tests for it. In addition, because of this, medical and public health personnel may have little previous experience in detecting and handling outbreaks of hepatitis E. The available guidance on the subject is also limited. Thus, responses from health administrators and field workers to such outbreaks may be inadequate and/or delayed. The lack of correct information, inadequate communication of key messages, and limited engagement and preparedness at the community level may lead to much concern in affected and at-risk populations. These may also result in costly emergency care and related services. Health promotion and prevention activities, and ensuring early, appropriate and equitable health-care services in response to hepatitis E outbreaks would improve public health outcomes, especially in resource-limited settings.

## 2. OBJECTIVE OF THE MANUAL

This manual aims to provide information about the methods for investigating outbreaks of hepatitis E, and measures for their prevention and control. In addition, the manual gives information about the causative agent – known as the hepatitis E virus (HEV) – its epidemiology, clinical manifestations of the disease and diagnosis.

This is the first manual on hepatitis E outbreaks by the World Health Organization (WHO). The target audience is those who may be involved in planning and executing responses to hepatitis E outbreaks both in the community as well as in refugee settings, such as public health authorities and health-care workers. It may also be useful for medical professionals and humanitarian health agencies working in outbreak areas.

## 3. THE DISEASE

### 3.1. Disease agent

Hepatitis E virus, the agent that causes hepatitis E, has small, 27–34 nm non-enveloped virions that contain a small, 7.2-kb single-stranded RNA genome.<sup>8,9</sup> The virus has at least four distinct genotypes, numbered from 1 to 4.<sup>10,11</sup> Genotypes 1 and 2 infect only humans, and are responsible for the majority of human disease caused by infection with this virus globally;<sup>11</sup> in contrast, genotypes 3 and 4 primarily circulate among mammalian animals, including pigs, wild boar, deer, and only occasionally infect humans.<sup>12,13</sup>

Genotypes 1 and 2 have been associated with large waterborne outbreaks.<sup>2,3</sup> Genotype 3 has been identified in occasional small foodborne outbreaks reported from developed countries.<sup>14-16</sup>

It is not known how long the virus persists in the environment. The virus appears to be susceptible to exposure to heat. Heating to 60°C for a few minutes has been shown to inactivate a large proportion of HEV particles.<sup>17,18</sup> These data indicate that drinking water can be rendered safe by pasteurization or boiling.

Several outbreaks of hepatitis E have been found to be related to the failure of chlorination,<sup>19-21</sup> suggesting that chlorine treatment protects against hepatitis E. Thus, although there is no direct evidence that chlorine inactivates HEV, chlorination of drinking water with adequate residual chlorine levels at the point of consumption continues to be a good public health intervention.

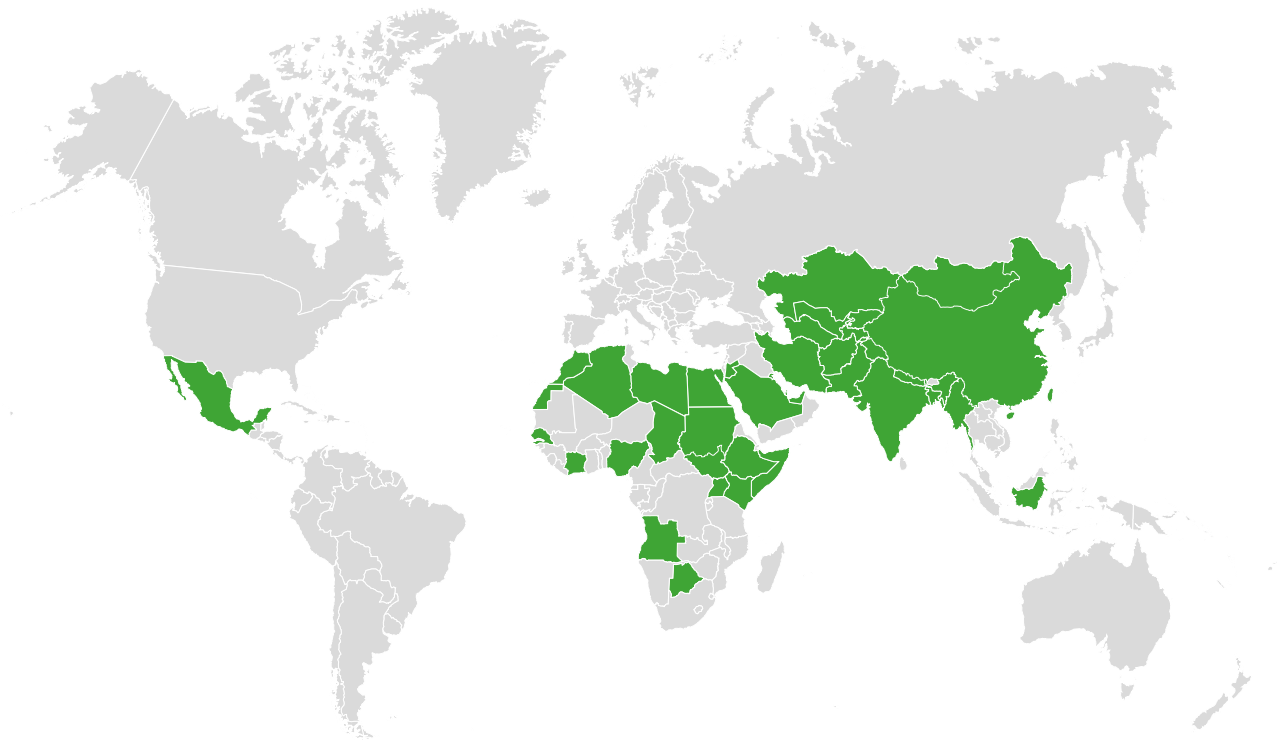
### 3.2. Geographical distribution

Hepatitis E has been reported from all parts of the world.<sup>1</sup> Two different epidemiological patterns have been reported, based on the frequency of clinical disease and genotype of circulating HEV: (i) high frequency of disease, which is caused by infection with genotype 1 or 2 virus, and (ii) infrequent disease, caused by infection with genotype 3 or 4 virus. The former is seen primarily in low-income countries where contamination of drinking water supplies and lack of proper sanitation are common. The latter is seen in higher-income countries where fecal contamination of water supplies is uncommon.

In most parts of Asia and Africa, waterborne outbreaks of hepatitis E are common.<sup>6,20, 22-24</sup> Some outbreaks have also been reported from Mexico.<sup>25,26</sup> These outbreaks are associated with infection with genotype 1 or 2 HEV and are of variable magnitude, affecting several hundred to several thousand persons. In these areas, besides outbreaks, a significant proportion of cases with sporadic acute hepatitis are also due to hepatitis E (Figure 1).

In areas where hepatitis E disease is infrequent, the occasional sporadic cases are believed to be due to zoonotic spread of genotype 3 or 4 HEV from animals, possibly through the consumption of undercooked meat.

**FIGURE 1** Geographical regions where waterborne hepatitis E is common and where outbreaks of this disease are likely to occur (green)



### 3.3. Modes of transmission

In regions where hepatitis E disease and outbreaks are common, fecal–oral transmission is the most common route of transmission of infection. Of various possible vehicles, fecal contamination of drinking water supplies is the most common mode of spread of hepatitis E. It is plausible that foodborne and other fecal–oral modes of transmission also play a role in the transmission of hepatitis E in these regions, though proving the existence of transmission through these routes may be difficult. For instance, because of the relatively long incubation period of hepatitis E, it is difficult to attribute disease to consumption of a particular food.

Fecal contamination of water can occur either at the source, such as rivers, streams, ponds or shallow wells, or during transport or storage. Several outbreaks have been linked with flooding following heavy rains, which washes fecal matter into surface water sources such as rivers and ponds.<sup>27</sup> Some outbreaks have been reported during the dry season – possibly related to increased concentration of contaminants in reduced river water flow.<sup>20</sup> Leaky water pipes that pass through soil contaminated with human feces may also allow for contamination of water during periods of low water flow due to the negative pressure within the pipes.<sup>28</sup>

Most of the initial published data showed that transmission of HEV through interpersonal close contact was infrequent.<sup>22,29</sup> In some recent outbreaks among displaced populations in Africa, spread through close person-to-person contact is believed to have played a role;<sup>30,31</sup> however, alternatively, the findings in these studies may be related to spread through environmental contamination due to lack of proper sanitation.

Transmission of HEV infection from mother to infant<sup>32</sup> and through blood transfusion<sup>33</sup> has been reported. However, these modes appear to account for only a small proportion of cases with hepatitis E, and have not been shown to be responsible for disease outbreaks.

### 3.4. Incubation period

The incubation period of hepatitis E varies from 2 to 10 weeks, with most cases occurring 4–6 weeks after exposure.<sup>a,27</sup>

### 3.5. Vulnerable groups

During outbreaks of hepatitis E, the disease attack rates are the highest among adolescents and young adults in the age group of 15–40 years.<sup>20,27</sup> Infection with HEV in young children is less likely to lead to disease. The disease appears to be somewhat more common among men than among women.<sup>20,27</sup>

HEV infection in pregnant women is associated with an increased likelihood of symptomatic disease, fulminant hepatic failure and death, as compared with men and non-pregnant women. The fatality rate among pregnant women who develop the disease may be as high as 15–20%.<sup>34</sup> The exact reason for this association remains unknown, though immunological and hormonal factors may play a role.

Persons with pre-existing chronic liver disease are also at an increased risk of severe illness.<sup>35,36</sup> In this situation, even mild liver damage may reduce liver function to a level that is life threatening.

Hard-to-reach and marginalized communities living in urban slums, IDP refugees, ethnic minorities, migrants, mobile and cross-border populations (particularly those in crisis or displacement settings) are at increased risk of hepatitis E and other infectious diseases because they often lack access to safe water and sanitation facilities and health education.

### 3.6. Clinical manifestations

The illness generally begins as an acute viral syndrome with symptoms such as mild fever, chills, headache, fatigue and malaise, which is often associated with marked loss of appetite, aversion to food, upper abdominal discomfort, nausea and vomiting. Some patients may also have generalized itching. Within a few days of the onset of these non-specific symptoms, the affected person develops dark urine and/or yellow discoloration of the sclera of the eyes and skin (jaundice).<sup>37,38</sup> The non-specific symptoms often resolve shortly after the onset of jaundice. Clinical examination may reveal slight enlargement of the liver and spleen.

The illness is clinically indistinguishable from other forms of acute viral hepatitis, such as hepatitis A, B and C, and other infectious diseases collectively referred to as “acute jaundice syndrome”. The syndrome is defined as “acute onset of jaundice and severe illness and absence of any known precipitating factors”,<sup>39</sup> or “acute onset of jaundice, with or without fever, and absence of any known precipitating factors”.<sup>40</sup> The jaundice usually persists for 1–6 weeks and then gradually resolves. Most of the affected persons recover completely.

A small proportion of those affected develop acute liver failure (also known as fulminant liver failure) or subacute liver failure, characterized by altered sensorium and loss of consciousness.<sup>38,39</sup> This complication may be heralded by mental changes, restlessness, haemorrhages and/or persistent vomiting. Symptoms and signs of increased intracranial pressure, and respiratory and/or circulatory disturbances are common. In addition, patients frequently have a coagulation

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<sup>a</sup> In 1957, when the outbreak in reference 27 occurred, the hepatitis E virus was not yet identified. However, the data from this outbreak are excellent as the water contamination was for a very short period, allowing an accurate estimation of the incubation period. The outbreak was subsequently shown to be caused by HEV infection.

disturbance, which may lead to bleeding from one or more body sites, and some may develop ascites. Patients with acute liver failure have a high fatality rate. It is more common among pregnant women with hepatitis E;<sup>34</sup> this issue is discussed further in Section 3.8, in relation to treatment.

In many persons, HEV infection occurs without any symptom or as a mild illness without jaundice. It is believed that, during hepatitis E outbreaks, such asymptomatic infection with HEV is severalfold more common than symptomatic hepatitis E.

### 3.7. Diagnosis

In an outbreak situation, individual case diagnosis in each affected person may not be necessary, and confirmation of the etiological diagnosis in a few cases is sufficient. Diagnosis of acute hepatitis E has three components:

- diagnosis of acute hepatitis,
- clinical differential diagnosis of acute jaundice syndrome, and
- definitive laboratory diagnosis of recent HEV infection.

#### 3.7.1. Diagnosis of acute hepatitis

Diagnosis of acute hepatitis is made by the demonstration of increased serum bilirubin and increased liver enzymes (alanine aminotransferase, aspartate aminotransferase [ALT, AST]) in persons with a suggestive clinical history and examination findings. Acute viral hepatitis caused by hepatitis A, B, C and E viruses is clinically indistinguishable. The clinical picture of acute hepatitis may at times be confused with that seen in other diseases. However, in an outbreak setting, with the occurrence of jaundice in several cases, diagnosis is unlikely to pose a problem.

Jaundice with increased serum levels of transaminase enzymes suggests a diagnosis of acute hepatitis.

Though several diseases may cause jaundice, simultaneous occurrence of several cases strongly suggests hepatitis.

#### 3.7.2. Clinical differential diagnosis of acute jaundice syndrome

Several viral, parasitic and bacterial infections can present with clinical features resembling acute hepatitis (acute jaundice syndrome), and may thus mimic hepatitis E. The most important of these are hepatitis A, B or C, yellow fever, dengue virus infection and leptospirosis. The clinical and epidemiological features of outbreaks of these diseases show some differences from outbreaks of hepatitis E, allowing for a distinction to be made (Table 1).

Administration of some drugs or exposure to some toxins can also lead to liver injury resembling acute hepatitis. This can be diagnosed by taking a clinical history. However, outbreaks of such illness are infrequent.

Several viral or other infections, and non-infectious diseases can be associated with outbreaks of acute jaundice syndrome. Exclusion of other causes is thus an important part of the diagnosis of hepatitis.

**TABLE 1.** Clinical and simple laboratory differential diagnosis of acute jaundice syndrome\*

Disease	Infectious agent	Incubation period	Mode of transmission	Symptoms	Jaundice	Haemorrhage	Laboratory	ALT/AST
Viral hepatitis	Hepatitis A virus	15–50 days	Fecal–oral	Moderate or no fever, anorexia, malaise, abdominal pain, nausea, headache, general muscle pain, fatigue	Present	May be present in the fulminant form, mainly in the gastrointestinal system	Urea and creatinine normal, no albuminuria, leukopenia, lymphocytosis	Very high; ALT >AST
	Hepatitis B virus	45–180 days	Vertical, blood transfusions, unsafe injections and unsafe sex					
	Hepatitis C virus	15–180 days	Blood transfusions, unsafe injections, unsafe sex					
	Hepatitis E virus	14–70 days	Fecal–oral					
Yellow fever	Yellow fever virus	3–6 days	Mosquito vector ( <i>Aedes aegypti</i> , <i>Haematophagus</i> , <i>Sabethes</i> )	Sudden onset with high fever, headache, dehydration, muscle pain (lumbar region and legs), intense prostration, nausea, vomiting, diarrhoea, abdominal pain	Present at onset	Between day 3 and 4; blood in vomit, stools, puncture sites; bruising, bleeding gums, nosebleed	Leukopenia, neutropenia, lymphocytosis, eosinopenia, increased serum bilirubin (predominantly direct)	Very high (over 1000 IU/L)
Leptospirosis	<i>Leptospira interrogans</i>	4–19 days (average 10)	Contact (through injured skin, mucous membrane or ingestion) with water, food or soil containing urine from infected animals, especially rats	Sudden onset, headache, fever, muscle pain (legs and lumbar region), anorexia, nausea, vomiting and prostration	Present initially. Present at a late stage in 15% of cases	Late	Leukocytosis, neutrophilia, eosinopenia, thrombocytopenia, increased ESR, increased urea and creatinine	Discrete elevation (usually up to 500 IU/L)
Dengue fever	Dengue virus	3–14 days	Vector ( <i>Aedes aegypti</i> )	High fever, headache, joint pain, muscle pain, hypovolaemia, abdominal pain, hepatomegaly, shock	Absent (except in severe forms with liver involvement)	Tourniquet test (+), petechiae, nosebleed, bleeding gums, ecchymosis, blood in vomit, bloody stools	Haemoconcentration, thrombocytopenia, decreased albumin	Discrete elevation
Falciparum malaria	<i>Plasmodium falciparum</i>	On average 12 days after mosquito bite	Vector ( <i>Anopheles</i> )	Clinical triad of intermittent fever, splenomegaly and anaemia. Headache, nausea, vomiting, prostration, shivering, sweating, enlarged spleen. Possible mental confusion	Present	Tendency to minor bleeding; gastric haemorrhage may be present	Initial anaemia, presence of malaria pigment in leukocytes, leukopenia, monocytosis	Discrete elevation

\* Adapted from: Yellow fever: investigation of yellow fever epidemics in Africa – field guide. Geneva: WHO; 2008 [WHO/HSE/EPR/2008.5]

### 3.7.3. Definitive laboratory diagnosis of acute HEV infection

Laboratory techniques for the diagnosis of infectious diseases are broadly of two types: (i) direct – those based on detection, demonstration or cultivation of the pathogen, or one of its components in body tissues or fluids; and (ii) indirect – those based on the host's specific immune response against the particular pathogen (Table 2). Positive results of the former type of tests indicate the presence of the pathogen, and hence imply current infection. On the other hand, the indirect tests may remain positive for a variable duration even after the pathogen has disappeared, and may thus represent either current infection or past exposure. Direct tests that detect the presence of viral nucleic acid usually require more elaborate laboratory facilities and are more expensive.

**TABLE 2.** Tests for the detection of HEV infection

Indirect tests (Detection of host immune response)	Direct tests <sup>a</sup> (Detection of a part of the virus)
Detection of anti-HEV antibodies <ul style="list-style-type: none"> <li>• IgM anti-HEV: recent infection</li> <li>• IgG anti-HEV: recent or past exposure</li> </ul>	Detection of viral nucleic acid: current infection

<sup>a</sup> Direct tests that detect viral nucleic acid need polymerase chain reaction (PCR), which is specialized and facilities for this may not be available in field settings in outbreak areas.

Diagnosis of hepatitis E in outbreak situations depends primarily on the detection of anti-HEV antibodies, an indirect test. Anti-HEV antibodies belonging to the immunoglobulin (Ig) M isotype can be detected in most patients almost simultaneously with the onset of illness (Figure 2). This is followed very soon by the appearance of IgG anti-HEV antibodies. IgM antibodies persist for around 5–8 months. In comparison, IgG anti-HEV antibodies persist for much longer, possibly for several years, though the exact duration till when these can be detected is uncertain and possibly varies from person to person. Thus, detection of IgM anti-HEV antibodies in serum indicates recent HEV infection, and is used for individual case diagnosis and confirmation of an outbreak of hepatitis E. The presence of IgG anti-HEV antibodies, on the other hand, indicates exposure to the virus, either recent or remote; their detection is thus not useful for confirming that HEV is the cause of disease during an outbreak.

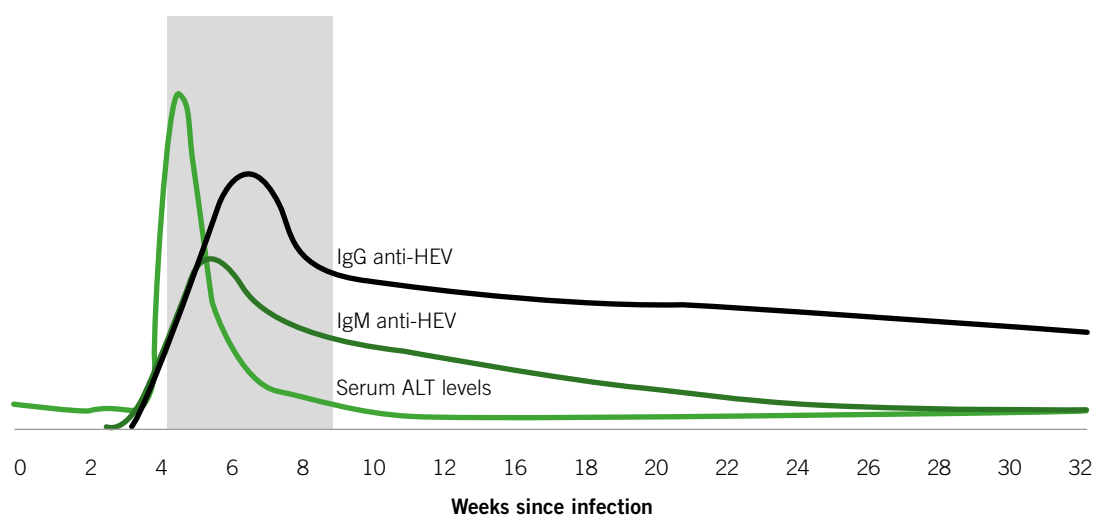
Detection of IgM anti-HEV antibodies in serum indicates recent HEV infection, and is used for individual case diagnosis and confirmation of an outbreak of hepatitis.

Several in-house and commercial tests for the detection of IgM anti-HEV antibodies are available worldwide. These tests mainly use the enzyme-linked immunosorbent assay (ELISA or EIA) format. These assays have undergone relatively limited testing, particularly in field settings in outbreak areas. Neither WHO nor any other international certifying agency has assessed the quality or performance of these tests. In various studies, these assays have shown sensitivity rates of 75–100% among epidemic cases with hepatitis E, and specificity rates of 80–98%. Thus, positive results of these tests in some cases during an outbreak of acute hepatitis are a strong indicator that the outbreak is related to HEV infection.

In recent years, point-of-care tests for IgM anti-HEV antibodies have been developed; these assays are rapid, provide a visual readout, do not need any equipment, are simple to perform and provide the convenience of testing individual specimens. Thus, these can be useful in field settings during outbreaks. However, these tests are not yet prequalified by WHO or other international agencies.



**FIGURE 2** Time course of appearance of IgM and IgG anti-HEV antibodies in relation to clinical and biochemical events during acute hepatitis E. The grey shading indicates the duration of illness. The Y axis indicates the concentration of antibodies or serum ALT (alanine aminotransferase) on a linear arbitrary scale.



Details of direct tests for HEV infection and some newer indirect tests are included in Appendix A.

Simultaneously, other diseases that can cause a similar illness may need to be excluded. Table 3 summarizes the laboratory tests used to exclude other causes, where necessary.

**TABLE 3.** Laboratory differentiation of outbreaks of hepatitis E from similar illnesses

Disease	Infectious agent	Serology	Notes
Viral hepatitis	Hepatitis A virus	IgM anti-HAV (+)	Presence of specific anti-HAV antibody of the IgM class indicates a recent infection with hepatitis A virus.
	Hepatitis B virus	HBsAg (+) Anti-HBc IgM (+)	Detection of hepatitis B surface antigen (HBsAg) may represent either acute or chronic infection with HBV. These conditions can be distinguished by the presence of IgM antibodies to hepatitis B core antigen (anti-HBc IgM) in acute infection (but not in chronic infection) with HBV. However, this test is not easily available in some areas. In the setting of an outbreak of jaundice where a majority of affected persons have detectable HBsAg, this test may not be immediately necessary; in this situation, a few serum specimens should be stored for subsequent testing for IgM anti-HBc and control measures for the outbreak of HBV infection instituted.  Failure to detect HBsAg in a large proportion of affected individuals would exclude HBV infection as the cause of the outbreak.
	Hepatitis C virus	Anti-HCV, HCV RNA	Hepatitis C only very infrequently causes acute hepatitis. Antibody tests may be negative in the early phase of the disease; in this situation, HCV RNA is helpful.

**TABLE 3. (continued)** Laboratory differentiation of outbreaks of hepatitis E from similar illnesses

Disease	Infectious agent	Serology	Notes
Yellow fever	Yellow fever virus	Specific IgM antibodies (+)	It is also possible to identify the virus in blood specimens or liver tissue collected after death; however, these tests require highly trained laboratory staff and specialized equipment and materials. High cross-reactivity is seen with related viruses and may lead to false-positive results.
Leptospirosis	<i>Leptospira interrogans</i>	Culture, polymerase chain reaction (PCR) or specific antibody test	Confirmatory diagnosis requires one of the following: (i) culture of pathogenic organisms from blood or other clinical material (ii) positive PCR result using a validated method (primarily for blood and serum in the early stages of infection), or a fourfold or higher rise in titre or seroconversion in microscopic agglutination test using a battery of local reference strains as antigens on paired samples obtained at least 2 weeks apart. <sup>41</sup>
Dengue fever	Dengue virus	Specific IgM and IgG antibodies or nonstructural protein 1 antigen	Detection of IgM antibodies indicates recent infection with dengue virus. Detection of IgG antibodies alone is not diagnostic, except when serial tests show that these have developed only recently, or their titre has shown a recent marked increase.
Malaria	<i>Plasmodium falciparum</i>	Thick and thin blood smear positive for parasites	Rapid tests for specific antigens are also available in some parts of the world.

### 3.8. Treatment

Hepatitis E is generally a self-limiting illness, and most patients improve in a few weeks. No specific treatment is indicated for uncomplicated disease. Patients with marked vomiting, fever or headache may benefit from symptomatic treatment. Dietary restrictions and bed rest do not have any proven role and are not indicated in the management of hepatitis E. Dietary restrictions may actually be harmful as they limit food intake. Unproven interventions with herbal products, heavy metals and the like may be harmful. Patient education about the disease, including hygiene measures and when to return to a medical facility (e.g. if symptoms worsen), are important elements of outpatient treatment.

Patients with symptoms such as irritability, photophobia and continued vomiting may need to be closely watched as they may be at a higher risk of developing severe disease. They should be asked to report quickly to a medical facility for admission. Patients with complications such as liver failure need hospitalization and specialist care, and should be referred to a hospital.

Pregnant women with hepatitis E are at a greater risk than others of developing liver failure and adverse outcomes. They may need to be carefully observed so that complications can be detected and treated early. Early delivery has not been shown to reduce morbidity or mortality among pregnant women with hepatitis E or their newborns. These patients may have a higher risk of bleeding because of coagulation factor deficiency due to liver injury. Hence, postpartum haemorrhage should be watched for; if it occurs, it should be managed early with drugs that induce uterine contractions. The infants born to these mothers are more prone to prematurity, low birth weight and complications such as hypoglycaemia and hypothermia; early detection and management of these complications may be helpful. It may thus be preferable to refer such women to a medical institution for delivery.

#### Warning and early signs of acute liver failure

- Severe or persistent vomiting
- Persistent sense of not feeling well
- Photophobia
- Irritability
- Disorientation or confusion
- Sleepiness

## 4. THE FIRST STEPS IN AN UNEXPECTED DISEASE EVENT

An outbreak is the occurrence of cases of a particular disease in excess of what would normally be expected in a defined geographical area or group of people over a particular period of time. When this happens, we usually presume that these cases are related to one another or that they have a common cause or source. Outbreaks can vary widely in spread (from a restricted geographical area to several countries), size (a few to several thousand cases), and duration (from a few days or weeks to several months). Larger outbreaks are often called “epidemics”, though some epidemiologists use the terms “outbreak” and “epidemic” interchangeably.

Detecting an outbreak, i.e. identifying the occurrence of an excess number of cases that are related to each other in a particular area or population, is the first step. An outbreak with hundreds of ill persons can be missed if they are spread out over a wide area.

This section deals with how to suspect and detect the occurrence of outbreaks of hepatitis E.

### 4.1. Usual methods for detection of disease outbreaks

Most disease outbreaks are detected in one of the following two ways:

- a. A health-care provider or worker (and sometimes a layman) recognizes a “cluster” of cases with similar illnesses and informs the public health authorities.
- b. Collection and systematic analysis of data on various illnesses from doctors, laboratories and other sources to track the pattern of disease in a community (public health surveillance) allows detection of an increase in the number of cases of a particular disease above the usual baseline.

### 4.2. Is this the beginning of an outbreak of hepatitis?

An outbreak of hepatitis is often suspected by a clinical health-care worker, who notices an unusual number of patients with acute jaundice syndrome within a short period of time. These patients present with one or more of the following features:

- similar clinical symptoms
- residence in the same area or location
- sharing the same water supply.

Some other features that may suggest an outbreak of hepatitis E include

- one or more confirmed maternal deaths following jaundice
- a recent breakdown in water quality (e.g. floods)
- recent population movement/displacement.

If baseline information from the same geographical area for previous years is available, it can be used to verify whether the number of cases in the present year is unusually high compared to that in previous years over the same period of time.

### **4.3. Are the patients suffering from acute viral hepatitis E?**

Hepatitis E is clinically indistinguishable from other causes of acute viral hepatitis except by laboratory tests. Occurrence of a large outbreak of acute hepatitis in situations where water quality may have been suspect during a few weeks before the occurrence of cases should arouse the suspicion of hepatitis E. Other features that suggest hepatitis E as the cause of the outbreak as compared to other causes include the following:

- a particularly high rate of disease, severe illness and mortality among pregnant women;
- predominant involvement of older children and young adults (compared to hepatitis A, where young children often outnumber adults);
- absence of specific risk factors such as recent hospitalization, blood transfusion, invasive medical procedures or injection drug use (compared to hepatitis B or C);
- predominant involvement of the liver without much involvement of the kidneys or other organ systems (compared to leptospirosis);
- disappearance of fever after the onset of jaundice (compared to leptospirosis, dengue fever and severe malaria).

For the purpose of outbreak investigation and control, all cases do NOT need to be tested. There is no evidence-based guidance about the number of samples that should be tested to diagnose the cause of an outbreak. The public health authority should decide how many samples should be tested, based on the total number of patients and the available resources.

If the facilities and supplies for tests are not locally available, a national or regional reference laboratory may be contacted. The reference laboratory may be able to test clinical specimens not only for a marker of hepatitis E but also for other diseases that cause similar illness.

# 5. RESPONDING TO AN OUTBREAK OF HEPATITIS E<sup>b</sup>

The steps involved in an epidemiological investigation of an outbreak of hepatitis E are similar to those for outbreaks of other infectious diseases.

The first step is to confirm the existence of an outbreak and identify the causative organism. Attempts should be made to look for possible risk factors, draw up a demographic profile of affected cases, estimate the number and proportion of persons affected in the population, and determine the characteristics of those affected more severely, the index case, and possible source(s) of infection and route(s) of transmission. Hepatitis E outbreaks are often related to contaminated water; hence, an investigation of water sources is an essential component of the response to outbreaks of this disease. In addition, the investigation should include collection of data on the availability of water (quantity available per person per day), quality of water sources, especially drinking water sources, and whether an adequate number of latrines is available for and used by the affected population.

The key components of response to an outbreak of hepatitis E are given step-wise below.

1. Prepare for an outbreak.
2. Verify the diagnosis and confirm the existence of an outbreak.
3. Define a case and conduct case-finding.
4. Tabulate and orient data: time, place, person.
5. Take immediate control measures.
6. Communicate findings.
7. Implement and evaluate control measures.

## 5.1. Prepare for an outbreak

Preparing for an outbreak of hepatitis E is especially important in emergency or high-risk situations such as refugee camps. To prepare for such an eventuality, it is essential that the following be done:

- A basic plan is developed for resource requirements in the event of an outbreak.
- A surveillance system is put in place to ensure early warning of an increase in the incidence or number of cases of diseases with epidemic potential, including in vulnerable populations.
- A microbiological water monitoring system is established to ensure water safety, including application of suitable water disinfection treatments.
- An outbreak response plan is written for hepatitis E, covering roles and responsibilities, resources, skills and activities required.
- Standard treatment protocols are available to all health facilities and agencies, and clinical workers are trained in case management, laboratory sample collection and transport, and water purification.

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<sup>b</sup> This section is adapted from Connolly MA, editor. Communicable disease control in emergencies: a field manual. Geneva: World Health Organization; 2005.

- Stockpiles of essential treatment supplies are available; these include medications and materials such as intravenous fluids, laboratory sampling kits, transport media and water purification supplies.
- A competent laboratory is identified for confirmation of cases.
- Sources of additional supplies are identified.

To ensure **early detection** of an outbreak in high-risk situations such as refugee camps or following floods, it is essential to establish a disease surveillance system with an early warning mechanism. For this, the health authority should develop methods to identify, collate and report cases of diseases that are particularly likely to occur. These methods include standardized case definitions, reporting forms, line list templates, case definitions and reporting mechanisms. In refugee or similar settings, consensus should be reached with all operational agencies in the community about the methods used to ensure synergy of action.

Clinical workers at the primary and secondary care levels are the key components of an early warning system. They must be trained to immediately report any suspected case of disease to the health authority. The analysis of such reports by the health authority will allow for early identification of clusters of similar cases and hence of an outbreak. It is vital that all alerts are followed up.

In camps established after displacement of a large population, an immediate response is necessary because of the potential for a high case attack rate and high mortality rate. Early detection may allow early intervention, which could have a major impact on reducing the number of cases and deaths during an outbreak.

Whereas routine surveillance depends on passive methods (i.e. the health workers report data weekly or monthly as part of their overall duties), during an outbreak there may be a need for active surveillance, where a member of the outbreak control team specifically goes to the health facilities and reviews the records to detect further cases.

In an explosive outbreak with a large number of cases, collection of detailed information about each case may not be possible, and finding out the numbers of cases and deaths using a line listing form and spot mapping may suffice (see Appendix B). For outbreaks that are smaller in size or that evolve more slowly, a case investigation form should be completed for each case to obtain additional information such as the contacts of cases.

The term *epidemic threshold* refers to the level of disease occurrence above which an urgent response is required. The threshold is specific to each disease and depends on the infectiousness, other determinants of transmission and local endemicity levels. For acute jaundice syndrome in emergency settings, alert thresholds of “five or more cases with acute jaundice syndrome in one location in one to a few weeks” and of “five cases with acute jaundice syndrome or 1.5 times the baseline rate” have been suggested to help early detection of potential outbreaks of hepatitis.<sup>40,42</sup>

### To ensure rapid detection of an outbreak in an emergency situation

- Set up an early warning system within the surveillance system, with immediate reporting of diseases with epidemic potential.
- Train clinical workers to recognize priority diseases/syndromes and report cases immediately to the health coordinator.
- Ask the health coordinator to report any increase in cases to the lead health agency.
- Arrange for enhanced surveillance during high-risk periods and in high-risk areas.

Epidemic thresholds of five or more cases in one location in a short period of time (one to a few weeks) or 1.5 times the baseline rate have been suggested to help early detection of potential hepatitis E outbreaks in humanitarian emergencies.

Once an outbreak is detected or alerts have been received, the health authority must set up an outbreak control team to investigate. It should include:

- a representative of the health authority
- a health-care provider
- a laboratory technician
- a water/sanitation specialist
- health educators
- community leaders.

In such a team, one person could have more than one role, particularly when the outbreak is small. Membership of the team may have to be expanded depending on the control measures required. One member of the team should be the team leader; this is usually the representative of the health authority. If the outbreak is in a refugee setting where multiple agencies are working, the role of each agency in the response to the outbreak should be defined clearly.

In the event of a suspected outbreak of acute jaundice syndrome, the outbreak control team should do the following:

- Make an attempt to confirm the diagnosis of acute jaundice syndrome and immediately start efforts to control the outbreak without waiting for laboratory confirmation.
- Immediately attempt to confirm the cause of the acute jaundice syndrome by laboratory tests.
- Meet as frequently as necessary to review the latest data on suspected cases and deaths, and to follow up any alerts.
- Respond to media inquiries and provide regular updates. The local health department should assign a media spokesperson who would be updated by the team.
- Implement the pre-existing outbreak response plan.
- Identify additional human and material resources for managing the outbreak, e.g. treatment sites.
- Define the tasks of each team member in managing the outbreak.
- Ensure the use of standard treatment protocols for the disease by all and train clinical workers if necessary.

## 5.2. Verify the diagnosis and confirm the outbreak

The first step in investigation of an outbreak is to determine whether the reported number of cases is unusual. Baseline surveillance data, if available, are useful for making this decision. Verifying the diagnosis through laboratory testing is also important.

As a variety of infectious agents can cause a clinical picture of acute jaundice syndrome, the initial investigation (questionnaires, laboratory tests, etc.) should focus on determining the causative agent responsible for the outbreak, and avoid consideration of only one preconceived diagnosis. Historical knowledge of endemic and epidemic diseases and their seasonality in the region may help to identify the likely causes. Clinical signs and symptoms may allow a presumptive differential diagnosis (see Section 3.7.2 and Table 1), and laboratory tests can help confirm the diagnosis of hepatitis E or another cause of acute jaundice syndrome (see Section 3.7.3 and Table 2).

Depending on the suspected cause of acute jaundice syndrome, different types of specimens may be required to identify the cause of the outbreak. If hepatitis E is suspected, serum specimens would suffice. An efficient mechanism is required for collecting appropriate specimens from patients and transporting them in a good condition to the laboratory, and rapidly returning the test results to the outbreak control team and clinical workers (see Appendix C for detailed information about collection, storage and transportation of specimens). While waiting for laboratory confirmation, collection of epidemiological information should continue, as this will facilitate the institution of initial control measures.

### 5.3. Define a case

Investigators should establish a case definition by characterizing cases according to clinical symptoms and signs, and epidemiological information related to person, place and time. Using the case definition, investigators can search for additional cases in the affected population.

A simple, clear, easily understood case definition (see box for examples) must be used consistently from the beginning of the outbreak and must be placed conspicuously at the top of each case reporting form. This outbreak case definition may have to be adapted from the surveillance case definition. The syndromic definitions often used by the surveillance system for early detection may not be sufficiently specific in a particular outbreak and could lead to an overestimation of cases.

During an outbreak, cases may be placed in two categories: suspected or confirmed. A *suspected case* is one in whom the clinical signs and symptoms are compatible with the disease in question but laboratory confirmation of infection is lacking (negative or pending). A *confirmed case* is one in whom definite laboratory evidence of current or recent infection is present, whether or not clinical signs or symptoms are or have been present. Once laboratory investigations have confirmed the diagnosis in the initial cases, the use of a clinical/epidemiological case definition may be sufficient and there may be no need to continue to collect laboratory specimens from new cases for the purposes of notification. During an epidemic, data should be analysed rapidly to determine the extent of the outbreak and the impact of actions taken to date.

In the case of mobile populations, as in mass migrations and refugee camps, cross-border surveillance and data gathering at other locations may be important. This may allow early detection of similar outbreaks in the areas of origin or along paths of movement of the population. These other locations may at times be across political boundaries or borders. For this activity, it is helpful to use similar standard data collection methods in various locations, so that the data across borders are comparable. Such data can help to better understand temporal and geographical trends, allowing better decision-making and monitoring of the outbreak response.

### 5.4. Tabulate and orient data: time, place, person

Possible cases should be interviewed using a standard questionnaire or case report form. Information about possible cases should be organized in a line list and summarized according to person, place and time. In most outbreaks, such epidemiological data are helpful for designing and implementing effective control mechanisms, particularly if variables related to risk factors and possible exposures (e.g. source of drinking water) are also included in the line list.

Members of the outbreak control team in charge of the epidemiological investigation should take the following steps:

- Define the extent of the outbreak in terms of time, place and person:
  - When did the cases occur – dates of onset (e.g. epidemic curve)?
  - Where do the cases live (e.g. spot map)?

#### CASE DEFINITIONS USED BY DIFFERENT AGENCIES IN HEPATITIS E OUTBREAKS

##### MINISTRY OF HEALTH DEFINITION OF A CLINICAL CASE:

Acute onset of jaundice and severe illness and absence of any known precipitating factors (other common symptoms may include dark urine, anorexia, malaise, extreme fatigue and right upper quadrant tenderness)

##### INTERNATIONAL MEDICAL CORPS DEFINITION OF A SUSPECTED CASE:

Clinically detectable jaundice and one or more of the following: malaise, loss of appetite, fever (or history of fever), abdominal pain or joint pains

##### MÉDICINS SANS FRONTIÈRES DEFINITION OF A CLINICAL CASE:

Recent onset of jaundice plus the presence of one or more symptoms of hepatitis E (malaise, anorexia, epigastric discomfort or nausea)



- Who are the affected persons (e.g. age, gender, pregnancy status, belonging to hard-to-reach and other vulnerable groups)?

This can be done using data from either individual case report forms or from the line list, if it includes data on these variables.

- Measure the severity of the outbreak:
  - How many cases occurred during the outbreak?
  - How many cases were hospitalized?
  - How many cases suffered complications?
  - How many cases died as a proportion of all cases (case-fatality rate)?

This step may need a review of the clinical records of individual cases and at times interviews with cases and even their treating physicians.
- Draw an epidemic curve, i.e. a graph showing cases by date of onset (see Panel C in Box 1). This helps to demonstrate when and how an outbreak began, how quickly the disease is spreading, the stage of the outbreak (starting, middle or waning phase) and whether control efforts are having an impact. It may also help in understanding whether the outbreak is caused by a common point source, a common persistent source, or by an initial point source exposure followed by propagated spread from the initial cases, and whether there are several separate clusters of cases caused by exposure to multiple sources.
- Draw a graph or table of the age and gender distribution of the cases (see Panel B in Box 1); this can be constructed from the line listing of cases. If population data are available, age-specific attack rates can be calculated.
- Draw a spot map. A map of the area, camp or community is marked with the location of all cases and deaths. Such a map can help identify areas with clusters of disease. Further investigation of these areas may reveal the source of infection or modes of transmission. When the outbreak primarily affects a refugee camp, the extent of the outbreak in the local community outside the camp should also be documented. Occurrence of cases outside the camp should lead to consideration of a source of infection outside the camp, and provision of assistance to the local health authorities for controlling the outbreak.
- Determine the source and mode of transmission: assess possible sources of infection (particularly drinking-water sources and sanitation facilities, and water quality for outbreaks of hepatitis E) by comparing attack rates in subgroups and using spot maps.
- Provide summary data of the outbreak by calculating the basic epidemiological indices set out in Table 4.

**TABLE 4.** Basic epidemiological measures

- 
- **The case-fatality rate (CFR)** is the percentage of cases that result in death.  

$$\text{CFR} = (\text{number of cases who died of the disease} / \text{total number of cases of the disease}) \times 100$$
- 
- **The weekly attack rate** is the number of cases per 10 000 people per week.  

$$\text{Weekly attack rate} = (\text{number of cases that occurred in a given week} / \text{total affected population in that geographical area}) \times 10\,000$$
- 
- **The age-specific weekly attack rate** is the number of cases per 10 000 people in one age group (e.g. 15–24 years).  

$$\text{Age-specific weekly attack rate} = (\text{number of cases that occurred in a given week in a particular age group} / \text{total affected population in that age group in that geographical area}) \times 10\,000$$
-

### BOX 1. Case study: a typical large outbreak of hepatitis E

During 1991, there was an outbreak of hepatitis in Kanpur, India, a large city with a population of around 2 million at that time. The city is located on the south bank of a large river (Ganga). The central part of the city with a high population density (marked with stippling in map – Panel A\*) was supplied with water derived from the river supplemented with that from tubewells, whereas areas in the east and west did not receive river water. A sample survey in randomly selected city areas (marked in black on the map) showed that disease was much more common in the areas that received river water than in those that received only tubewell water (5.6% versus 1.2%).<sup>20</sup> Based on the sample survey data, it was estimated that the outbreak caused nearly 79 000 clinical cases.

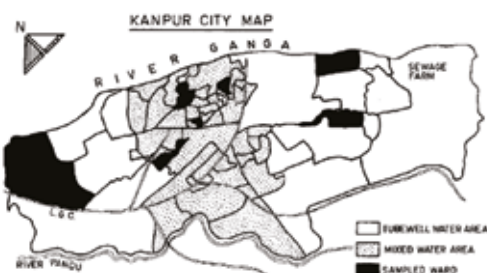
In the sample survey, most of the affected persons were adults, with children younger than 10 years accounting for only 6% of the cases (Panel B).

The epidemic curve (Panel C) showed an initial peak that began in January 1991, reached a summit in February 1991 and then started to decline. However, this decline was overridden by a larger and longer peak, which faded away by May–June 1991. Water analysis data showed evidence of water contamination beginning in December 1990 and lasting till April 1991 (the horizontal arrow below the epidemic curve shows the period of water contamination). This possibly started the epidemic. In mid-February (vertical arrow), there was failure of water chlorination on one day – and this was possibly responsible for the larger peak that followed a few weeks later.

The river had in recent times receded from the city's water intake point. Hence, a water channel had been dug to bring water to the intake point (Panel D). A sewer drain opened upstream of the intake point. However, the sewage would get diluted with the river water. Silting of the intake channel (stippled area) in late 1990 and early 1991 caused a reduced flow rate in the channel and increased sewage contamination at the intake point, leading to the epidemic. Diversion of the sewage drain and dredging of the water channel in early April 1991 led to control of the epidemic. A subsequent follow up in the sample survey area confirmed the absence of delayed cases, indicating little intrafamilial transmission.<sup>29</sup>

\* All figures are taken from reference 20 (Naik SR, Aggarwal R, Salunke PN, Mehrotra NN. A large waterborne viral hepatitis E epidemic in Kanpur, India. Bull WHO. 1992;70:597–604.)

A



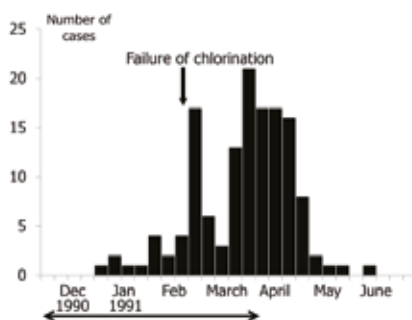
B

Table 2: Age and sex distributions of hepatitis cases in the sample survey

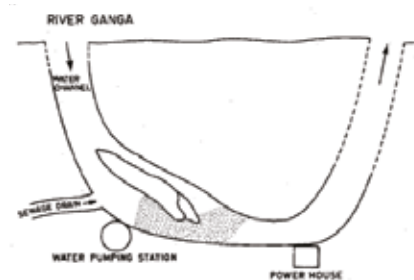
Age group (years)	No. of persons		
	Male	Female	Total
0–9	6	2	8 (5.8) *
10–19	29	19	48 (34.8)
20–29	31	15	46 (33.3)
30–39	10	8	18 (13.0)
40–49	7	2	9 (6.5)
50–59	5	2	7 (5.1)
≥60	1	1	2 (1.5)
<b>Total</b>	<b>89</b>	<b>49</b>	<b>138</b>

\* Figures in parentheses are percentages.

C



D



### 5.4.1. Collection and analysis of data and development of hypotheses

The systematic recording of data on cases and deaths (time, place and person) in an outbreak is essential to ensure accurate reporting. These data are helpful in forming hypotheses about the pathogen involved, its source and route of transmission, and to measure the effectiveness of control measures. This process is summarized in the six key questions: Who? What? When? Where? Why? How?

Some of these pieces of information would be available from medical records as such information is routinely collected during clinical care of the cases; examples include demographic details of the cases, their place of residence, and date of onset and nature of symptoms. Some laboratory test data may also be available from the clinical records. It may be useful for the outbreak investigation team to contact and interview medical personnel who looked after the cases that have been treated.

However, some of the information required for an outbreak investigation, for instance, information related to different exposures, is often either not available in the clinical records or its accuracy cannot be vouched for. For such information, public health authorities need to contact each affected individual (or a family member if the case is not available because of death, migration, and similar reasons) and obtain the information using a structured questionnaire (see Appendix D for details on the content of such a questionnaire).

At times, follow-up visits to cases may be required to obtain information on some supplementary questions that may arise as the outbreak investigation proceeds, or for case-control studies (see below).

### 5.4.2. Active case-finding

In hepatitis E outbreaks, a fair proportion of cases may not seek health care, because the disease may be mild, services may not be available or cases may seek alternative care. Information about such cases could be collected by community workers to determine the real extent of the outbreak. Community health-care workers should be trained to identify suspected cases (active case-finding) and refer them to a health facility for clinical assessment and advice.

For each case identified during active case-finding, information should be collected on the name, age, location, water sources (particularly those used for drinking water), date of onset and outcome of the disease, similar to the cases that seek health care. They may also be interviewed using the structured questionnaire developed for cases.

### 5.4.3. Further investigation/epidemiological studies

In some outbreaks, routine data are sufficient to clearly indicate the cause and source of the outbreak. However, when routine data do not provide sufficient information, further investigation, such as analytical epidemiological studies or environmental assessment, may be required to identify the source of the outbreak, risk factors, the causative agent or mode of transmission. This may require collaboration with groups skilled in epidemiological investigation or in specific diseases.

In analytical epidemiology, hypotheses regarding the relationship of various exposures to disease are tested, usually through case-control studies. In these studies, a group of people with the disease (cases) are compared with an otherwise similar group of people without the disease (controls), and the frequency of various suspected exposures is compared, using a summary measure of association (odds ratio). In such studies, comparability of cases and controls is an important concept and thus the controls must be derived from the same population as the cases. If the number of cases is small, one can include a larger number of controls to attain sufficient statistical power.

Though statistical significance is often tested to evaluate the association, a high odds ratio even in the absence of such significance may be sufficient to implicate a particular exposure in the causation of disease.

Such case–control studies may need to be repeated within a particular outbreak when initial studies fail to identify an exposure as the cause of the outbreak and further hypotheses need to be tested.

Laboratory tests on clinical specimens from cases and environmental studies (e.g. of water sources) may also provide information that is useful in identifying the source of infection and the mechanism(s) of its spread from such a source.

## 5.5. Take immediate control measures

If the source of the outbreak is apparent and is still active, thus posing a potential threat to public health, appropriate control measures should be taken as quickly as possible. Examples of control measures are chlorination of water sources, closing a restaurant, and prohibiting swimming in a certain area. For hepatitis E, these most often relate to ensuring water quality and checking water contamination.

The available data should reveal the source of infection responsible for the outbreak and the mechanisms of its spread. These, together with knowledge about the epidemiology and biology of the likely organisms, will help define the measures needed to control the outbreak and prevent further problems.

An outbreak may be controlled by eliminating or controlling the source of infection, interrupting transmission and protecting persons at risk. In the initial stage of an outbreak, the exact nature of the causative agent may not be known and general control measures may have to be taken based on the suspected cause(s). Once the cause has been confirmed, more specific measures can be undertaken. It should also be remembered that in special circumstances such as refugee camps, outbreaks or sporadic cases of other diseases could occur simultaneously with the hepatitis E outbreak.

Control strategies fall into four major categories of activity.

1. *Prevention of exposure:* the source of infection is controlled to reduce the risk of the disease spreading to other members of the community. For hepatitis E outbreaks, this is the most important measure, and involves the following:
  - Improving the quality and quantity of drinking water
  - Treating and disposing of human waste correctly
  - Improving personal hygiene, and
  - Preparing safe and clean food.
2. *Prevention of infection:* specific focus should be placed on identifying pregnant women at health facilities, antenatal clinics and other points. Particular effort should be made to reduce the risk of HEV infection among pregnant women since the infection is more likely to lead to severe disease and death in such women than in the general population. These women should be a priority group for provision of safe water and good sanitation.
3. *Prevention of disease:* a vaccine has been recently developed against hepatitis E. There are currently no data on the effectiveness of this vaccine in the control of hepatitis E outbreaks.

Remember that other disease outbreaks (such as an outbreak of gastrointestinal illness) could occur simultaneously with the hepatitis E outbreak, particularly in special circumstances such as refugee camps. Implementation of good control measures should help control several infectious diseases.

Also, the vaccine is not yet available worldwide. Issues related to the HEV vaccine are discussed further in section 5.5.4.

4. *Prevention of death:* Deaths can be minimized through prompt diagnosis and management of cases, including timely referral to a health-care facility. It may be important to avoid administration of unnecessary drugs, as these may be hepatotoxic; such drugs are likely to be particularly harmful for patients with acute hepatitis E.

### 5.5.1. Water, sanitation and hygiene

As most large outbreaks of hepatitis E are related to contamination of drinking water supplies, preventive measures should focus on treatment of water sources at collection points and households to ensure a continuous supply of safe drinking water in adequate amounts. This can be done through the principles of preventive, risk-based water safety management. These principles are operationalized through water safety plans, which provide a systematic means to address the risks posed by hepatitis E as well as other pathogens of fecal origin (e.g. those causing diarrhoeal disease), and determine which preventive measures are most appropriate and feasible.

Water safety planning draws on the principles and concepts of sanitary inspections, the multiple-barrier approach, and hazard assessment and critical control points.<sup>43</sup> The water safety plan approach requires the identification of hazards and associated risks in the entire water supply chain, from catchment to the point of use, and the prioritization and management of those risks.<sup>44</sup> It also requires regular monitoring of the control measures that have been put in place and periodic confirmation of water quality (verification or compliance monitoring). Appendix E provides more information on making water safety plans.

During a waterborne hepatitis E outbreak, as a minimum immediate response, the concentration of free chlorine should be increased to more than 0.5 mg/L throughout the system (Appendix E). If microbial quality cannot be maintained, it may be necessary to advise people to boil water during the outbreak.

Such “boil water” advisories should indicate that water can be made safe by boiling until it bubbles. After boiling, the water should be allowed to cool on its own without the addition of ice. This procedure is effective at all altitudes and even with turbid water. Other water treatment methods for rendering water safe at the point of use are also available.

Appendix F includes information on the benefits and drawbacks of each of these methods, as well as a comparison of different methods for making water safe. It also contains information on various safe water storage options.

In addition to water quality, the quantity of water required per household per day also needs consideration, to ensure that an adequate amount of safe water is available to the entire population (Appendix E). Similarly, availability of an adequate number of containers in which water can be stored safely may need to be ensured.

As the incubation period of hepatitis E is fairly long (2–10 weeks), cases may continue to occur for up to 10 weeks (the maximum incubation period) after steps have been instituted to ensure safe drinking water, sanitation and improved hygiene. Therefore, longer-term monitoring after institution of these prevention measures is needed. Information about the expected delay in reduction of occurrence of new cases after the institution of control measures must be communicated to the community to maintain their faith in the public health system and control measures.

During a waterborne hepatitis E outbreak, the concentration of free chlorine should be increased to more than 0.5 mg/L throughout the system as a minimum immediate response.

It is important to note that water, sanitation and hygiene (WASH) interventions disrupt transmission not only of hepatitis E but also of a host of other water-related diseases such as giardiasis, typhoid, shigellosis and helminthic infestations. These additional benefits should be considered in coordinating prevention actions and seeking partners or funding for hepatitis E prevention and control.

#### *Improving access to adequate quantity and quality of safe water supplies*

Access to safe and adequate water supplies is critical for an effective outbreak response, but interventions to enhance and secure supplies are often of an emergency and temporary nature. Whenever possible, investment in water supplies should seek to achieve sustainability of the supplies and complementarity with existing infrastructure and service providers to prevent future outbreaks.

*Urban water supplies* – priority interventions relating to urban water services include repairing existing systems, boosting bulk storage options, increasing and monitoring residual chlorine levels and supply through water tankers, and bucket chlorination where there are no other options.

Construction of new and additional (permanent) water supplies should be prioritized as necessary in outbreak-affected areas. Pre- or post-emergency risk mapping should identify critical supplies and define steps to address shortfalls and promote sustainability of supplies. Efforts to improve urban water services while responding to an outbreak should consider involving communities/user groups and the value of their contribution to outbreak control efforts. They can play an important role in monitoring the provision of services and their effectiveness, reporting leaks or breakdowns in the system to the authorities, and supporting the operation and maintenance of point sources.

*Rural water supplies* – access to safe water supplies is usually more limited in rural areas than in urban areas. Sustainability presents a considerable challenge, although some communities can make their systems sustainable using a range of management models, such as small-scale private operators, community committees and privately owned sources.

#### *Improving food safety and hygiene*

The role of food in the transmission of HEV infection during hepatitis E outbreaks remains unclear. However, theoretically, such transmission should be possible if contaminated water is used to prepare food, particularly for procedures where water is not boiled, e.g. for washing vegetables that are eaten raw or for making ice. Thus, during an outbreak, it may be important to ensure hygienic practices for the preparation of food.

Besides hygienic preparation and cooking, attention to hygienic storage and serving of food are also of paramount importance. It is important to ensure that food stalls in marketplaces and restaurants comply with sanitation and hygiene standards. Training food handlers working in food outlets, and monitoring food quality for adherence to minimum standards of hygiene are critical elements of the outbreak response.

Raising general public awareness of basic food safety standards is a valuable way of encouraging food handlers to improve their practices.

#### *Improving access to and use of safe excreta disposal*

As the primary cause of hepatitis E outbreaks is excretion of HEV in human feces, it is important to pay attention to the safe disposal of human feces. Appendix G discusses options for safe disposal of excreta.

*Excreta disposal in urban areas* – in urban areas, excreta disposal has proved to be challenging. The provision of temporary communal latrines in public places or institutions during the response phase may be the only option that funding allows, but this option requires time and effort to establish and sustain, as it requires effective operation, maintenance and cleaning.

Sharing latrines can also be promoted. Alternatively, where plastic bags are commonly used or introduced as a temporary measure for excreta disposal during an outbreak, the effective collection, transport and final disposal will need particular attention to ensure that feces from the outbreak area do not get back into the environment.

*Excreta disposal in rural areas* – during an outbreak, efforts should focus on minimizing open defecation and other dangerous sanitation practices, primarily through communications for behaviour change and community mobilization. Messages should focus on what actions people can take immediately; for example, in rural and periurban areas, the burying of feces (sometimes called the “cat method” of disposal) is usually possible.

Some specific contexts may demand additional actions, for example, the construction of latrines in case of an outbreak in a camp for IDP. Timing constraints often prevent adequate provision and use of new latrines during an outbreak, so alternative means of feces disposal are frequently required. Community groups, schools and religious institutions may be encouraged to undertake community-level and community-led actions to eliminate open defecation and promote safe excreta disposal.

*Maintenance, cleanliness and handwashing facilities* – where latrines exist, efforts should focus on ensuring that these are used, kept clean and provided with handwashing facilities. In the absence of latrines, other forms of safe excreta disposal should be promoted and households should be encouraged to establish handwashing stations. Individuals should be encouraged to always wash their hands with soap after defecation and/or disposing of feces.

*Accessibility of excreta disposal facilities* – efforts must be made to make sure that public and institutional latrines are gender specific and accessible in terms of both travel distance and physical design for people with limited mobility, such as people with disabilities, the elderly and pregnant women.

*Understanding barriers to latrine use and motivators for behaviour change* – telling people unaccustomed to using latrines that they should use these is an uncertain proposition at best. Cultural practices relating to defecation, excreta and its disposal must be understood to discover the barriers to latrine construction and use. Training for community-level staff (extension workers, community health workers, health brigades, Red Cross or Red Crescent volunteers, among others) should encourage the identification of barriers to practising healthy behaviours. Although investigating such community-specific issues may not always be possible during outbreaks, relevant information can be gathered and lessons drawn from prior research, and from assessment and monitoring processes during the outbreak in order to gain insight and consider actions to address the challenge.

### *Improving handwashing practices*

Making handwashing with soap easier at key times through the use of facilities positioned next to the latrine, kitchen or canteen is a practical action that communities can support (such as the construction of low-cost handwashing stations, so-called “tippy taps”). Ash can be used as an alternative where soap is not available; however, discussion with community members is needed to ensure that this is acceptable.

TIP

#### **Critical times for handwashing with soap**

- After using the toilet / latrines
- After cleaning a soiled baby
- Before eating
- Before feeding a child



### *Specific guidance for WASH in humanitarian emergency situations*

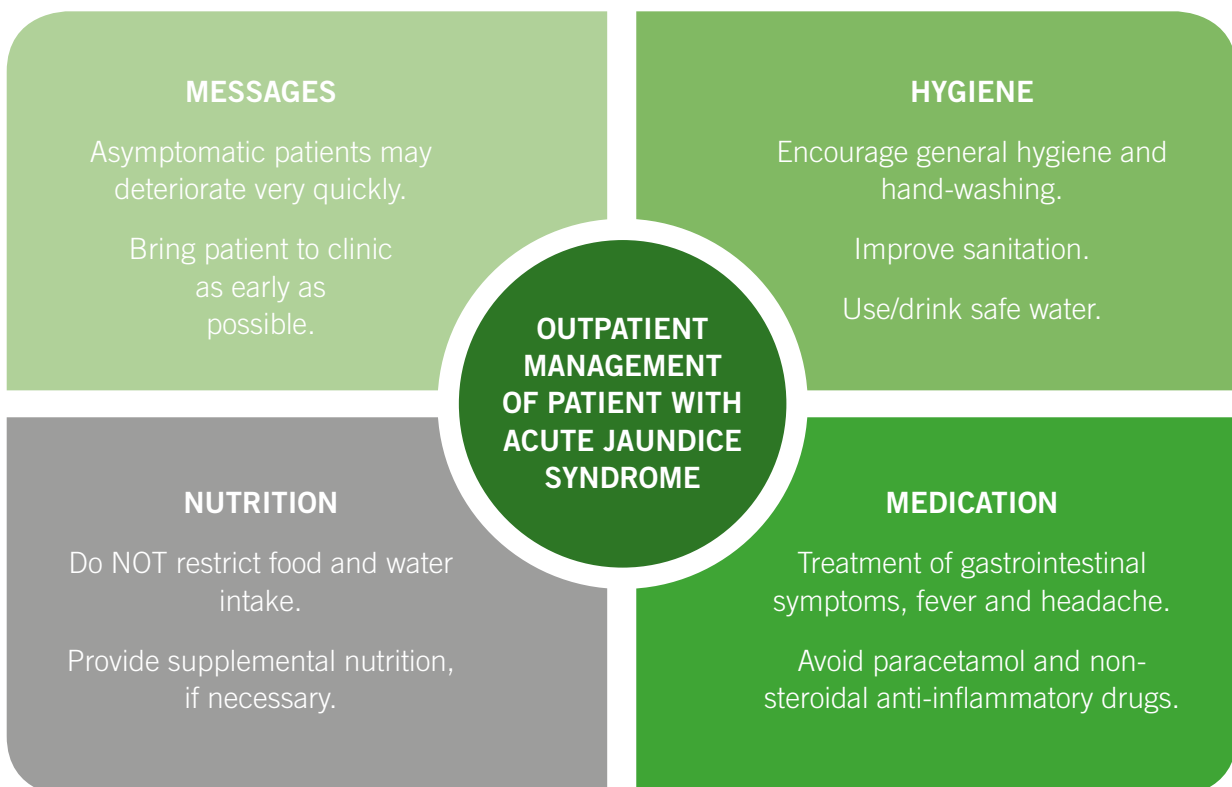
Disease outbreaks during disasters and emergencies pose special challenges related to WASH. The World Health Organization and Water Engineering Development Centre (WEDC) have jointly developed several illustrated notes that provide practical, evidence-based recommendations for responding to the immediate and medium-term WASH needs of populations affected by such emergencies. These notes are relevant to a wide range of emergency situations, including both natural and conflict-induced disasters. They are particularly suited for use by field technicians, engineers and hygiene promoters, as well as other staff dealing with these emergencies and disease outbreaks that may occur during these. Appendix H provides a listing of these notes and their online source.

#### **5.5.2. Patient management**

During an outbreak, the large number of cases may overwhelm the existing health-care facilities and personnel. Thus, measures to enhance the capacity of local health facilities and providers may be required. In addition, the existing health referral pathways, which are often non-existent or weak in low-resource settings, may need to be developed or strengthened. It is important to define policy for hospital admissions. The policy should be based on available infrastructure and size of the outbreak. Facilities should be prepared for potentially large numbers of patients in a variety of physical conditions, from pregnant women admitted for observation to people with altered consciousness or coma.

Health-care providers should follow the appropriate infection prevention and control measures (Appendix I), such as handwashing, the use of personal protective equipment and cleaning. Patient isolation and use of special protective equipment are NOT recommended for hepatitis E outbreaks. Efforts should focus on improving sanitation, hygiene and providing adequate quantities of safe water.

In addition, when hepatitis E outbreaks affect marginalized populations, particularly refugees, migrants, IDP mobile and cross-border populations, it is important to ensure follow up, and continued care and treatment of affected persons.





For more discussion on treatment, see Section 3.8.

Box 2 below shows an outpatient management framework used by Médecins Sans Frontières in a refugee camp during an outbreak in South Sudan in 2012–13. It may be useful to lay down such a framework early in the outbreak.

### 5.5.3. Community engagement and communication

Communicating with affected populations and engaging with the surrounding community are critically important steps to help mitigate the threat of hepatitis E outbreaks. Communication and community engagement can identify behavioural and social actions that may contribute to the spread of the disease and should be conducted before, during and after an infectious disease outbreak. Simply telling a community about hepatitis E may not change behaviours that spread the virus. Infectious disease outbreaks may have more to do with underlying problems, such as the local infrastructure, health systems, access to resources, and existing beliefs, behaviours and norms. Community understanding of diseases and their spread is complex, context dependent and culturally mediated. In cooperation with local health experts, it is important to look in the right places, ask the right questions and listen thoroughly before making technical recommendations and implementing interventions.

These methods can help to avoid initial infection or control an outbreak but should be done with consideration of the local setting. These considerations include identification of target audiences, information-seeking behaviour, literacy levels, cultural beliefs and potential barriers to behaviour change. Communicating with communities in combination with culturally adapted risk communications can ultimately help strengthen relationships, build trust and enhance transparency.<sup>45</sup>

Costly errors can be avoided if the issues and principles of risk communication are considered in advance.

#### HOSPITALIZATION CRITERIA USED BY MSF IN MABAN, SOUTH SUDAN

INDICATIONS FOR HOSPITALIZATION WHEN AT LEAST ONE OF THE FEATURES BELOW IS PRESENT:

- Mental status changes
- Hypoglycaemia
- Spontaneous bleeding
- Severe nausea and vomiting
- Generalized weakness and severe lethargy
- Pregnancy (especially in third trimester)

#### OPTIONAL INDICATIONS

- Positive malaria test
- Evidence of bacterial infection (e.g. fever)
- No indication for admission: clinical review in 7 days

#### BOX 2. Case report: Upper Nile, South Sudan

The surge of patients with acute jaundice syndrome required a sustained medical response in challenging field conditions. MSF's clinical response focused on supportive management. In addition to individual symptom management, all outpatients received multivitamins, supplemental nutrition, soap and hygiene education. A concerted effort to improve community outreach was implemented. Outpatients were reassessed every 7 days until symptoms resolved. Patients with high fever, anorexia, vomiting, diarrhoea, bleeding, agitation or coma were admitted, as were patients with a positive rapid diagnostic test for malaria, hypoglycaemia or pregnancy. A low-threshold approach to hospitalization was taken, including admission of all jaundiced pregnant women for observation, because of challenges in predicting clinical course. Critically ill patients had confusion, agitation, coma, hypoglycaemia or suspected electrolyte imbalances. These patients required intensive care in a resource-limited setting to manage fluid balance and complications of hepatic encephalopathy. Initial treatment included antibiotics and intravenous fluids.

*Source:* Adapted from Investigation of hepatitis E outbreak among refugees — Upper Nile, South Sudan, 2012–2013. MMWR 2013;62;581–6.

Keeping in mind the importance of communication in outbreak situations, this manual contains several appendices on this aspect of outbreak management.

Appendix J provides information on best practices for effective communication during disease outbreaks. An example of a successful community engagement and communication plan through a “village health committee” used during an outbreak of hepatitis E in Sudan is provided in Appendix K.

A template on gathering information to support outbreak communication and outreach efforts is provided in Appendix L, and a template for the first announcement about an outbreak in Appendix M. Some additional resources on effective communication are listed in Appendix N.

#### **5.5.4. Vaccine**

At present, one hepatitis E vaccine has been commercially developed and licensed in China. The vaccine contains a recombinant viral capsid protein. The vaccine has not yet undergone WHO prequalification. The WHO Strategic Advisory Group of Experts on Immunization (SAGE) set up a Working Group in the last quarter of 2013 to publish a WHO position paper on the use of hepatitis E vaccine.

The available data for this vaccine relate to pre-exposure protection after administration of three doses over a six-month period (0, 1 and 6 months), and to a limited extent following that of the first two doses (at 0, 1 month). The vaccine appears to be effective for at least two years;<sup>46</sup> future follow-up studies should provide data on whether the vaccine provides longer-term protection. No data are yet available on its effectiveness in the post-exposure setting, i.e. when a person has already been infected with the virus and receives the vaccine during the incubation period; this is often the situation in an outbreak setting. It is also not known whether the first dose of this vaccine provides any protection against the disease. Furthermore, it is unclear whether this vaccine can prevent asymptomatic infection and help interrupt viral transmission.

The maximum benefit from vaccine administration during an outbreak may be expected to accrue to subjects who are at a high risk of serious disease and adverse outcomes, such as pregnant women and persons with pre-existing chronic liver disease. However, currently, data on the efficacy of hepatitis E vaccine in these subgroups, and in preventing serious complications of hepatitis E, such as acute liver failure, are limited. Limited data on safety during pregnancy are available and are encouraging.<sup>47</sup>

Alternatively, a high coverage rate with the vaccine may be expected to prevent new infections and interrupt prolonged outbreaks. Further data are needed about the role of the hepatitis E vaccine in controlling outbreaks of this disease when added to conventional control measures. WHO and other international agencies have not yet provided any clear guidelines on the use of hepatitis E vaccine during disease outbreaks.

WHO has recently published a framework for decision-making on vaccination in acute humanitarian emergencies;<sup>48</sup> Appendix O provides further information.

## **5.6. Communicate findings**

Throughout the investigation, all relevant information should be communicated within the health authority in charge, to other relevant organizations, and to the general public. Outbreaks provide a unique opportunity to educate the general public about health promotion and disease prevention, and this opportunity should be seized.

Appendix P lists some of the key messages that may be conveyed to the general public during outbreaks of hepatitis E.

A template for a formal outbreak investigation report to the health authority in charge is given in Appendix Q.

## 5.7. Implement and evaluate control measures

Once the cause of the outbreak has been identified, longer-term control measures to end the current outbreak and prevent future outbreaks should be implemented. These control measures are more extensive than earlier control measures and should be evaluated to determine if they are effective. Examples of such measures are: recommending different food safety procedures in public eating places and implementing a better chlorination programme for public water systems.

After an outbreak, the outbreak control team must carry out a thorough evaluation of the response to the particular outbreak, including identification of its cause(s), surveillance and detection, level of preparedness, management and control measures during the outbreak.

The specific issues that should be evaluated under each heading include the timeliness of detection and adequacy of response, effectiveness, cost, lost opportunities and new/revised policies.

The findings of this evaluation should be documented in a written report that contains clear recommendations on the epidemiological characteristics of the epidemic, surveillance, preparedness and control measures carried out.

Please see Appendix O for guidance on evaluating the response to an outbreak.

## 5.8. Governance in outbreak response

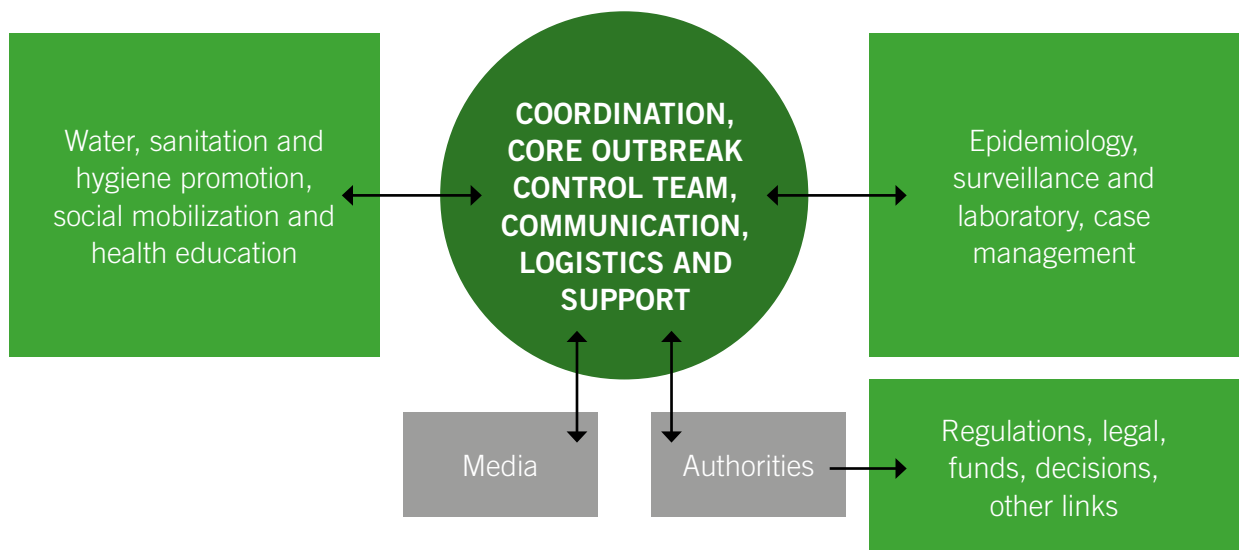
Governance in outbreak response may be defined as the way in which authority is shared among stakeholders, and the processes, systems and mechanisms used to respond to an outbreak. Good governance helps to define the scope of operations, activities, distribution of authority and resource mobilization (funds, personnel and supplies). The overall authority of coordinating an outbreak response rests with the national authorities, in consultation with local authorities. Where the government has limited resources and presence, authority may be entrusted to or assistance sought from international agencies or local nongovernmental organizations (NGOs).

Good governance must be cognizant of the diversity among stakeholders, and the cultural practices of the population affected by the outbreak. The community affected by the outbreak should be a part of the governance structure.

The International Health Regulations, 2005<sup>49</sup> provide a broad framework for an appropriate public health response to the international spread of diseases and risks from public health events of international concern. These regulations call for strengthened core surveillance and response capacities at all levels of the government.

An effective outbreak response should be coordinated and structured. In any outbreak, a functional structure that includes the key elements of response is essential. Figure 3 shows a generic outbreak coordination and response structure, and the key elements that should be considered during an outbreak of hepatitis E. Ideally, the coordination structure should be in place as a key activity of epidemic preparedness and response at the national or regional level. The coordination should be flexible, and interact with epidemiology, clinical, laboratory, education and other task forces. Functional logistics systems and skilled personnel are essential for an effective and efficient response.

The governance structure is also responsible for the generation of timely and quality information, management of information (storage, analysis), report writing and dissemination.

**FIGURE 3** Outbreak coordination and response structure

It is recommended that external experts be asked to conduct a post-outbreak evaluation, which is the responsibility of and should be facilitated by the government.

Some additional considerations may apply to outbreaks in special settings such as refugee camps and humanitarian emergencies. Although national authorities have the overall responsibility for outbreak coordination and response, they may call upon United Nations (UN) agencies such as WHO and United Nations High Commissioner for Refugees (UNHCR), and NGO partners for technical guidance and support. Technical assistance may include outbreak investigation, specimen collection and transport, laboratory processing of specimens, resource mobilization, and initiating and facilitating international support, if deemed necessary.

### Challenges to coordination

Hepatitis E has a long incubation period. Some outbreaks of hepatitis E have lasted for a year or even longer. Control of such outbreaks requires concerted efforts over relatively long periods of time and teams should be ready for this.

Appearance of new cases will continue for a few weeks even after the institution of adequate interventions and successful interruption of transmission. The public and administrative authorities may perceive this phenomenon as ineffective coordination and failure to institute effective interventions. It is therefore imperative that proper and accurate communication with stakeholders is initiated at an early stage and maintained throughout the outbreak.

## 6. APPENDIX A: DIRECT AND NEWER INDIRECT TESTS FOR DIAGNOSIS OF HEV INFECTION

### Nucleic acid testing

The nucleic acid of HEV (HEV RNA) can be detected in a fair proportion of serum or plasma specimens collected during the first two weeks of acquiring acute hepatitis E using reverse transcription and PCR, or a real-time-based PCR. These tests are highly specific. Further, the viral nucleic acids from specimens testing positive can be sequenced to determine the viral genotype to answer questions related to the epidemiology and pathogenesis of the disease. Thus, even if facilities for such tests are not immediately or easily available, it may be useful to store serum specimens from at least a few well-characterized affected persons during an outbreak for future analyses.

For this, blood should be drawn (10 mL), serum separated within 2–3 hours and then frozen in multiple aliquots at the lowest temperature for which facilities are available (preferably  $-80^{\circ}\text{C}$ ; if this facility is not available, store at  $-20^{\circ}\text{C}$ ). If a  $-20^{\circ}\text{C}$  facility is not available, some alternatives described below may be considered.

### Alternative specimen collection techniques

Some alternative specimen collection techniques may be considered in field settings with limited laboratory facilities, though direct experience with these for the diagnosis of HEV infection is limited.

Blood (10 mL) may be drawn into a commercially available EDTA tube containing anticoagulant (often referred to as a sequestrene tube as used by haematology laboratories), mixed by gentle inversion and the plasma separated by centrifugation. If centrifugation facilities are not available, tubes can be racked overnight for separation of cells by gravity. The EDTA plasma can then be removed and stored at ambient temperature. For hepatitis C virus, another RNA virus, this technique has been shown to lead to only minimal loss of RNA signal for up to 5 days.<sup>50</sup>

Drops of capillary blood, usually from a needleprick on a finger, may be spotted on an absorbent paper and allowed to dry (the infant postnatal dried blood spot screening paper, the Guthrie card, used in infant screening for metabolic disease is an example). Once dry, the spotted paper can be appropriately labelled, placed in an envelope, then transported at ambient temperature to a reference laboratory where a measured amount of the blood spot, usually achieved by using a paper punch to produce a disc, can be eluted and the resulting diluted blood sample tested. Blood spot samples can be stable for many months if stored dry and kept cool or at least out of direct sunlight, and have been used successfully for antibody, antigen and nucleic acid testing of several pathogens. These are particularly useful in situations with limited facilities for venesection, sample separation or rapid transportation.

## Testing for anti-HEV antibodies in oral fluid

In situations where blood samples are impossible to obtain, for example, in children, or for religious or social reasons, oral fluid may be a useful alternative specimen. It is collected from the mouth cavity using a specially designed absorbent brush, which is gently rubbed along the edge of the gums and placed in its original tube before transportation. However, the techniques for detection of anti-HEV antibodies in saliva are not yet well standardized, and may be available in only a few laboratories.

## 7. APPENDIX B:

# LINE LISTING AND SPOT MAPS

“Line listing” and “spot maps” are common epidemiological tools used for the detection and initial investigation of a disease outbreak. Each of these is described below.

### Line listing

Traditionally, epidemiologists collect data from each suspected case in an outbreak using a standard case report form or a questionnaire. However, the data in these individual forms are often detailed and difficult to interpret. Further, these do not provide a complete picture of the outbreak.

To overcome this difficulty, epidemiologists often place information from all forms into one “line listing”. This document, prepared either on paper or in an electronic format, looks like a spreadsheet, with rows and columns (Table B1). Information for each case is placed on one row, and each column represents an important variable. The line listing contains all the key information on every case. It is periodically updated, and allows a quick visual scanning, which is often much more efficient than reviewing all the case report forms.

The choice of variables to be listed is somewhat arbitrary and is based on the items deemed important and the hypotheses being tested. These could include the following.

#### Identifying information

- Identification number or case number, usually in the first column
- Name or initials of the person as a cross-check

#### Descriptive epidemiology—person, time and place

- Age, sex, race/ethnicity, occupation (if relevant), and other relevant characteristics
- Date and/or time of onset
- Place of residence: worksite, school, day care centre, if relevant

#### Clinical information

- Important symptoms
- Important laboratory results
- What was the physician’s diagnosis? Was diagnosis confirmed? If so, how?
- Was the person hospitalized? What was the outcome (e.g. death)?

#### Risk factors and possible causes

- Specific to disease and outbreak setting

Line listing is an efficient way of displaying the key data elements and is very useful for the outbreak investigation team. It provides a log of all the possible and confirmed cases identified to date.

**TABLE B1.** An example of line listing of cases during an outbreak of hepatitis E

No.	Name	Age	Sex	Report date	Onset date	Water source	Clinical signs and symptoms					Laboratory tests			
							F	N	V	J	P	Bilirubin (mg/dL)	ALT*	Anti-HEV IgM	HBsA
1	ABC	28	M	18-Jun	12-Jun	Well A	1	0	1	1	NA	6.5	8	NA	Negative
2	DEF	22	F	19-Jun	17-Jun	Well A	0	1	1	1	0	4.3	16	+	Negative
3	GHI	19	F	21-Jun	15-Jun	Well A, B	0	1	0	1	0	2.7	13	+	Negative
4	JKL	25	M	21-Jun	17-Jun	Well A, C	1	1	1	1	0	7.9	18	Awaited	Negative
5	PQR	37	M	21-Jun	18-Jun	Well A	1	1	0	1	1	5.6	NA	NA	Negative

F=fever, N=nausea, V=vomiting, J=jaundice, P=pain abdomen, ALT=alanine aminotransferase (\*in fold upper limit of normal, to nearest whole number), 1=present, 0=absent, NA=not available

It can help identify those cases that have been interviewed and those that have not. A visual scan can reveal common responses, outliers and missing data in each column, allowing for a quick analysis of data for any risk factors. This helps to generate hypotheses regarding source and mechanisms of transmission of infection, which can then be formally tested using further epidemiological tools.

For instance, in the example provided in the Table 1, one can easily notice that the cases are mostly young and belong to both sexes. All of them have jaundice, and most also have nausea and vomiting. At least two of the five have IgM anti-HEV and all lack HBsAg (a marker of hepatitis B), suggesting that the outbreak may be caused by HEV infection. All the cases use “well A” as their water source, suggesting that it could be the source of infection.

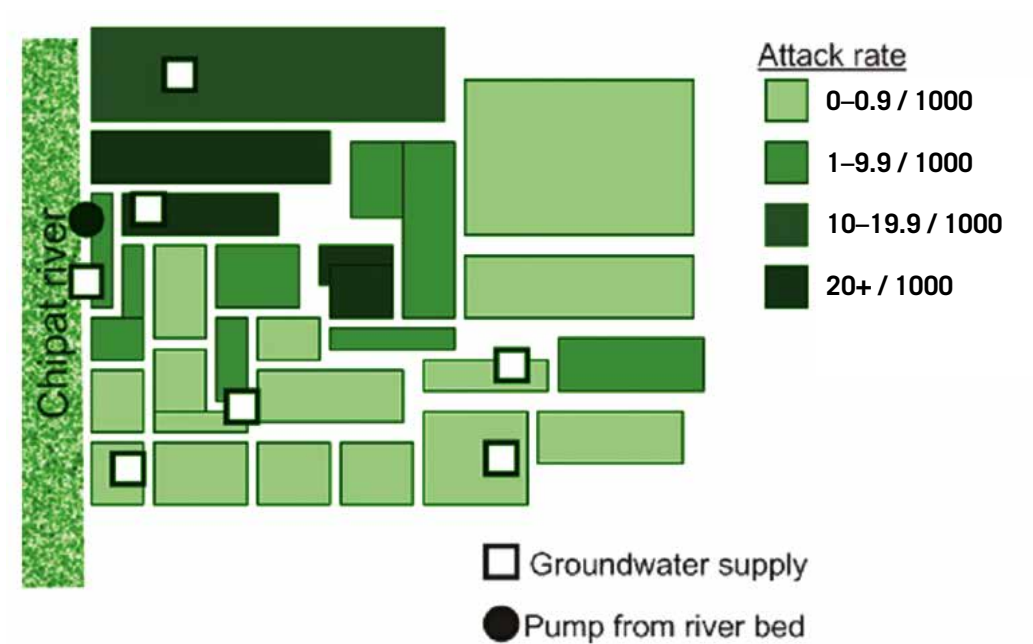
## Spot maps

Assessment of cases in an outbreak by place provides information on the geographical extent of the outbreak. A simple and useful technique for this is to plot the places where affected people live, work, or which they may have visited on a “spot map” of the area. These maps may reveal clusters or patterns that provide clues to the identity and origins of the problem. These patterns could relate to the water supply system, or to a source of food (e.g. proximity to a restaurant or food market).

One must, however, be careful that clustering of a large number of cases in a small area may occur if that area has a higher density of population than the surrounding areas. In such cases, plotting “attack rates” in different population units (Figure B1) may be helpful.



**FIGURE B1.** An example of a “spot map” during an outbreak of hepatitis E. It shows that the disease attack rate was much higher in one part of Baripada city where the outbreak occurred. This part received water from the neighbouring river.



*Source:* Reprinted from Transactions of the Royal Society of Tropical Medicine and Hygiene, vol. 104, Swain SK, Baral P, Hutin YJ, Rao TV, Murhekar M, Gupte MD, A hepatitis E outbreak caused by a temporary interruption in a municipal water treatment system, Baripada, Orissa, India, 2004, pp. 66–69, copyright 2010, with permission from Elsevier.

## 8. APPENDIX C: SPECIMEN COLLECTION, STORAGE AND TRANSPORT

In an outbreak situation, it is important to plan for collecting, storing and transporting specimens.

Select the laboratory for specimen testing. Once the receiving laboratory(ies) has been identified, decide which clinical specimens are required to confirm the cause of the outbreak. All aspects of the handling of clinical specimens, from selection of sample type, collection materials, local or on-site processing, transport of specimens, and transmission of results should be organized in consultation with the laboratory. The laboratory may need to supply special instructions in advance. It is essential that key contact personnel be nominated in advance; these include persons who will be responsible for coordinating the logistical aspects of sample handling, and transmit information or queries between the field and the laboratory.

Decide who will collect, process and transport the specimens. Decide whether a laboratory specialist or technician should join the team. Otherwise, the team must receive training in the collection, handling and transport of the required specimen, as well as safety and decontamination procedures. Remember to offer this training to persons joining the team during the course of the investigation, e.g. local health-care workers assisting at a particular site.

Define the procedures necessary for specimen management. Consider in advance the logistic requirements for sampling equipment and supplies, specimen handling and transport to the laboratory (timing, route, transit temperature requirements, shipping procedures and documentation) and decontamination procedures. In addition, arrange transport, accommodation and protection for the team, and secure lines of communication (e.g. satellite phone), and return of test results from the laboratory to the field.

### **Blood specimen collection<sup>51</sup>**

Blood and separated serum are the most common specimens taken in outbreaks of communicable diseases. Venous blood can be used for isolation and identification of the pathogen in culture by inoculation, or separated into serum for the detection of genetic material (e.g. by polymerase chain reaction), specific antibodies (by serology), and antigens or toxins (e.g. by immunofluorescence). For the diagnosis of viral pathogens, serum is preferable to unseparated blood, except where otherwise directed.

When specific antibodies are being assayed, it is often helpful to collect paired sera (i.e. an acute sample at the onset of illness and a convalescent sample 1–4 weeks later).

## Venous blood samples

### Materials for collection

The following materials are required:

- Skin disinfection: 70% alcohol (isopropanol, ethanol) or 10% povidone–iodine, swabs, gauze pads and adhesive dressings;
- Disposable latex or vinyl gloves;
- Tourniquet, Vacutainer or similar vacuum blood collection devices, or disposable syringes and needles, and sterile screw-cap tubes (or cryotubes if indicated);
- Labels and indelible marker pen.

### Method of collection

- Place a tourniquet above the venepuncture site.
- Palpate and locate the vein. The venepuncture site must be meticulously disinfected with 10% povidone–iodine or 70% alcohol by swabbing the skin concentrically from the centre of the venepuncture site outwards. Let the disinfectant evaporate. Do not palpate the vein again.
- Perform venepuncture.
- If using conventional disposable syringes, withdraw 5–10 mL of whole blood from adults, 2–5 mL from children and 0.5–2 mL from infants.
- Using an aseptic technique, transfer the specimen to the appropriately capped transport tubes. Secure caps tightly.
- If using a vacuum system, withdraw the desired amount of blood directly into each transport tube.
- Remove the tourniquet. Apply pressure to the site until bleeding stops, and then apply a dressing.
- Label the tube, including the unique patient identification number, using an indelible marker pen.
- Do not recap used sharps (e.g. needle devices, scalpels or lancets).
- Discard directly into a sharps disposal container.
- Complete the case investigation and the laboratory request forms using the same identification number.

### Handling and transport

- Blood specimen bottles and tubes should be transported upright and secured in a screw-cap container or in a rack in a transport box.
- They should have enough absorbent paper around them to soak up all the liquid in case of a spill.
- For serum samples (e.g. for measles), the blood cells must be separated from serum. Let the clot retract for 30 minutes, then centrifuge at 2000 rpm for 10–20 minutes and pour off the serum.
- If no centrifuge is available, place the sample in a refrigerator overnight (at least 4–6 hours) and pour off the serum and transport it in a clean glass tube.

Full protection and infection control measures must be taken.

# 9. APPENDIX D: HOW TO DESIGN A STRUCTURED QUESTIONNAIRE

## General considerations

While designing a questionnaire, it is important to first decide whether it would be self-administered or used for face-to-face interviews. The language used must be simple, clear, unambiguous, and understood by people living in the outbreak area.

The questions could be open-ended (with a large number of possible answers) or close-ended (with one of the few predefined, mutually exclusive but exhaustive options); often, a mix of these two types of questions is the most economical in terms of time taken to collect information. Further, it is important to include a short, clear introduction on why the information is being collected and a section to obtain informed consent. The questionnaire should try to cover all the information required without being too long. It is important to pre-test the questionnaire on a few cases to ensure that the questions are easily understood, and elicit consistent and interpretable answers. Depending on the feedback, the questionnaire should be modified. In some outbreak settings, it may be difficult to interview the cases directly (e.g. women in some cultures); it may be useful to try and design a questionnaire that can be answered by a proxy respondent (usually a family member).

## Nature of information to be elicited

The questionnaire should elicit information on the following points:

- a. Identifying information and address;
- b. Clinical characterization of the disease syndrome, including any available laboratory data – to help in identifying the diseases that need consideration and those that can be reasonably excluded based on previous information about various diseases (e.g. if there is no fever, malaria can be excluded);
- c. Descriptive epidemiological information about cases -- in terms of “time, place and person” (age, sex, race/ethnicity, occupation, onset of illness, place of residence and work);
- d. Information on the severity of illness (need for hospitalization, outcomes such as death);
- e. Information on risk factors and exposures, which may point to the source and route of transmission;
- f. Information on confounding factors, i.e. factors that may be closely associated with the disease but are not responsible for causing it (e.g. socioeconomic exposures) as well as other exposures, leading to false exposure–disease association.

The questions to be included in the questionnaire would thus depend on the stage of the outbreak at which the questionnaire is to be used. For instance, in the early stages of an outbreak when the cause of acute jaundice syndrome is unclear, questions on clinical characterization would be more important.

By contrast, if it is clear that the cases have acute viral hepatitis, questions on symptoms associated with other causes of acute jaundice syndrome may not be required, but those for modes of transmission of different hepatitis viruses would be important (e.g. exposure to blood, intravenous drugs or commercial sex workers for hepatitis B virus, and sources of water and food for hepatitis A and E). If it is already clear that the outbreak is due to hepatitis E, a more focused questionnaire on the use of different water sources in the community may be more helpful.

It is often useful to carry out open-ended interviews on a few cases to elicit the views of the community on the possible sources and causes of the outbreak. It also helps to visit the area of the outbreak to get first-hand knowledge about the practices prevalent in the community (e.g. those related to water transport, storage and use at home). These actions may throw up clues that can then be assessed in the questionnaire.

# 10. APPENDIX E:

## WATER SUPPLIES AND TREATMENT<sup>c</sup>

For control of waterborne outbreaks, it is critical to provide and improve access to safe and adequate water supplies. The improvement in water supply should be sustainable.

The table below describes the residual chlorine requirements for various distribution channels during a cholera outbreak or high-risk period; it may be reasonable to follow these recommendations during hepatitis E outbreaks.

Free chlorine residuals required in distribution systems during a cholera outbreak or when there is a risk of an outbreak

Location in the distribution system	Residual (after 30-minute contact time)
At all points in a piped system	0.5 mg/L
At all standpipes in systems with standpipes	1.0 mg/L
In tanker trucks, at filling	2.0 mg/L

*Note:* During a cholera outbreak, there should be a chlorine residual of 0.2–0.5 mg/L at all points in the supply, which means that a chlorine residual of about 1 mg/L will be needed when the water leaves the treatment plant.

For tankers, the chlorine level needs to be checked near the point of discharge. If it is below 0.2 mg/L, more chlorine should be added. Chlorination in a tanker will prevent build-up of organic matter in the tank as well as make the water safe to drink.

Chlorine levels can be tasted at about 0.8 mg/L and therefore, unless higher levels are vital for health reasons such as cholera outbreaks (see the note below for standpipes), it is recommended that such high levels, while being safe for health, are avoided at the point of consumption.

The higher chlorine levels at standpipes are included because of the higher risk of contamination between the standpipe, home and point of consumption, leading to a reduced chlorine level by the time the water has been drunk.

### Chlorination of wells

The aim of chlorinating wells is to keep residual chlorine at a minimum of 0.5–1.0 mg/L at the point of water collection during the outbreak.

The options for chlorinating wells include the following:

- Use of pot chlorinators with-slow release chlorine tablets;
- Adding a solution made from powdered chlorine on a regular basis (see documents listed in Appendix H – Technical notes on drinking water and sanitation and hygiene in emergencies, 2011)

Both involve regular monitoring of the resultant chlorine residuals.

<sup>c</sup> Adapted from the Cholera toolkit. New York: UNICEF; 2013. <http://www.unicef.org/cholera/> (accessed on 03 May 2014).

The use of pot chlorinators (floating containers into which a slow-release chlorine tablet is added) in wells has been shown to have variable results. In general, it is recommended that pot chlorinators should not be used for high-risk, lined wells during a disease outbreak. Instead, these wells can be chlorinated directly using calcium hypochlorite (HTH chlorine) on a regular basis. Residual chlorine testing should be done several times a day.

Chlorination is not recommended for unlined wells because the chlorine will be used up by the organic materials of the well walls, so it will be difficult to establish or maintain the target levels of free chlorine residual. Instead, when a well is unlined, point-of-use water treatment and safe storage should be promoted.

The decision to chlorinate wells is also complicated if some people use household chlorination and others do not use any form of household treatment. A decision will have to be made based on the perceived risks and alternatives available, including whether point-of-use treatment is being taken up and practised correctly and consistently by a significant proportion of the population. See the note below on the health impacts of chlorine, which confirms that even if water is treated with chlorine twice, the result is unlikely to present a health hazard. However, it is possible that people will not want to drink double-treated water if the chlorine taste is too strong.

### **WHO guidance on the health impacts of chlorine**

The WHO guidelines for drinking water quality (2011, p. 334–5) ([http://www.who.int/water\\_sanitation\\_health/publications/2011/dwq\\_guidelines/en/](http://www.who.int/water_sanitation_health/publications/2011/dwq_guidelines/en/)) note that, at 5 mg/L, “The guideline value is conservative, as no adverse effect level was identified in the critical study.” It also notes that most people are able to taste chlorine in water at the guideline level, which means that people will reject drinking water because of a strong chlorine taste before it becomes a hazard to health. Appendix F provides further detail on point-of-use water treatment and safe storage (PoUWT&SS).

### **Water needs for basic survival**

- Survival needs: water intake (drinking and food): 2.5–3 L per day (depends on the climate and individual physiology)
- Basic hygiene practices: 2–6 L per day (depends on social and cultural norms)
- Basic cooking needs: 3–6 L per day (depends on food type and social and cultural norms)
- Total basic water needs: 7.5–15 litres per day

### **Maximum number of people per water source:**

- 250 people per tap (based on a flow of 7.5 L/min)
- 500 people per hand pump (based on a flow of 17 L/min)
- 400 people per single-user open well (based on a flow of 12.5 L/min)

### **Urban and rural water supplies**

- Work with epidemiologists to map and identify the hotspot areas where outbreaks are occurring and prioritize these areas, neighbouring areas and other high-risk areas to ensure an adequate water supply with associated sanitation and hygiene.
- Undertake assessments and sanitary surveys in the affected area and/or the area most vulnerable to new outbreaks in order to identify the source of the outbreak or the potential source of new outbreaks (where possible); check sanitary conditions, including integrity of sewage systems; assess water quality at point of supply.
  - Identify key gaps in the water supply or distribution system, and which actions could have the greatest effect on supply in a short time frame, such as: repairing strategic distribution or borehole pumps;
  - Repair major leaks;

- Transport clean water in tankers to temporary tanks in low-income, high-density underserved areas;
  - Assist community management committees to repair pumps that have broken down;
  - Mend broken sewerage pipes and reduce other opportunities for contamination of the source (e.g. mending cracked well heads, improving drainage);
  - Chlorinate improved water sources that have been repaired but may have previously been contaminated;
  - Use bucket chlorination at the source as a last resort temporary measure during the period of repair, where it is not possible to repair improved sources, where improved sources do not exist, or where it is not possible to ensure effective household water treatment in a short time frame;
  - Close off contaminated or high-risk water points, provide temporary alternatives (such as trucking to storage tanks with tap stands) and plan for future actions to repair or improve high-risk sources after the outbreak;
  - Increase supply times in the most vulnerable areas (high-density, overcrowded areas, those with the least access to safe water supply and sanitation, those next to lakes and on transport routes);
  - Temporarily reduce or remove financial charges for water at tap stands in the most vulnerable areas.
- Increase storage capacity for bulk supplies to allow for gaps in supply, and also assess the need for increased household storage. (Appendix F provides more information on household water storage methods).
  - Borehole drilling takes time to set up and complete (from the development of contracts, the hydrogeological surveys, drilling, well development, construction of platform and handover). Unless the hydrogeological surveys results are available and contracts are in place, or the hydrogeology of the area means that boreholes drilled in any location are likely to be successful, borehole drilling should only be used as a last resort during a cholera outbreak. If boreholes or construction of other new water points is undertaken, associated support should be provided for longer-term ownership, operation and maintenance.
  - Increase staffing to undertake actions to improve water services in the most vulnerable areas.
  - Ensure that all urban water treatment works have an adequate supply of coagulants and chlorine (gas or HTH depending on the dosing mechanism).
  - Increase the doses of chlorine to ensure increased residuals.
  - Increase monitoring for fecal contamination and residual chlorine at peripheral points of use in the cities.
  - Undertake community mobilization and raise awareness on the importance of protecting water sources and of storing water in the home safely;
  - Work with private water vendors and tanker owners and drivers to increase awareness on cholera and their role in cholera prevention.
  - If water safety plans for urban water services have been prepared by the water authorities, these can be useful tools for the identification of key risks in the system, allowing actions to respond to the risks.



# 11. APPENDIX F:

## POINT-OF-USE WATER TREATMENT AND SAFE STORAGE<sup>d</sup>

Just providing clean water to a community or household may not be adequate, as there are opportunities for it to be contaminated beyond that point, i.e. during storage or by the users themselves before it is consumed. This appendix deals with approaches to prevent or deal with such contamination.

### Point-of-use water treatment in outbreaks: challenges, controversies and potential

Point-of-use water treatment and safe storage (PoUWT&SS) has recently gained much attention, notably in the context of emergency situations. Chlorine tablets are often selected as the first product of choice for PoUWT and distributed in non-food item packages or as part of social marketing campaigns extended from the development context.

It is often mistakenly assumed that once products (often chlorine tablets) have been distributed, water quality has been effectively addressed, which is frequently not the case.

### Challenges and controversies of PoUWT in emergencies

- There have been limited evaluations of interventions such as chlorine tablet distribution and other products in emergencies. These evaluations have shown that correct and effective use of products varies from 20% to over 30%. The use of PoUWT&SS in emergencies has been more effective where these programmes were already being practised and included training, follow up and provision of safe storage containers. However, this is not the usual default situation.
- PoUWT products are often distributed in an emergency, without considering what households will do when the supply runs out or when parts need replacing. Scale-up studies of PoUWT have shown significant challenges in ensuring the correct and consistent use of products, sustaining their use over the longer term, and problems relating to the supply chain.
- The recommendation to filter and use a double dose to chlorinate water that is turbid is still controversial.

### The potential for PoUWT in disease outbreaks

While considering the above challenges and controversies, the following should also be noted:

- In many contexts, including, in particular, dispersed rural contexts, the supply of safe water is still limited and is likely to remain so for some time. While progress is being made, human resources, logistics and sustainability all continue to challenge the concept of universal access to a safe water supply.

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<sup>d</sup> Adapted from the Cholera toolkit. New York: UNICEF; 2013. <http://www.unicef.org/cholera/> (accessed on 03 May 2014).

- Water will continue to be contaminated between the water source and the point of drinking until everyone practises safe excreta disposal and good hygiene or until all water supplies have an effective chlorine residual at the point of supply to overcome contamination that may occur during collection, handling and storage.
- PoUWT&SS allows the family control over the provision of safe water, reducing reliance on others. This control is particularly valuable in an outbreak situation and where provision of safe water is likely to be some time away.

## The use of PoUWT&SS options in outbreaks

When considering the use of PoUWT&SS products, the following should be considered:

- What are the alternatives to the promotion of PoUWT&SS? Is there a more feasible way to increase the proportion of people who drink safe water?
- If the promotion of PoUWT&SS options means that a reasonable proportion of people start using safe water, then it is still valuable as an outbreak response – a reasonable proportion, such as 30%, is better than none. This should be balanced with consideration of the time, effort and resources required to put PoUWT&SS in operation.
- Unless water supplies have a chlorine residual, the risk of contamination will still be present in the household (although it can be reduced by safe handling and storage). Most other supply options do not respond to the issue of post-supply contamination.

## Selection of a PoUWT&SS option for use in an outbreak

Considerations needed for the selection and promotion of PoUWT&SS option in an outbreak:

- Which PoUWT&SS options sufficiently reduce contaminants and protect health?
- Which PoUWT&SS option is the affected population familiar with?
- Which equipment and consumables are already available in the local shops?
- Can support be prioritized for PoUWT&SS systems that are already known and used by households?
- Who is already promoting PoUWT&SS in the area, what methods are they supporting and do they have the capacity to increase their efforts?
- Which PoUWT&SS options have proven to be the most effective in the particular context?

## Comparison of PoUWT options

	Benefits	Drawbacks	Appropriateness
<b>Household chlorination</b>	<ul style="list-style-type: none"> <li>• Documented reduction of most bacteria (including cholera) and viruses in water</li> <li>• Residual protection against contamination</li> <li>• Acceptability to some users because of ease of use</li> <li>• Documented health impact</li> <li>• Scalability</li> <li>• Low cost</li> </ul>	<ul style="list-style-type: none"> <li>• Relatively low protection against parasitic cysts</li> <li>• Lower disinfection effectiveness in turbid waters contaminated with organic and some inorganic compounds</li> <li>• Potential user taste and odour objections</li> <li>• Necessity of ensuring quality control of solution</li> <li>• Misunderstandings about the effects of chlorination by-products</li> </ul>	Most appropriate in areas with a consistent water supply chain, with relatively lower turbidity water, and situations where educational messages can reach a target population to encourage correct and consistent use

## Comparison of PoUWT options (continued)

	Benefits	Drawbacks	Appropriateness
<b>Flocculent / disinfectant products</b>	<ul style="list-style-type: none"> <li>• Documented reduction of bacteria, viruses and protozoa in water</li> <li>• Reduction of some heavy metals and pesticides</li> <li>• Residual protection against contamination</li> <li>• Documented health impact</li> <li>• Acceptability to users because of visual improvement in the water</li> <li>• Sachets are easily transported due to their small size</li> <li>• Long shelf-life</li> <li>• Classified as non-hazardous material for air shipment</li> </ul>	<ul style="list-style-type: none"> <li>• The need for multiple steps to use the product, which requires a demonstration to teach new users</li> <li>• The need for users to have, employ and maintain two buckets, a cloth and a stirring device</li> <li>• The higher relative cost per litre of water treated compared to other household water treatment options</li> </ul>	Most appropriate in areas with very turbid water or a consistent supply chain, and in situations where product can actually be demonstrated and educational messages can reach a target population to encourage correct and consistent use
<b>Solar disinfection</b>	<ul style="list-style-type: none"> <li>• Documented reduction of viruses, bacteria and protozoa in water</li> <li>• Documented reduction of diarrhoeal disease in users</li> <li>• Acceptability to some users because of the simplicity of use</li> <li>• No cost to the user after obtaining plastic bottles</li> <li>• Minimal change in taste of the water</li> <li>• Minimal likelihood of recontamination due to safe storage</li> </ul>	<ul style="list-style-type: none"> <li>• The need for pre-treatment (filtration or flocculation) of water with high turbidity</li> <li>• User acceptability concerns because of the limited volume of water that can be treated at once</li> <li>• The lack of visual improvement in water aesthetics to reinforce the benefits of treatment</li> <li>• The length of time required to treat water</li> <li>• The large supply of intact, clean, suitable plastic bottles required</li> </ul>	Most appropriate in areas where bottles are available and repeated community motivation and training can be conducted for users on how to correctly and consistently use solar disinfection for treating household drinking water. Effectiveness is reduced in very turbid water.
<b>Ceramic filtration (candle, bucket, etc.)</b>	<ul style="list-style-type: none"> <li>• Documented reduction of bacteria and protozoa in water</li> <li>• Acceptability to users because of the simplicity of use and the aesthetic improvement in treated water</li> <li>• Documented reduction of diarrhoeal disease among users</li> <li>• Potentially long life if the filter remains unbroken</li> <li>• One-time cost</li> </ul>	<ul style="list-style-type: none"> <li>• Low effectiveness against viruses</li> <li>• Lack of residual protection can lead to recontamination if treated water is stored unsafely</li> <li>• Variability in quality control of locally produced filters</li> <li>• Filter breakage and need for spare parts</li> <li>• Filters and receptacles need to be regularly cleaned, especially when using turbid source waters</li> <li>• A low flow rate of 1–3 L/hour (slower in turbid waters)</li> </ul>	Most appropriate in areas where there is capacity for quality ceramics filter production, a distribution network for replacement of broken parts, and provision of user training on how to correctly maintain and use the filter. It might not be feasible in emergency contexts.
<b>Biosand filtration</b>	<ul style="list-style-type: none"> <li>• Documented removal of protozoa and bacteria</li> <li>• Acceptability to users because of high flow rate (~20 L/hour), ease of use, and visual improvement in the water</li> <li>• Production from locally available materials</li> <li>• One-time installation with low maintenance requirements</li> <li>• Long life</li> </ul>	<ul style="list-style-type: none"> <li>• The biosand film where the biological processes happen takes some time to build up and hence unless it is already running would not be appropriate for an outbreak</li> <li>• Comparatively low inactivation of viruses</li> <li>• Absence of post-filtration residual protection so that if water is filtered into an open or unclean bucket there is potential for contamination</li> <li>• The difficulty in producing and transporting a heavy filter housing and the high initial cost that make scalability more challenging</li> </ul>	Most appropriate in areas where there is external funding to subsidize the initial cost of the filter, education for users, locally available sand, and a transportation network capable of moving the buckets and sand. It might not be feasible in emergency contexts.

## Comparison of PoUWT options (continued)

	Benefits	Drawbacks	Appropriateness
<b>Boiling</b>	<ul style="list-style-type: none"> <li>Existing presence in many households of materials needed to boil water</li> <li>Documented inactivation of bacteria, viruses and protozoa, even from turbid or contaminated water (almost all bacteria and viruses are killed after 12 seconds by the time water reaches 65 °C)</li> <li>Sociocultural acceptance of boiling for water treatment in some cultures</li> </ul>	<ul style="list-style-type: none"> <li>Lack of residual protection against contamination</li> <li>Lack of epidemiologically confirmed health impact</li> <li>Potential for burn injuries and increased risk of respiratory infections from indoor stoves or fires</li> <li>Potentially high cost of carbon-based fuel source (with concurrent deforestation risk) and the opportunity cost of collecting fuel</li> <li>Potential user taste objections</li> <li>Potential for incomplete water treatment if users do not bring water to full boiling temperature</li> </ul>	Most appropriate in areas with an affordable and accessible supply of cooking fuel, a cultural tradition of boiling, and where water is stored safely after boiling

## Comparison of safe storage options

Container type	Benefits	Drawbacks
<b>Narrow-necked container</b>	Less opportunity for contamination because of difficulty for hands or implements to be put inside the container	More difficult to clean inside the container More bulky to transport (unless collapsible)
<b>Covered container with tap</b>	Reduces opportunity for contamination because the user does not need to put hands or implements inside the container	Tap can become damaged or may leak Additional cost for the tap and its replacement More difficult to transport unless taps are fixed at the point of distribution Easier to clean inside the container (than a narrow-necked container)
<b>Container with a lid and dedicated implement for taking out the water</b>	A lid reduces opportunities for contamination and so does a dedicated implement (versus an uncovered container and no dedicated implement for abstracting the water)	Risk of some users using the abstraction implement for other purposes (drinking, eating, etc.) Easier to clean inside the container (than a narrow-necked container)

## Other factors to consider for point-of-use water treatment and safe storage

Private sector organizations or others using social or commercial marketing approaches might have established supply chains that are active in the area. They can be useful resources to provide information on PoUWT&SS and ensure that products are available and accessible through local outlets.

Training in the use of household water treatment products should be always provided, together with monitoring and support to users. Instructions on the use of products must be available and distributed in the local language.

Distribution of PoUWT&SS products requires special logistics arrangements, which can take considerable time to become operational, especially in sparsely populated areas. Consider this when including PoUWT&SS as part of the response plan.

The turbidity of water will affect the efficiency of chlorine products. Double dosing is often recommended but this can also lead to a strong chlorine taste, which can result in people rejecting the water for drinking.

Coordinate with all other actors to ensure that the same products are being supported and have the same instructions; otherwise, this can cause confusion among the users (some products are used with 10 L of water, some with 20 L of water).

## Further reading

For information on the log removal of bacteria, viruses and protozoa with different PoUWT options, refer to the WHO Guidelines for water quality, 2011, pp 145–6. ([http://www.who.int/water\\_sanitation\\_health/publications/2011/dwq\\_guidelines/en/index.html](http://www.who.int/water_sanitation_health/publications/2011/dwq_guidelines/en/index.html))

For further information and views, refer to the SMART disinfection solutions (<http://www.washdoc.info/docsearch/title/171589>) (Netherlands Water Partnership), p. 25, and the publication by the International Federation of Red Cross and Red Crescent Societies on household water treatment and safe storage (<http://www.ifrc.org/Global/Publications/disasters/142100-hwt-en.pdf>).

Although an outbreak does not constitute a humanitarian situation by itself, Sphere Minimum Standards for Humanitarian Response (The Sphere Project, 2011) could serve as a baseline when no additional standards are available at the national level.<sup>52</sup>

For further information on water quality including on PoUWT&SS, refer to the Sphere Minimum Standards (<http://www.sphereproject.org/handbook/>), pp 100–3 (key actions, indicators and guidance notes).<sup>52</sup>

## 12. APPENDIX G: SAFE DISPOSAL OF EXCRETA<sup>e</sup>

If there is an outbreak during a humanitarian crisis, the response needs to take the Sphere Standards into account. These standards are of two types (pp 105–10 of the Sphere Handbook).<sup>52</sup>

*Excreta disposal standard 1:* Environment free of human feces: “The living environment in general and specifically the habitat, food production areas, public centres and surroundings of drinking water sources are free from human fecal contamination.”

*Excreta disposal standard 2:* Appropriate and adequate toilet facilities: “People have adequate, appropriate and acceptable toilet facilities, sufficiently close to their dwellings, to allow rapid, safe and secure access at all times, day and night.”

The Sphere Standards on excreta disposal list the following alternatives for safe excreta disposal:<sup>52</sup>

1. Demarcated defecation area (with sheeted-off segments) – first phase: the first two to three days when a huge number of people need immediate facilities
2. Trench latrines – first phase: up to two months
3. Simple pit latrines – plan from the start through to long-term use
4. Ventilated improved pit latrines (VIP) – context-based for middle- to long-term exposure
5. Ecological sanitation (Ecosan) with urine diversion – context based, in response to high water table and flood situations, right from the start or middle- to long term
6. Septic tanks – middle- to long-term phase

The Sphere Standards also note that: “In flood or urban disasters, the provision of appropriate excreta disposal facilities is usually difficult. In such situations, various human waste containment mechanisms, such as raised toilets, urine diversion toilets, sewage containment tanks and the use of temporary disposable plastic bags with appropriate collection and disposal systems, should be considered. These different approaches need to be supported by hygiene promotion activities.”<sup>52</sup>

For further information on excreta disposal, please refer to the section on Excreta disposal in Sphere Minimum Standards (pp 105–10).<sup>52</sup>

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<sup>e</sup> Adapted from the Cholera toolkit. New York: UNICEF; 2013. <http://www.unicef.org/cholera/> (accessed on 03 May 2014).

## Excreta disposal in outbreaks of disease with fecal–oral transmission

Focus on what is achievable in a short time frame, for example, burying feces versus constructing a new latrine if a person does not already have access to one, and on keeping existing latrines clean and with functioning handwashing facilities with soap.

An outbreak can, however, be a good motivator to construct latrines, so when human resources are available to build on this opportunity, they should be utilized.

Where possible, identify common barriers to use and what factors might motivate people to use a latrine and wash hands with soap at critical times. This will be useful for designing programme interventions that will help overcome the barriers to action.

# 13. APPENDIX H:

## TECHNICAL NOTES ON DRINKING WATER, SANITATION AND HYGIENE IN EMERGENCIES<sup>f</sup>

The following technical notes, originally prepared in 2011 and updated in 2013, provide practical, evidence-based recommendations on responding to immediate and medium-term water, sanitation and hygiene needs of populations affected by emergencies.

These four-page illustrated notes are relevant to a wide range of emergency situations, including both natural and conflict-induced disasters.

1. Cleaning and disinfecting wells
2. Cleaning and disinfecting boreholes
3. Cleaning and disinfecting water storage tanks and tankers
4. Rehabilitating small-scale piped water distribution systems
5. Emergency treatment of drinking water at the point of use
6. Rehabilitating water treatment works after an emergency
7. Solid waste management in emergencies
8. Disposal of dead bodies in emergency conditions
9. How much water is needed in emergencies?
10. Hygiene promotion in emergencies
11. Measuring chlorine levels in water supplies
12. Delivering safe water by tanker
13. Planning for excreta disposal in emergencies
14. Technical options for excreta disposal in emergencies
15. Cleaning wells after seawater flooding

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<sup>f</sup>World Health Organization/Water, Engineering and Development Centre (WEDC). Technical notes on drinking water, sanitation and hygiene in emergencies. 2011 (updated in 2013). [http://www.who.int/water\\_sanitation\\_health/publications/technotes/en/](http://www.who.int/water_sanitation_health/publications/technotes/en/) (accessed 20 June 2014).



# 14. APPENDIX I: INFECTION PREVENTION AND CONTROL<sup>9</sup>

## 14.1. Principles of hospital infection prevention and control

Infection prevention and control (IPC) are integral to the provision of safe health care. Hospital IPC aims to prevent transmission of communicable diseases, including tuberculosis, those caused by bloodborne and enterically transmitted pathogens, acute respiratory diseases, as well as transmission of disease during medical procedures or surgery.

The purpose of IPC includes preventing the transmission of both endemic and epidemic infections. Community-acquired infections can be amplified by transmission within the health facility in the absence of effective IPC practices, with transmission to other patients, visitors and health workers. These practices are ongoing requirements that apply every day, as well as to special situations, such as when there are novel organisms causing an acute respiratory disease or a haemorrhagic fever.

Hospital managers should refer to other sources on developing, implementing and monitoring an IPC programme, training health workers in IPC, providing adequate infection control commodities, assuring a safe blood supply, managing a sterilization section within the hospital, and improving the infrastructure to make the hospital a safer work environment.

Hospital infrastructure should be arranged and improved as necessary to facilitate hand hygiene, safe waste management and patient placement. Triage and waiting areas should be well ventilated (open-air shelters with a roof are recommended for patient waiting areas), and narrow, poorly ventilated corridors avoided as patient waiting areas. Improving air ventilation in rooms for patient care includes leaving windows and doors open when possible to maximize cross-ventilation. IPC recommendations should be prioritized based on an assessment of the risk of nosocomial infection in the specific health-care facility and in specific patient care areas.

Standard precautions for all patients include:

- hand hygiene
- appropriate personal protective equipment (PPE)
  - gloves
  - facial protection (eyes, nose and mouth)
  - gown
- respiratory hygiene and cough etiquette
- prevention (and management) of injuries from sharp instruments
- environmental cleaning
- appropriate handling of contaminated linen
- waste disposal
- patient care equipment

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<sup>9</sup> This section is adapted from: IMAI district clinician manual: hospital care for adolescents and adults. Guidelines for the management of common illnesses with limited resources. Geneva: World Health Organization; 2011. <http://www.who.int/hiv/pub/imai/imai2011/en/> (accessed on 20 June 2014).

## Standard precautions in health care

### Background

**Standard precautions are meant to reduce the risk of transmission of bloodborne and other pathogens from both recognized and unrecognized sources.**

They are the basic level of infection control precautions which are to be used, as a minimum, in the care of all patients.

**Hand hygiene** is a major component of standard precautions and one of the most effective methods to prevent transmission of pathogens associated with health care. In addition to hand hygiene, the use of **personal protective equipment** should be guided by **risk assessment** and the extent of contact anticipated with blood and body fluids, or pathogens.

In addition to practices carried out by health workers when providing care, all individuals (including patients and visitors) should comply with infection control practices in health-care settings. The control of spread of pathogens from the source is key to avoid transmission. Among source control measures, **respiratory hygiene/cough etiquette**, developed during the severe acute respiratory syndrome (SARS) outbreak, is now considered as part of standard precautions.

Worldwide escalation of the use of standard precautions would reduce unnecessary risks associated with health care. Promotion of an **institutional safety climate** helps to improve conformity with recommended measures and thus subsequent risk reduction. Provision of adequate staff and supplies, together with leadership and education of health workers, patients, and visitors, is critical for an enhanced safety climate in health-care settings.

### Important advice

- Promotion of a safety climate is a cornerstone of prevention of transmission of pathogens in health care.
- Standard precautions should be the minimum level of precautions used when providing care for all patients.
- Risk assessment is critical. Assess all health-care activities to determine the personal protection that is indicated.
- Implement source control measures for all persons with respiratory symptoms through promotion of respiratory hygiene and cough etiquette.

### ✓ Checklist

#### Health policy

- Promote a safety climate.
- Develop policies which facilitate the implementation of infection control measures.

#### Hand hygiene

- Perform hand hygiene by means of hand rubbing or hand washing (see detailed indications in table).
- Perform hand washing with soap and water if hands are visibly soiled, or exposure to spore-forming organisms is proven or strongly suspected, or after using the restroom. Otherwise, if resources permit, perform hand rubbing with an alcohol-based preparation.
- Ensure availability of hand-washing facilities with clean running water.
- Ensure availability of hand hygiene products (clean water, soap, single use clean towels, alcohol-based hand rub). Alcohol-based hand rubs should ideally be available at the point of care.

#### Personal protective equipment (PPE)

- ASSESS THE RISK of exposure to body substances or contaminated surfaces BEFORE any health-care activity. **Make this a routine!**
- Select PPE based on the assessment of risk:
  - clean non-sterile gloves
  - clean, non-sterile fluid-resistant gown
  - mask and eye protection or a face shield.

#### Respiratory hygiene and cough etiquette

- Education of health workers, patients and visitors.
- Covering mouth and nose when coughing or sneezing.
- Hand hygiene after contact with respiratory secretions.
- Spatial separation of persons with acute febrile respiratory symptoms.



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## 14.2. Hand hygiene

Ensure the availability of handwashing facilities with clean running water.

- Ensure the availability of hand hygiene products (clean water, soap, single-use clean towels and alcohol-based hand rub). Alcohol-based hand rubs should be made available at every point of care and are the standard of care.
- When to wash hands with soap and running water:
  - when hands are visibly dirty.
- When to use alcohol-based hand rub:
  - when hands appear clean (i.e. are not visibly soiled).

### 14.2.1. Indications for hand hygiene

- Before and after any direct contact between a health worker and a patient and contact between patients, whether or not gloves are worn. Hands should be washed before gloves are put on, and immediately after gloves are removed.
- Before handling an invasive device
- After touching blood, body and tissue fluids, secretions, excretions, non-intact skin and contaminated items, even if gloves are worn
- During care, e.g. when moving from a contaminated to a clean body site of the same patient
- After contact with inanimate objects in the immediate vicinity of the patient.

Ensure that the hands are dry before starting any activity. Dry the hands with single-use towels.

### 14.2.2. Techniques for hand hygiene

Hand washing (40–60 seconds)

- Wet hands and apply soap; rub all surfaces; rinse hands and dry thoroughly with a single-use towel; use towel to turn off faucet and dispose of the used towel.

Hand rubbing (20–30 seconds)

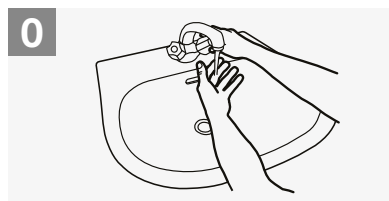
- Apply enough product to cover all areas of the hands; rub hands until dry.

# How to Handwash?

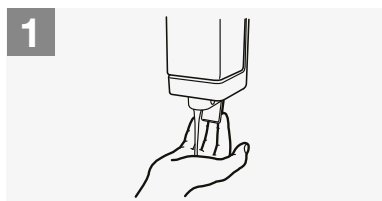
WASH HANDS WHEN VISIBLY SOILED! OTHERWISE, USE HANDRUB



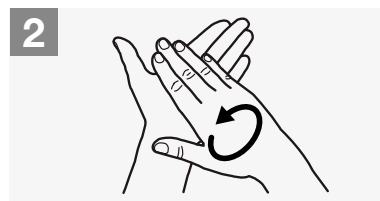
**Duration of the entire procedure: 40-60 seconds**



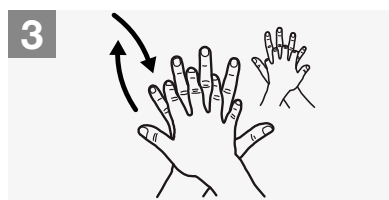
**0** Wet hands with water;



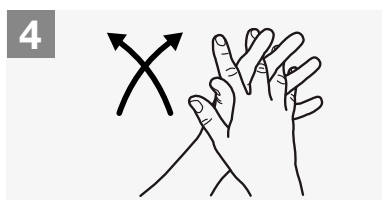
**1** Apply enough soap to cover all hand surfaces;



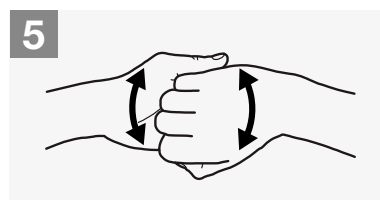
**2** Rub hands palm to palm;



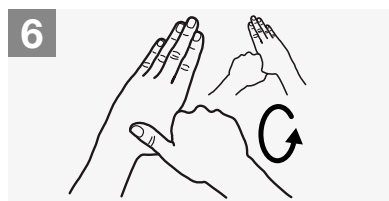
**3** Right palm over left dorsum with interlaced fingers and vice versa;



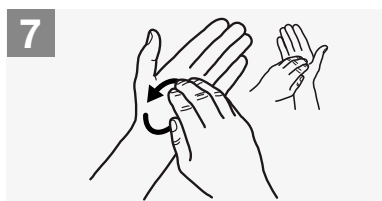
**4** Palm to palm with fingers interlaced;



**5** Backs of fingers to opposing palms with fingers interlocked;



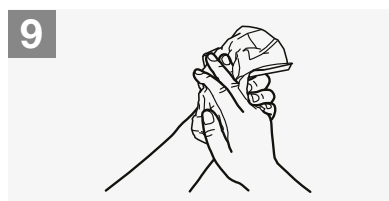
**6** Rotational rubbing of left thumb clasped in right palm and vice versa;



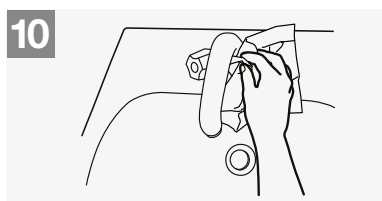
**7** Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa;



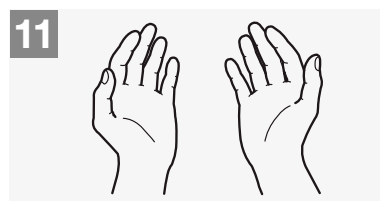
**8** Rinse hands with water;



**9** Dry hands thoroughly with a single use towel;



**10** Use towel to turn off faucet;



**11** Your hands are now safe.



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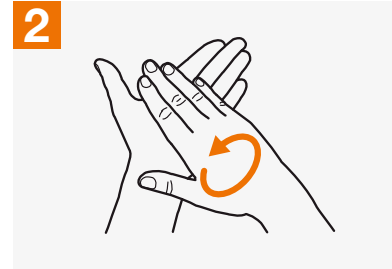
# How to Handrub?

**RUB HANDS FOR HAND HYGIENE! WASH HANDS WHEN VISIBLY SOILED**

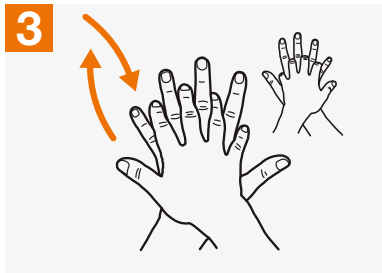
 **Duration of the entire procedure: 20-30 seconds**



Apply a palmful of the product in a cupped hand, covering all surfaces;



Rub hands palm to palm;



Right palm over left dorsum with interlaced fingers and vice versa;



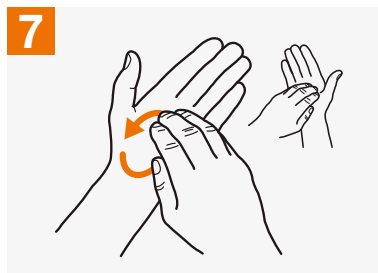
Palm to palm with fingers interlaced;



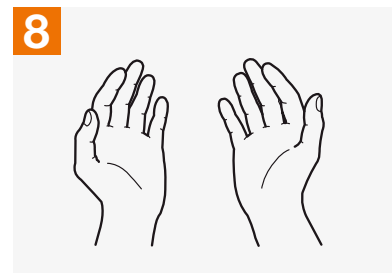
Backs of fingers to opposing palms with fingers interlocked;



Rotational rubbing of left thumb clasped in right palm and vice versa;



Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa;



Once dry, your hands are safe.



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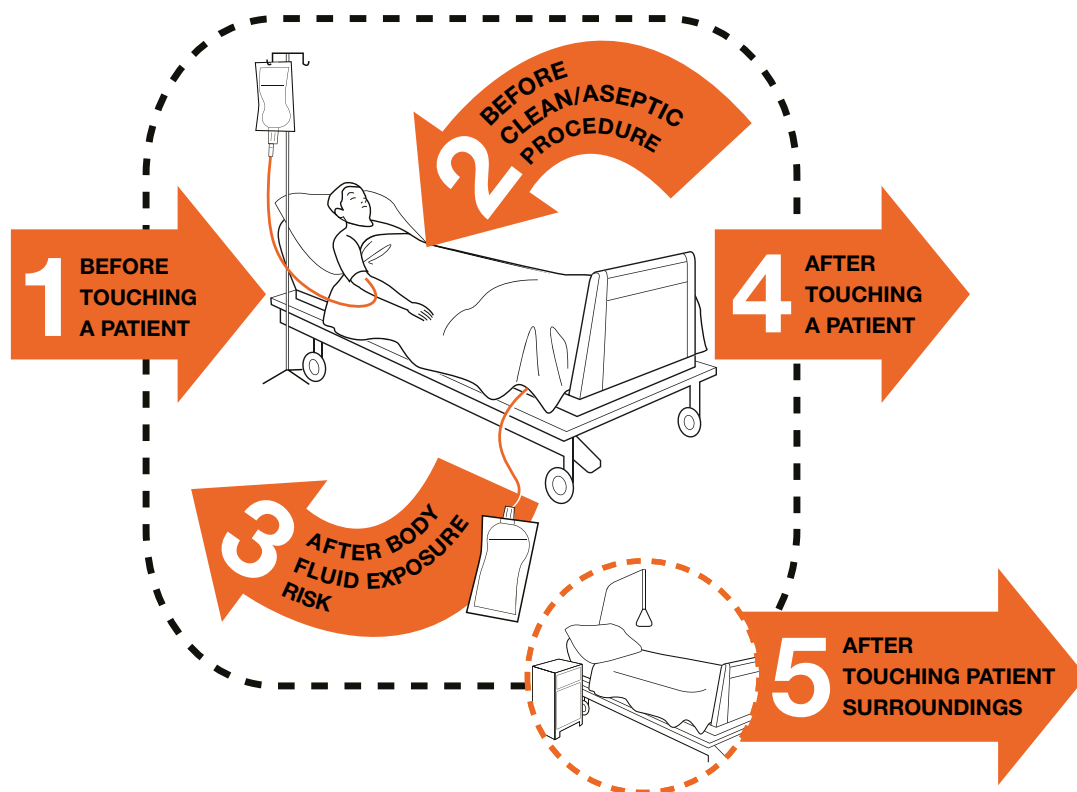
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# Your 5 Moments for Hand Hygiene



<b>1</b>	<b>BEFORE TOUCHING A PATIENT</b>	<b>WHEN?</b>	Clean your hands before touching a patient when approaching him/her.
		<b>WHY?</b>	To protect the patient against harmful germs carried on your hands.
<b>2</b>	<b>BEFORE CLEAN/ASEPTIC PROCEDURE</b>	<b>WHEN?</b>	Clean your hands immediately before performing a clean/aseptic procedure.
		<b>WHY?</b>	To protect the patient against harmful germs, including the patient's own, from entering his/her body.
<b>3</b>	<b>AFTER BODY FLUID EXPOSURE RISK</b>	<b>WHEN?</b>	Clean your hands immediately after an exposure risk to body fluids (and after glove removal).
		<b>WHY?</b>	To protect yourself and the health-care environment from harmful patient germs.
<b>4</b>	<b>AFTER TOUCHING A PATIENT</b>	<b>WHEN?</b>	Clean your hands after touching a patient and her/his immediate surroundings, when leaving the patient's side.
		<b>WHY?</b>	To protect yourself and the health-care environment from harmful patient germs.
<b>5</b>	<b>AFTER TOUCHING PATIENT SURROUNDINGS</b>	<b>WHEN?</b>	Clean your hands after touching any object or furniture in the patient's immediate surroundings, when leaving – even if the patient has not been touched.
		<b>WHY?</b>	To protect yourself and the health-care environment from harmful patient germs.



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### 14.3. Appropriate personal protective equipment

Assess the risk of exposure to body substances or contaminated surfaces BEFORE any health-care activity. Make this a routine!

- Select PPE based on the assessment of risk:
  - clean, non-sterile gloves
  - clean, non-sterile, fluid-resistant gown
  - mask and eye protection or a face shield.
- Ensure that there is a continuing supply of PPE.
- Educate and train hospital staff on how to wear, remove and dispose of PPE.

Some PPE is used based on the procedure or type of patient care, no matter what the organism may be (these are part of standard precautions). Additional PPE may be needed based on the patient's likely diagnosis and suspected pathogen, as pathogens differ in the way that they are spread – by contact, by large droplets (requiring droplet precautions) or by very small droplet nuclei, which can travel more than a meter and stay suspended in the air (requiring airborne precautions).

PPE to be used for any patient also varies according to likely exposure to blood, secretions and non-intact skin.

#### Gloves

- Wear gloves if there is any chance of touching blood, body fluids, secretions, excretions, mucous membranes or skin, especially skin that is not intact.
- Change gloves between tasks and procedures on the same patient after contact with potentially infectious material, to prevent further contamination.
- Remove after use, before touching non-contaminated items and surfaces, and before going to another patient. Perform hand hygiene immediately after removal.

#### Facial protection (eyes, nose and mouth)

- Wear a surgical or procedure mask and eye protection (eye visor, goggles) or a face shield to protect mucous membranes of the eyes, nose and mouth during activities that are likely to generate splashes or sprays of blood, body fluids, secretions or excretions.
- Use masks only when it is useful and recommended.

#### Gown

- Gowns protect the skin and prevent soiling of clothing during activities that are likely to generate splashes or sprays.
- Wear a gown whenever there is any risk of splashes of blood or body fluids.
- If splashing with blood or other body fluids is anticipated and gowns are not fluid-resistant, wear a waterproof apron over the gown.
- Remove soiled gowns as soon as possible, and perform hand hygiene.

### 14.4. Environmental cleaning

- Use adequate procedures for the routine cleaning and disinfection of the environment and other frequently touched surfaces.
  - Floors and horizontal work surfaces should be cleaned at least once a day.
  - Cleaning should always be carried out from “clean” areas to “dirty” areas, in order to avoid contaminant transfer.
  - Dry sweeping with a broom should never be done.
  - Rags with dust should not be shaken out and surfaces should not be cleaned with dry rags. Cleaning with a moistened cloth helps to avoid contaminating the air with airborne particles.

- Clean BEFORE you disinfect.
- Change cleaning solutions and equipment frequently, as these items get contaminated quickly (follow your hospital protocols).

Setting	Manual cleaning with water and detergent	Disinfection (sodium hypochlorite 1% in-use dilution, bleaching powder, alcohol [70%])	Sterilization (steam under pressure, dry heat sterilization, automated chemical)
Floors, work tops	+		
Spillage – of blood, body fluids, secretions and excretions	+	+	
Commode, toilet seats	+	+	
Mops, wash mops	+		
Dressing trolleys	+	+	
Mattress and pillows (always cover with plastic covers)	+	+	
Reusable instruments	+		+
AMBU bag and mask	+		+

## 14.5. Linen

Carefully handle, transport and process used linen:

- To prevent skin and mucous membrane exposure and contamination of clothing.
- To avoid transfer of pathogens to other patients or the environment:
  - All used linen and waste should be placed in bags or containers that are able to withstand transportation without being damaged.
  - Any solid matter on soiled linen should be removed and flushed down a toilet.
  - Used linen should be handled carefully to prevent contamination of surrounding surfaces or people.
  - Used linen should be washed according to normal routine.

## 14.6. Waste disposal

- Ensure safe waste management.
- Treat waste contaminated with blood, body fluids, secretions and excretions as clinical waste, in accordance with local regulations.
- Human tissue and laboratory waste that is directly associated with specimen processing should be treated as clinical waste.
- Segregate at the point of generation the four categories of waste:
  - sharps
  - non-sharp infectious waste
  - non-sharp non-infectious waste
  - hazardous waste.
- Discard single-use items properly.

For hepatitis E, general hygienic precautions, hand hygiene, use of gloves, environmental hygiene and simple precautions during disposal of fecal waste are the most important, and patient isolation and use of special protective equipment are usually NOT required.



# 15. APPENDIX J:

## BEST PRACTICES FOR EFFECTIVE OUTBREAK COMMUNICATION<sup>h</sup>

The five critical practices that influence the effectiveness of outbreak communication are trust, announcing early, transparency, listening and planning. When these modern risk communication principles are applied, they promote the primary public health goal of rapid outbreak containment with the least possible disruption to economies and society.<sup>53,54</sup>

### 1. Trust

The key principle of outbreak communication is to communicate in ways that build, maintain or restore trust between the public and outbreak managers. Without this trust, the public will not believe, or act on, the health information that is communicated by health authorities during an outbreak.

*What can health authorities do to help build trust within a community?*

- Engage with the community on a regular basis prior to a health crisis to establish yourself as a trusted health information resource.
- Communicate with the community at the first sign of a potential outbreak and tell them where they can get additional information.
- Vigilantly work towards strengthening trust with the community. Trust is hard to gain, easy to lose and very difficult to regain once lost.

*Potential partners for community engagement to better ensure trust building may include the following:*

- Local health authorities
- Local leaders and tribal elders
- Traditional healers
- Religious leaders
- School administrators and teachers
- Refugee camp managers
- Others such as NGOs and the media

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<sup>h</sup> Adapted from Outbreak communication: best practices for communicating with the public during an outbreak. Report of the WHO Expert Consultation on Outbreak Communications held in Singapore, 21–23 September 2004. Geneva: WHO; 2005 [WHO/CDS/2005.32]. [http://www.who.int/csr/resources/publications/WHO\\_CDS\\_2005\\_32web.pdf](http://www.who.int/csr/resources/publications/WHO_CDS_2005_32web.pdf) (accessed 03 May 2014).

and

World Health Organization Outbreak communication planning guide. Geneva: WHO; 2008. <http://www.who.int/ihr/elibrary/WHOOutbreakCommsPlannngGuide.pdf> (accessed on 20 June 2014).

## 2. Announcing early

Proactive communication of a real or potential health risk is crucial for alerting those affected and minimizing an infectious disease threat. Announcing early – even with incomplete information – prevents rumours and misinformation. The longer officials withhold information, the more frightening the information will seem when it is eventually released, especially if it is provided by an outside source. Late announcement will erode trust in the ability of public health authorities to manage the outbreak.

### *Methods to use with first announcement*

- Come to terms with the fact that your first announcement is likely to be wrong. You will not know all the facts.
- Tell the community what you know, what you do not know and what you are doing to respond to the emergency.
- Tell people that this is an evolving situation and that information and recommendations may change in the coming days/weeks.
- Express empathy for the victims and their families before stating casualty numbers.
- Tell people where they can get more information and provide frequent (say, daily) updates.
- Provide approximately three easily understood recommendations.
- Refute rumours with factual information.

For more information, see Appendix M.

Ensure that both first announcements and later health education materials reach special populations. The persons who need to learn about HEV prevention, symptoms, infection and treatment include the following:

- Head of the household
- Pregnant women
- Water gatherers (for families, these are often children)
- Community/refugee camp health staff and volunteers
- Schoolteachers and children
- Health-care workers
- Sanitation workers
- Caretakers
- General population.

## 3. Transparency

Maintaining the public's trust throughout an outbreak requires ongoing transparency, including timely and complete information of a real or potential risk and its management. As new developments occur over the course of an outbreak, they should be communicated proactively. Transparency should characterize the relationship between outbreak managers, the public and partners as it promotes information gathering, risk assessment and decision-making processes associated with outbreak control.

### *How can health authorities communicate transparently?*

- Openly discuss what the outbreak investigation and response teams have done in the past (including exercises) that relate to the current outbreak.
- Openly discuss what the outbreak investigation and response teams are doing to help stop the current outbreak. Discuss the investigation process.
- State what is not known about the disease and explain why it is difficult to scientifically prove this.
- Ask community members for help such as assisting vulnerable members of their community or sharing specific information that may help the outbreak investigation.

To ensure transparency, identify information-seeking behaviours and trusted information sources of the target audience(s). Ensure that information about hepatitis E is distributed through trusted sources.

*When, where and to whom do affected audience(s) seek information about health?*

- Popular media – radio, newspaper, community message boards, SMS, television, etc.
- Community health centre
- Religious gatherings
- Marketplace announcements
- In schools for children
- Posters at the local water supply area
- Refugee camp check-in point
- Open-air movie showings
- Social media
- Town hall meetings.

## 4. Listening

Understanding the public's risk perceptions, views and concerns is critical to effective communication and the broader emergency management function it supports. Without knowing how people understand and perceive a given risk and what their existing beliefs and practices are, decisions and required behaviour changes necessary to protect health may not occur, and societal or economic disruption may be more severe.

*Methods to use in listening to the affected population during an outbreak of hepatitis E*

- Consider literacy levels and cultural beliefs when developing messages and materials.
- Field-test most recent messages and materials through intercept interviews or focus groups. Record feedback and alter the messages or address other barriers identified.
- Gather the most common questions and misunderstandings through media reports, health hotlines, local clinics, community meetings, etc.

*What factors may affect an audience's ability to comprehend communication material?*

- Spoken and written languages of the setting
- Educational and basic literacy level of the target audience
- Use of technical jargon in materials
- Terminology used by the target population (do they use different terms for hepatitis E, the symptoms, other terms describing the spread or prevention of the virus?)
- Creating materials with pictorial recommendations
- Pre-testing materials with members of the target population if possible

### **Cultural beliefs**

*Are there cultural and behavioural practices that may prevent or enhance adherence to recommendations?*

- Shared washing vessels where water is reused for washing hands, bodies, brushing teeth, etc.
- Beliefs hindering medical care during pregnancy
- Preference for home-based deliveries
- Dietary practices/restrictions
- Use of traditional healers
- Common bathing practices
- Avoiding the use of latrines
- Belief that children's feces do not carry harmful germs or viruses.

## 5. Planning

Public communication during an outbreak represents an enormous challenge for any public health authority and therefore demands sound planning, in advance, to adhere to the principles described above. Planning is an important principle, but more importantly, it must translate into action.

### *Planning in advance for an outbreak of hepatitis E*

- Draw up a list of communication stakeholders and their contact information. These may include press officers from other responding agencies, public affairs officers from the national or local health or political authority, and hospital communications units.
- Draw up a list of media outlets and their contact information.
- Conduct journalist trainings on the topic of hepatitis E to explain the disease, its causes and public health threat.
- Determine spokesperson roles and jurisdictional agreements for communication.
- Determine clearance chains prior to release of a media message.
- Pre-develop messages and materials based on the most likely scenario for a hepatitis E outbreak and identify clearly where changes may occur.
- Pre-develop materials that can be easily edited and leave space for local health authority logos.
- Translate messages and materials in advance.
- Field-test materials using hypothetical scenarios that mimic the local likelihood of hepatitis E outbreaks.
- Conduct a communication exercise with a mock hepatitis E outbreak or ensure that communications is included in other emergency response exercises on the topic.

When planning, consider barriers that may inhibit a population's ability to adopt recommendations.

### *Do messages and materials match the audiences' ability to carry out recommendations?*

- Are water vessels, chlorine and other required goods readily available to the target audience?
- Do target audience members have facilities to boil water?
- Do communities have proper latrines located away from water sources?
- Do they have access to soap and water?

# 16. APPENDIX K:

## AN EXAMPLE OF SUCCESSFUL COMMUNITY ENGAGEMENT AND COMMUNICATION THROUGH A “VILLAGE HEALTH COMMITTEE”

Below is a plan (including members and responsibilities) that was successfully used in Sudan to address outbreaks of hepatitis E. It is possible to adapt this plan to other outbreak situations, depending on the local context.

### Village health committee for containment of hepatitis E outbreaks *Best practice from Sudan (North Kordofan state)*

#### Village health committee: composition

1. Supervisory committee to be led by health authority at local level (e.g. district, county)
2. Safe Water Supply subcommittee
3. Sanitation subcommittee
4. Notification and Health Education subcommittee

#### Supervisory committee

##### Committee members

- Community leader serves as the committee chair
- Health personnel (medical assistant, midwife, community health worker, etc.)
- Teacher
- Youth representative
- Woman representative
- Red Crescent volunteer
- Two other volunteers

##### Responsibilities

- Establish subcommittees.
- Schedule and conduct regular meetings.
- Help in outbreak control measures.
- Notify cases.
- Facilitate community health education.
- Follow up with subcommittees and supervision at village level.
- Evaluate the general activities and report to health authorities.

#### Safe Water Supply subcommittee (3 community members – volunteers)

##### Needs

- Training on water chlorination processes and other methods to ensure safe drinking water
- Providing chlorine (WASH)
- Preparing aids for chlorination of drinking water
- Providing easy-to-use templates for reporting forms on water testing and usage

##### Responsibilities

- Work as chlorinators at level of source and households.
- Separate the source of water supply for humans from that for animals.
- Guard drinking water sources to ensure that there is no use of non-chlorinated water.
- Ensure chlorination of drinking water at the household level, by providing training to mothers and water carriers on the use of chlorine, and handling and transporting safe water.

### Sanitation subcommittee

(3 community members – 2 volunteers and 1 youth representative)

#### Needs

- Sanitary latrines
- Tools for digging latrines (provided by community)
- Plans for building fences to surround the toilets (prepared by the community)

#### Responsibilities

- Planning for the construction of latrines away from homes and drinking water sources (share plan with WASH)
- Coordination for the processing of drilling to build the latrines
- Arrangement for the disposal of solid wastes, with the help of families.

### Notification and Health Education subcommittee

(3 community members – teacher, health-care worker and female representative from community)

#### Needs

- Fact sheet
- Brief and concise health messages

#### Responsibilities

- Visit homes and educate families regarding the disease and chlorination.
  - Teach families about the risks of traditional treatment and demonstrate some of its dangerous side-effects.
  - Deliver messages to families about the risk of defecating near water sources.
  - Teach schoolchildren about risks and prevention measures.
-

# 17. APPENDIX L:

## TEMPLATE FOR GATHERING INFORMATION ON OUTBREAK COMMUNICATION<sup>i</sup>

### *At-risk groups/populations*

- Which specific groups are at risk?
- Which specific groups or partners are indirectly involved?
- Are there groups or partners who should be considered as communication priorities in light of their likelihood to be looked to for advice or direction?
- Are there particularly vulnerable/high-risk groups that need to be reached?

### *Knowledge, awareness, perceptions*

- What do individuals and communities know about the cause and transmission of the disease?
- What are the local terms or descriptions of the disease?
- What are the individual and community perceptions of risk posed by the outbreak?
- Have these groups experienced outbreaks before and how have they managed them?
- What are the messages circulating within the community?

### *Information sources, channels and settings*

- Where/who do people get information (health and other sources of advice) from and why? Who are the “trusted” and “credible” information sources and what makes them so? (e.g. health-care staff/local leaders/religious leaders/influential individuals)
- Which media or channels of communication are available to promote messages? Which channels are the most popular and influential among the different affected groups? Which traditional media are used? (Some examples of channels are: fact sheets, face-to-face communication, newsletters, posters, brochures, public service announcements, news media, websites, podcasts, text messages, email messages, secure networks, etc.)
- What are the current patterns of social communication? What active community networks and structures exist and how does the local population perceive them?
- Which other organizations are currently addressing the issue in the community?
- Which settings are relevant to deliver communication materials and messages? (e.g. clinic, home, village, etc.)

### *Existing household and community practices*

- What are the non-outbreak health-seeking and health-care practices?
- Which existing practices amplify risk and what are the beliefs and values that underpin them?
- Which existing practices reduce risk, e.g. handwashing, chlorination, and what are the beliefs and values that underpin them?
- What are the decision-making processes within communities and the household related to seeking health care?

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<sup>i</sup> World Health Organization Outbreak communication planning guide. Geneva: WHO; 2008. <http://www.who.int/ihr/elibrary/WHOOutbreakCommsPlanngGuide.pdf> (accessed on 20 June 2014).

*Sociocultural, economic and environmental context*

- Are there any social and political tensions that may affect risk reduction practices?
- Do people have access to sufficient resources to implement risk reduction practices? (e.g. Do people have access to clean water?) Are health services available and accessible? Are there problems related to transporting sick people to clinics/hospitals?
- Are there any existing traditional religious beliefs and social norms that may inhibit the implementation of risk reduction practices?



# 18. APPENDIX M: FIRST ANNOUNCEMENT TEMPLATE<sup>j</sup>

This message template can be used for the initial announcement of a public health incident when little information is available.

## *Template*

1. Please pay close attention. This is an urgent health message from [your public health agency].
2. Officials [emergency, public health, etc.] believe there has been a serious incident [describe incident including time and location] in \_\_\_\_\_ area.
3. At this time, we do not know the cause or other details about the incident.
4. Local officials are investigating and will work with [State/Federal] officials to provide updated information as soon as possible.
5. Stay informed and follow the instructions of health officials so you can protect yourself, your family and your community against this public health threat.
6. [Give specific information about when and how the next update will be given.]

When more information is known, additional messages may be added about what is happening.

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<sup>e</sup> Adapted from US Centers for Disease Control and Prevention, Office of Public Health Preparedness and Response (OPHPR). First hours: message template for the first minutes for all emergencies. <http://emergency.cdc.gov/firsthours/resources/messagetemplate.asp> (accessed 20 June 2014).

# 19. APPENDIX N:

## ADDITIONAL COMMUNICATIONS RESOURCES

- WHO Outbreak communication planning guide.  
<http://www.who.int/ihr/elibrary/WHOOutbreakCommsPlanngGuide.pdf>
- Outbreak communication: best practices for communicating with the public during an outbreak.  
[http://www.who.int/csr/resources/publications/WHO\\_CDS\\_2005\\_32web.pdf](http://www.who.int/csr/resources/publications/WHO_CDS_2005_32web.pdf)
- Communication for behavioural impact (COMBI): a toolkit for behavioural and social communication in outbreak response.  
[http://www.who.int/ihr/publications/combi\\_toolkit\\_outbreaks/en/](http://www.who.int/ihr/publications/combi_toolkit_outbreaks/en/)
- Communication for behavioural impact (COMBI): field workbook for COMBI planning steps in outbreak response.  
[http://who.int/ihr/publications/combi\\_toolkit\\_fieldwkbk\\_outbreaks/en/](http://who.int/ihr/publications/combi_toolkit_fieldwkbk_outbreaks/en/)
- Effective media communication during public health emergencies: a WHO handbook.  
<http://www.who.int/csr/resources/publications/WHO%20MEDIA%20HANDBOOK.pdf?ua=1>
- Effective media communication during public health emergencies: a WHO field guide  
<http://www.who.int/csr/resources/publications/WHO%20MEDIA%20FIELD%20GUIDE.pdf?ua=1>
- US CDC. Crisis and emergency risk communication (CERC).  
<http://emergency.cdc.gov/cerc/>
- CDCynergy (multimedia CD-ROM).  
<http://www.cdc.gov/healthcommunication/cdcynergy/index.html>

## 20. APPENDIX 0: DECISION-MAKING STEPS ON VACCINE USE IN ACUTE HUMANITARIAN EMERGENCIES<sup>k</sup>

WHO recently published a framework for decision-making on vaccination in acute humanitarian emergencies,<sup>48</sup> which provides guidance to senior-level government and partner agency officials in reaching a decision regarding the need for one or more vaccines in such emergencies.

Diseases are considered to fall within the scope of this framework if the following conditions are met:

- (i) Burden of the disease may increase during an acute emergency.
- (ii) A WHO prequalified vaccine exists that can provide at least some protection against the disease in an emergency setting.
- (iii) In exceptional cases where a prequalified vaccine for the specific disease does not exist, the following additional criteria may be applied:
  - a. The manufacturer should be WHO prequalified for the supply of at least one other vaccine;
  - b. The vaccine should be licensed by the national regulatory authority in the country of origin and in the country of intended use; and
  - c. The vaccine should be licensed and marketed in at least two additional countries with functional national regulatory authorities as assessed by WHO.

The above criteria are intended as guidance. It is recommended that any modification made on the basis of national benefit–risk considerations should ensure that if a non-prequalified vaccine is used, it is at least as safe and efficacious as one that would comply with these criteria.

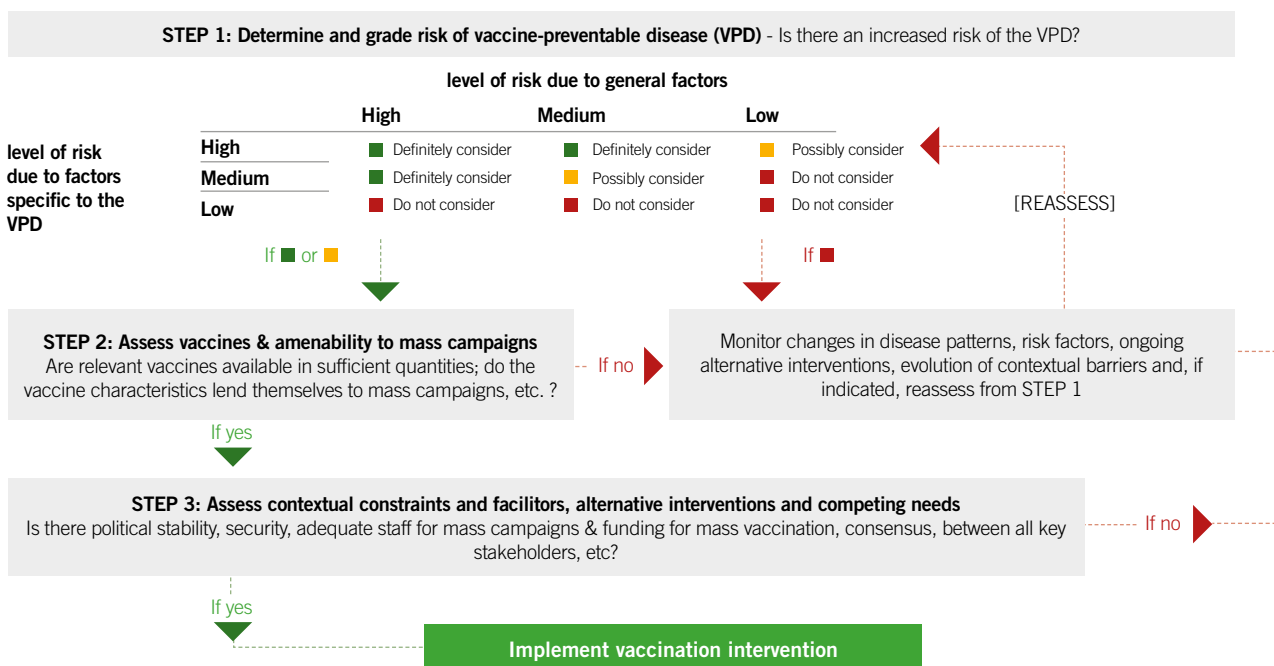
Reproduced below is a diagrammatic representation of an algorithm for decision-making on vaccination to prevent a vaccine-preventable disease in a humanitarian emergency. Please refer to the original document<sup>48</sup> for details and full explanation.

Further details of step 3 in the figure above are provided in the next figure from the same document.

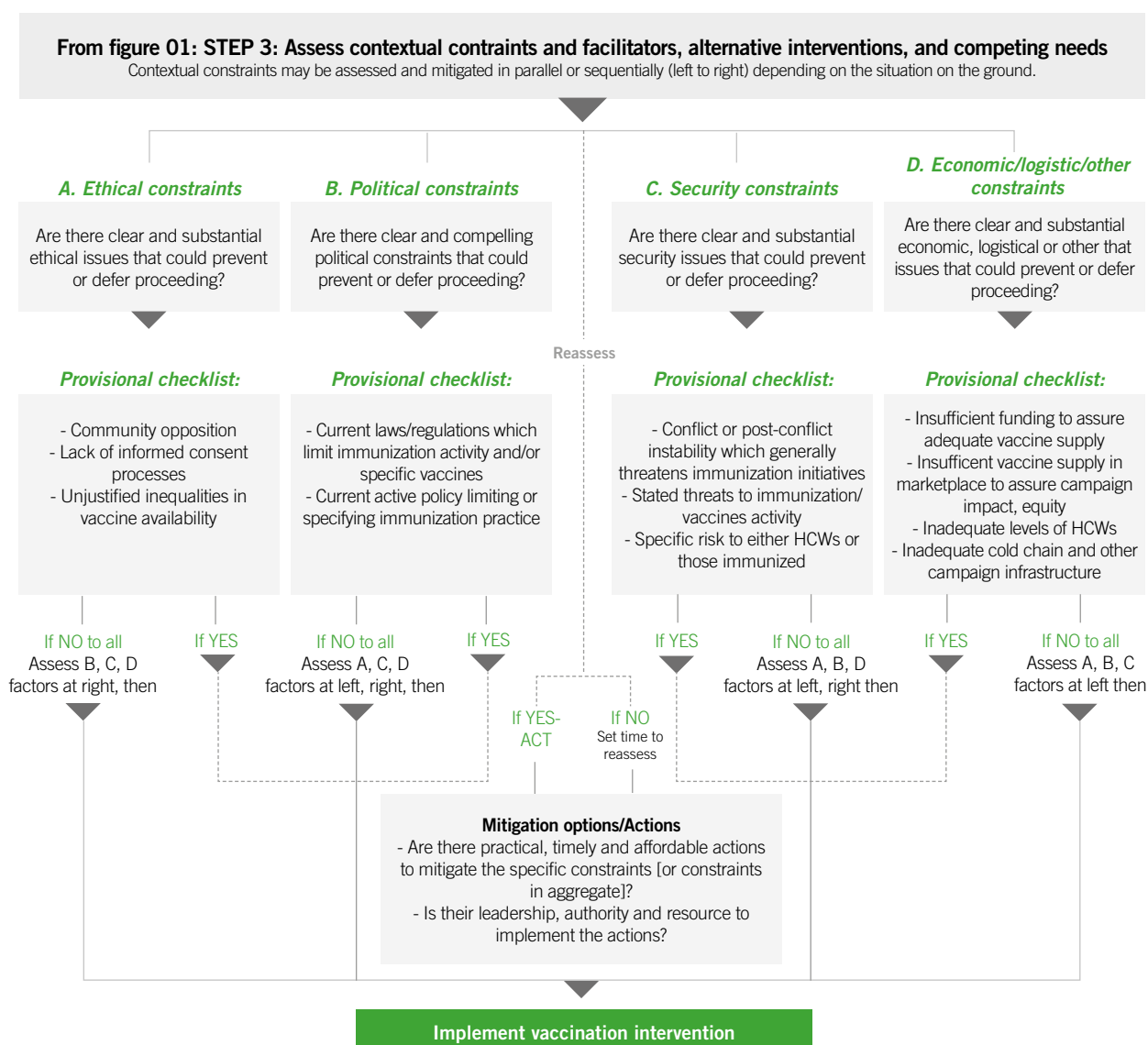
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<sup>k</sup> Adapted from: Vaccination in acute humanitarian emergencies: a framework for decision-making. Geneva: WHO Department of Immunization, Vaccines and Biologicals and SAGE Working Group on Vaccination in Humanitarian Emergencies; 2013. ([http://apps.who.int/iris/bitstream/10665/92462/1/WHO\\_IVB\\_13.07\\_eng.pdf](http://apps.who.int/iris/bitstream/10665/92462/1/WHO_IVB_13.07_eng.pdf), accessed 03 May 2014).

**FIGURE 01** Algorithm for decision-making on vaccination



**FIGURE 02** Algorithm for assessing contextual factors



# 21. APPENDIX P:

## KEY MESSAGES FOR THE PUBLIC

### DURING AN OUTBREAK OF HEPATITIS E<sup>f</sup>

#### Boil your water – cook your food – wash your hands – use latrines

##### 1. SAFE DRINKING WATER

- Even if it looks clear, water can contain germs.
- Boil water until it actively bubbles or add drops of chlorine to the water before drinking.
- After boiling or chlorinating drinking water, keep it in a clean, covered pot or bucket or other container with a small opening and a cover. It should be used within 24 hours of collection.
- Pour the water from the container – do not dip a cup into the container.
- If dipping into the water container cannot be avoided, use a cup or other utensil with a handle.
- Do not put hands into a container with clean water.

##### 2. PERSONAL HYGIENE

- Wash your hands with soap, ashes or lime:
  - before cooking,
  - before eating and before feeding your children,
  - after using the latrine or cleaning your children after they have used the latrine.
- Wash all parts of your hands – front, back, between the fingers, under the nails.
- Do not share a water container for washing hands.
- Use a latrine to defecate.
- Keep the latrine clean.

##### 3. WELLS

- Do not defecate or urinate in or near a source of drinking water.
- Do not wash yourself, your clothes, or your pots and utensils in the source of drinking water (stream, river or water hole).
- Cover open wells when not in use to avoid contamination.
- Hang up the buckets used to collect water when not in use – they must not be left on a dirty surface.
- Keep the area surrounding a well or hand pump as clean as possible.
- Get rid of refuse and stagnant water around a water source.

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<sup>f</sup> Adapted from Cholera outbreak: assessing the outbreak response and improving preparedness. Geneva: World Health Organization; 2004 (last update 2010) [WHO/CDS/CPE/ZFK/2004.4]. <http://www.who.int/cholera/publications/OutbreakAssessment/en/> (accessed 18 June 2014).

#### 4. FOOD

- Cook raw food thoroughly.
- Eat cooked foods immediately.
- Store cooked food carefully in a refrigerator.
- Reheat cooked food thoroughly.
- Avoid contact between raw food and cooked food.
- Eat fruits and vegetables you have peeled yourself.
- Keep all kitchen surfaces clean.
- Wash your cutting board especially well with soap and water.
- Wash your utensils and dishes with soap and water.

#### Cook it – peel it – or leave it.

#### 5. TAKING CARE OF PATIENTS

- Wash your hands after taking care of patients, touching them, their stools, vomit or clothes.
- Avoid contaminating a water source by washing a patient's clothes in it.
- Disinfect the patient's clothing and bedding with a solution of chlorine (0.05%) or by stirring them in boiling water or by drying them thoroughly in the sun before and after normal washing.

The above principles, though originally collated for the control of cholera outbreaks, apply fairly well to the control of several water- and foodborne disease outbreaks, including those of hepatitis E.

# 22. APPENDIX Q:

## TEMPLATE FOR AN OUTBREAK INVESTIGATION REPORT<sup>m</sup>

### 1. Introduction

The introduction contains a brief presentation of:

- the situation in which the outbreak occurred;
- the rationale for the assessment of the outbreak response and objectives of the evaluation;
- the composition of the team in charge of the assessment;
- the methodology of the assessment (revision of documents, personal interviews, focus groups, observation of practices or meetings, case–control study, etc.).

### 2. Epidemiological description

The epidemiological description should include:

- disease trends over time and the population groups affected by the disease if the country has had previous hepatitis E outbreaks;
- the nature of the recent outbreak, in terms of the time, places and people when it started, where, who was affected, what were the decisions taken to control the outbreak;
- the high-risk areas or population groups (who are the most affected) – attack rate and case-fatality rate (CFR) by place, age and sex;
- a list of the risk factors, such as overcrowding, sea shore in a tropical area, poor sanitation, lack of safe water, contaminated food, fecal–oral transmission risk, underlying factors such as malnutrition.

### 3. Assessment of the outbreak response

The assessment of the response should address the questions in Appendix R.

### 4. Recommendations

These should be grouped into short term, medium term and long term.

### 5. Conclusion

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<sup>m</sup> Adapted from Cholera outbreak: assessing the outbreak response and improving preparedness. Geneva: World Health Organization; 2004 (last update 2010) [WHO/CDS/CPE/ZFK/2004.4]. <http://www.who.int/cholera/publications/OutbreakAssessment/en/> (accessed 18 June 2014).

## 23. APPENDIX R:

# QUESTIONS TO ASSESS THE RESPONSE TO AN OUTBREAK OF HEPATITIS E<sup>n</sup>

### Detection

1. How and when were the first cases notified to the health authorities (through the surveillance system, media release or radio announcements, informal sources, other)? Are the communication channels for reporting cases well established in regions or municipalities?
2. At the beginning, what alerted the people to the possibility of an outbreak:
  - a. Sudden occurrence of the disease?
  - b. Persistent increase in reported cases (over a period of more than one week)?
  - c. Sudden increase in the number of cases?
  - d. An abnormal number of deaths?
3. On what basis was it decided that this was an outbreak:
  - a. A single case?
  - b. A cluster of cases?
  - c. Case incidence higher than expected (compared with the same period of time in previous years)?
4. How long did the information take to reach the decision-making level from the area where the outbreak occurred?
5. What were the first actions taken at the central level:
  - a. Telephone call to the affected areas to verify rumours?
  - b. Dispatch of a rapid response team?
  - c. Other?

### Confirmation

1. How was the diagnosis confirmed?
  - a. By clinical case definition?
  - b. By laboratory confirmation?
  - c. By epidemiological suspicion associated with clinical case definition?
2. What case definition was used to collect further information on cases and deaths?
3. In the case of laboratory confirmation, were the collection and transportation of samples adequate?
4. How long did the laboratory take to provide confirmation?
5. How many samples were taken?
6. What proportion of samples was positive?

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<sup>n</sup> Adapted from Cholera outbreak: assessing the outbreak response and improving preparedness. Geneva: World Health Organization; 2004 (last update 2010) [WHO/CDS/CPE/ZFK/2004.4]. <http://www.who.int/cholera/publications/OutbreakAssessment/en/> (accessed 18 June 2014).



## Organization of response

1. Was there a central outbreak response team to follow up the outbreak and take decisions?  
Was this committee multisectoral?
2. What measures have been taken to control the outbreak?
  - a. Legal decisions taken (inspection of water and food handlers, restaurants, etc.)?
  - b. Assistance provided to affected areas (supplies, technical and staff support)?
  - c. Health education campaigns?
  - d. Timely and adequate mobilization of emergency supplies?
  - e. Information campaigns and use of media?
  - f. Training organized (in surveillance or case management)?
3. How was the response monitored?
  - a. Follow up of the outbreak through regular epidemiological reports?
  - b. Impact of control activities on epidemiological trends?
  - c. Field investigation to identify the source of contamination?
4. Who was the person designated to monitor and document control activities?
5. Was there an easy information flow from affected areas to the control level and vice versa?

## Communication

1. Was there a strategy to disseminate accurate information promptly rather than respond to rumours?
2. Did the involvement of the media contribute constructively to control of the outbreak?
3. Was there a designated spokesperson for the media?
4. Was there any procedure for assessing the impact and spread of information?

## Case management

1. Were flowcharts illustrating proper management of hepatitis E cases prepared and available to health-care workers?
2. Were patients and their families informed of the preventive measures to be taken at the household level?
3. Were the health-care workers aware of the infection prevention and control measures necessary to avoid contamination (standard precautions)?

## Mortality reduction

1. How was the CFR calculated? Was there any risk of bias?
2. Have professionals been trained to manage patients with acute liver failure?
3. Were appropriate medications available?
4. Was there adequate surveillance of patients with severe disease?
5. Were health-care facilities available for severe cases? Were there any geographical limitations on accessibility, or cultural, linguistic or economic barriers?

## Community

1. Was health education an important part of the outbreak response?
2. Were the messages elaborated with the community?
3. Were the messages disseminated through community or religious leaders or through any channel that reaches the maximum of people with the greatest impact on their behaviours?
4. Were the messages adapted to local cultural beliefs about the disease and to the capacity for

implementing control measures in the community (e.g. if soap is unavailable, has ash been recommended for washing hands)?

5. Have efforts been made to encourage the use of latrines?
6. Was there active case-finding in the community?
7. Were education messages given to the patients and their relatives in health-care facilities?
8. Were health-care workers able to disseminate the appropriate messages?

## Safe water

1. Have the different sources of contaminated water been identified?
2. Have these sources been disinfected during the outbreak?
3. If wells were chlorinated, was there regular monitoring of residual chlorine?
4. What measures were recommended to avoid contamination of water?
5. Where chlorination of a water source was not possible, was there any programme to ensure safe drinking water at the household level?
6. Were chemicals for water disinfection (chlorine compounds) available in the local market at affordable prices?
7. Was there any system for providing safe water to high-risk groups during the outbreak?
8. Did the population receive a supply of at least 20 L of safe water per person per day?
9. Were health workers properly trained to teach local people about hygiene and disinfection techniques?
10. Was the community informed about preventing water contamination?

## Safe food

1. Was the supply of water adequate for street food vendors (acceptable quality and sufficient quantities for drinking, washing food and hands, cleaning utensils)?
2. Was there any regulation to ensure that food handlers observed minimum standards of hygiene during the outbreak? Was the inspection of food handling practices effective?
3. Is there any regulation to ensure minimum levels of hygiene for food products in the marketplace?
4. Are food handlers who sell raw or partially processed animal products for immediate consumption required to display a sign that informs the public of the increased health risk associated with consuming such food?
5. Are latrines and handwashing facilities available in marketplaces?

## Sanitation

1. What percentage of the population was served with improved sanitation facilities?
2. Was there a good system in place for excreta management and disposal during the outbreak (latrine emptying and sludge removal from septic tanks)?
3. Were the sanitation facilities vulnerable to flooding or other natural disasters?
4. Could the sanitation facilities potentially contaminate any drinking water sources?
5. Was consideration given to providing sanitation services for high-risk groups during the outbreak?
6. Were health workers properly trained to teach local people about good hygiene behaviours?

## Surveillance

### *Basic analysis*

1. Were data from previous outbreaks available and used to provide a better understanding of the current outbreak?
2. Was there a good analysis of data by time, area and high-risk group during the outbreak?
3. Was the information collected and analysed promptly enough to be used for monitoring the outbreak?
4. Did health-care workers understand the purpose of collecting information?
5. Did the patient file contain the essential basic information: patient's name, address, age and sex, date of onset of symptoms, initial clinical assessment, evolution of illness, treatment received?
6. Was the information available and easily understandable to decision-makers?

## Epidemiological investigation

1. Has an epidemiological investigation of the outbreak been undertaken?
2. What kind of data analysis has been done: descriptive (person, place, time) or analytical (case study)? Have high-risk channels of transmission been identified?
3. Have the results of the investigation influenced the outbreak response?
4. What kind of difficulties arose during the investigation (logistics, contact with media, delay in organizing the investigation)?

## Governance

1. Were international partners involved in the outbreak response?
2. What mechanisms were established to involve international partners (UN agencies, NGOs, international donors, private sector) in the outbreak response, in addition to health authorities?
3. Has a list been drawn up of needs that might be supported by international partners?
4. Was there any formal mechanism for raising funds to support the outbreak response? Was a project proposal developed?
5. Which organization was coordinating the various partners involved in the outbreak response?
6. Was there any strategic plan for the response, with specific tasks assigned to each partner?
7. What was the role of WHO in the outbreak response (coordination, financial support, technical support)? At what level was WHO involved (headquarter, regional level, country level)?

## 24. ADDITIONAL RESOURCES

### Water, sanitation and hygiene in emergencies

Environmental health in emergencies and disasters. Geneva: WHO; 2002 (Chapter 7 on water supply and Chapter 8 on sanitation).

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### Water safety plans

Bartram J, Corrales L, Davison A, Deere D, Drury D, Gordon B, et al. Water safety plan manual: step-by-step risk management for drinking-water suppliers. Geneva: WHO; 2009. [http://whqlibdoc.who.int/publications/2009/9789241562638\\_eng\\_print.pdf](http://whqlibdoc.who.int/publications/2009/9789241562638_eng_print.pdf) (accessed 01 May 2014).

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Water safety planning for small community water supplies: step-by-step risk management guidance for drinking-water supplies in small communities. Geneva: WHO; 2012. [http://www.who.int/water\\_sanitation\\_health/publications/2012/water\\_supplies/en/index.html](http://www.who.int/water_sanitation_health/publications/2012/water_supplies/en/index.html) (accessed 01 May 2014).

### Water quality, access and health

Diarrhoea: why children are still dying and what can be done. New York, NY/ Geneva: UNICEF/WHO; 2009. [http://www.who.int/maternal\\_child\\_adolescent/documents/9789241598415/en/index.html](http://www.who.int/maternal_child_adolescent/documents/9789241598415/en/index.html) (accessed 01 May 2014).

Progress on drinking water and sanitation: 2012 update. New York, NY/Geneva: UNICEF/WHO; 2012. <http://www.unicef.org/media/files/JMPReport2012.pdf> (accessed 01 May 2014).

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## Household water treatment and safe storage reference materials

WHO/UNICEF. International network on household water treatment and safe storage. Website: [http://www.who.int/household\\_water/en/index.html](http://www.who.int/household_water/en/index.html) (accessed 01 May 2014).

WHO/UNICEF. Toolkit for monitoring and evaluating household water treatment and safe storage programmes. Geneva: WHO; 2012.

[http://www.who.int/household\\_water/resources/toolkit\\_monitoring\\_evaluating/en/index.html](http://www.who.int/household_water/resources/toolkit_monitoring_evaluating/en/index.html) (accessed 01 May 2014).

The Ceramics Manufacturing Working Group. Best practice recommendations for local manufacturing of ceramic pot filters for household water treatment. Atlanta, GA: CDC; 2011. <http://waterinstitute.unc.edu/media/Best%20Practice%20Recommendations%20for%20Manufacturing%20Ceramic%20Pot%20Filters%20June2011.pdf> (accessed 01 May 2014).

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## **Waterborne Outbreaks of Hepatitis E: Recognition, Investigation and Control**

Outbreaks of hepatitis E occur in several parts of the world where water quality is suboptimal or inconsistent. At times, these outbreaks may be very large, and may occur in areas with humanitarian emergencies, either natural or human-induced.

Medical and health-care professionals often have limited knowledge of hepatitis E, its epidemiology, and measures for its prevention and control. An outbreak of hepatitis E may thus be a cause for consternation and concern. This document summarizes the current knowledge about the clinical and public health aspects of hepatitis E, describes how outbreaks of hepatitis E may be detected early and investigated, and how they can be prevented and controlled. Public health authorities, medical professionals and humanitarian health agencies working in areas where such outbreaks occur would find this document an invaluable guide.

Feedback and suggestions for improvement may be sent to: [hepatitis@who.int](mailto:hepatitis@who.int).

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