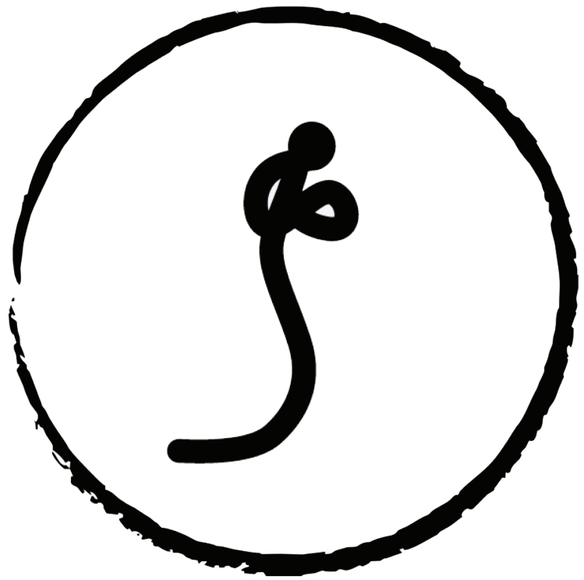

Understanding Ebola: A Visual Guide

by Xinyu Liu, John Pring, Juhan Sonin, Emily Twaddell ● Involution Studios

http://www.goinvo.com/features/ebola/

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The 2014 Ebola outbreak is the most severe outbreak of Ebola Virus Disease (EVD) since the discovery of ebolaviruses in 1976. As of 14 October 2014, the WHO, CDC and local governments together have reported a worldwide total of 9,216 suspected cases and 4,555 deaths (4,995 cases and 2,729 deaths having been laboratory confirmed). Many experts believe that the official numbers substantially understate the size of the outbreak, due in part to community resistance to reporting cases, and a lack of personnel and equipment to investigate reports of the disease.[1]

Ebola Cases by Year

EVD, formerly called Ebola hemorrhagic fever, was first identified in 1976 with two simultaneous outbreaks in Sudan (South Sudan) and Zaire (now the Democratic Republic of the Congo).[1]

Nzara - South Sudan

What is now South Sudan saw the world's first known outbreak of EVD (Ebola-Sudan). More than 284 people were infected. [1]

MORTALITY RATE: 53%

Yambuku - People's Democratic Republic of Congo

EVD cases (Ebola-Zaire) also emerged from Yambuku, infecting 318 people. [1]

MORTALITY RATE: 88%

*The Yambuku outbreak was in a village situated near the Ebola River, from which the disease takes its name [2]

Ebola is caused by infection with a virus of the family Filoviridae, genus Ebolavirus. Five subtypes have been identified: Zaire, Sudan, Bundibugyo, Ivory Coast/Tai Forest\, and Reston. Reston Ebola virus infects only non-human primates.[4]

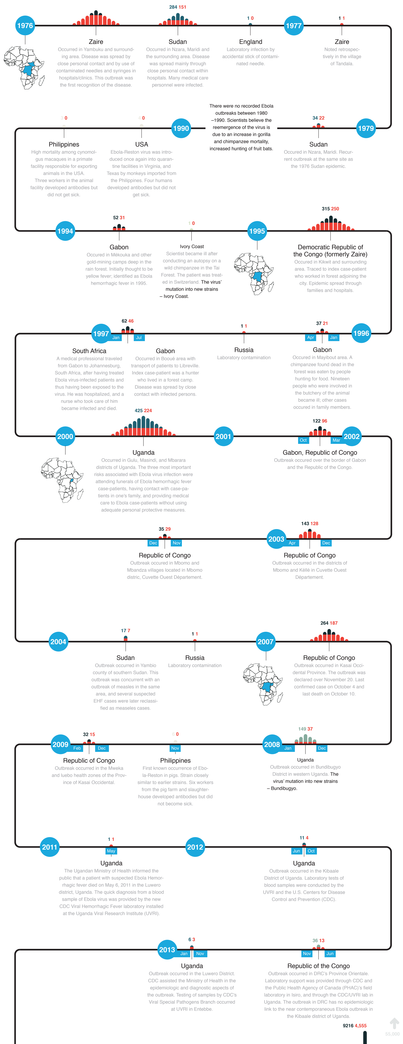
Average Fatality Rate [5]

Ebola Strains

Seven countries have confirmed cases of the Ebola virus worldwide (five countries in West Africa).

Fruit bats, a delicacy for some West Africans, are considered to be virus's natural host.[6]

The illustration below describes **Ebola cases between 1976 and 2014**, with the number of infections and deaths: [7]



There has been a sharp rise in cases in the first half of August. This graph illustrates the increase over time of cases and deaths during the 2014 outbreak: [8]

The outbreak began in March, with the first case reported in Guinea. Since then the numbers of cases and deaths have risen at an alarming rate.

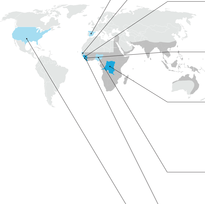
**On 8th August 2014, the WHO declared an international emergency in relation to the Ebola outbreak, with officials reporting that a coordinated response would be essential to stop and reverse the spread of the virus.

The numbers of cases and deaths have been listed for the biggest outbreaks.

Some experts predict that if we don't get control of the virus, the number of infections could mushroom to nearly 55,000 cases by November 2014.[9]

The Ebola outbreak in Guinea Liberia, and Sierra Leone is the first in West Africa since 1994, when a scientist contracted the disease while working with infected chimpanzees. The scientist had the Ivory Coast strain and eventually recovered.[10]

Guinea, Sierra Leone, Liberia and Nigeria are the four main countries involved in the 2014 outbreak.



Madrid, Spain

Suspected and confirmed case count: 1
Suspected and confirmed case deaths: 0

MORTALITY RATE: 0%

Senegal

Suspected and confirmed case count: 1
Suspected and confirmed case deaths: 0

MORTALITY RATE: 0%

Guinea

Suspected and confirmed case count: 1,519
Suspected and confirmed case deaths: 862

MORTALITY RATE: 58%

Sierra Leone

Suspected and confirmed case count: 3,410
Suspected and confirmed case deaths: 1,200

MORTALITY RATE: 32%

Democratic Republic of the Congo

Suspected and confirmed case count: 70
Suspected and confirmed case deaths: 43

MORTALITY RATE: 61%

*This outbreak is unrelated to the current outbreak of Ebola in West Africa.

Nigeria

Suspected and confirmed case count: 20
Suspected and confirmed case deaths: 8

MORTALITY RATE: 40%

Liberia

Suspected and confirmed case count: 4,262
Suspected and confirmed case deaths: 2,484

MORTALITY RATE: 57%

United States

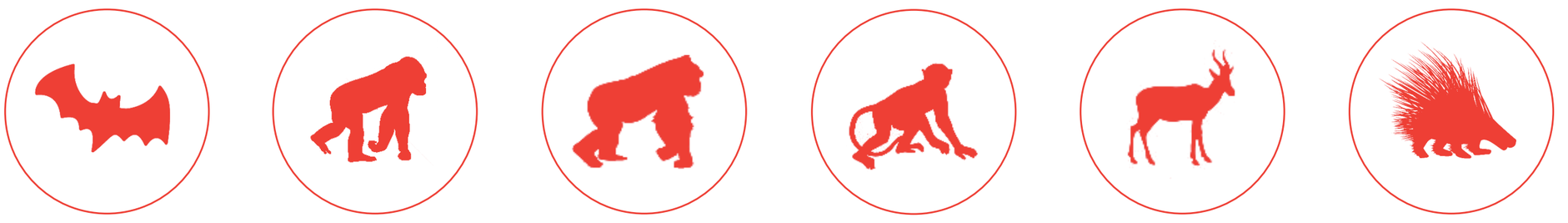
Suspected and confirmed case count: 3
Suspected and confirmed case deaths: 1

MORTALITY RATE: 33%

Home range of Pteropodidae family of fruit bat [11]
Country reported EVD outbreaks
Country reported travel-associated Ebola case in human

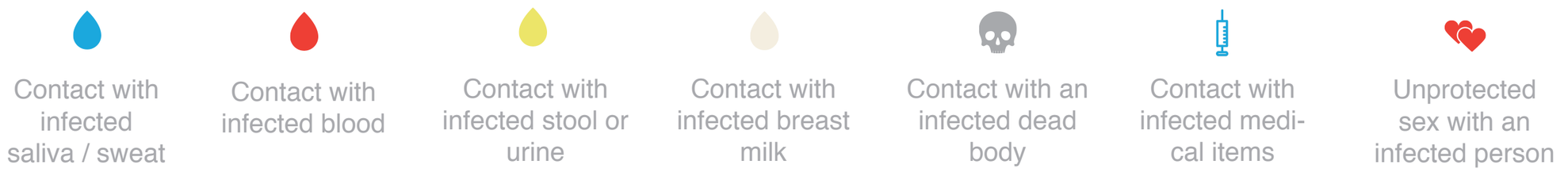
Ebola is introduced into the human population through contact with an infected animal. Ebola is spread through close and direct physical contact with infected bodily fluids, the most infectious being blood, faeces and vomit. The Ebola virus has also been detected in breast milk, urine and semen.

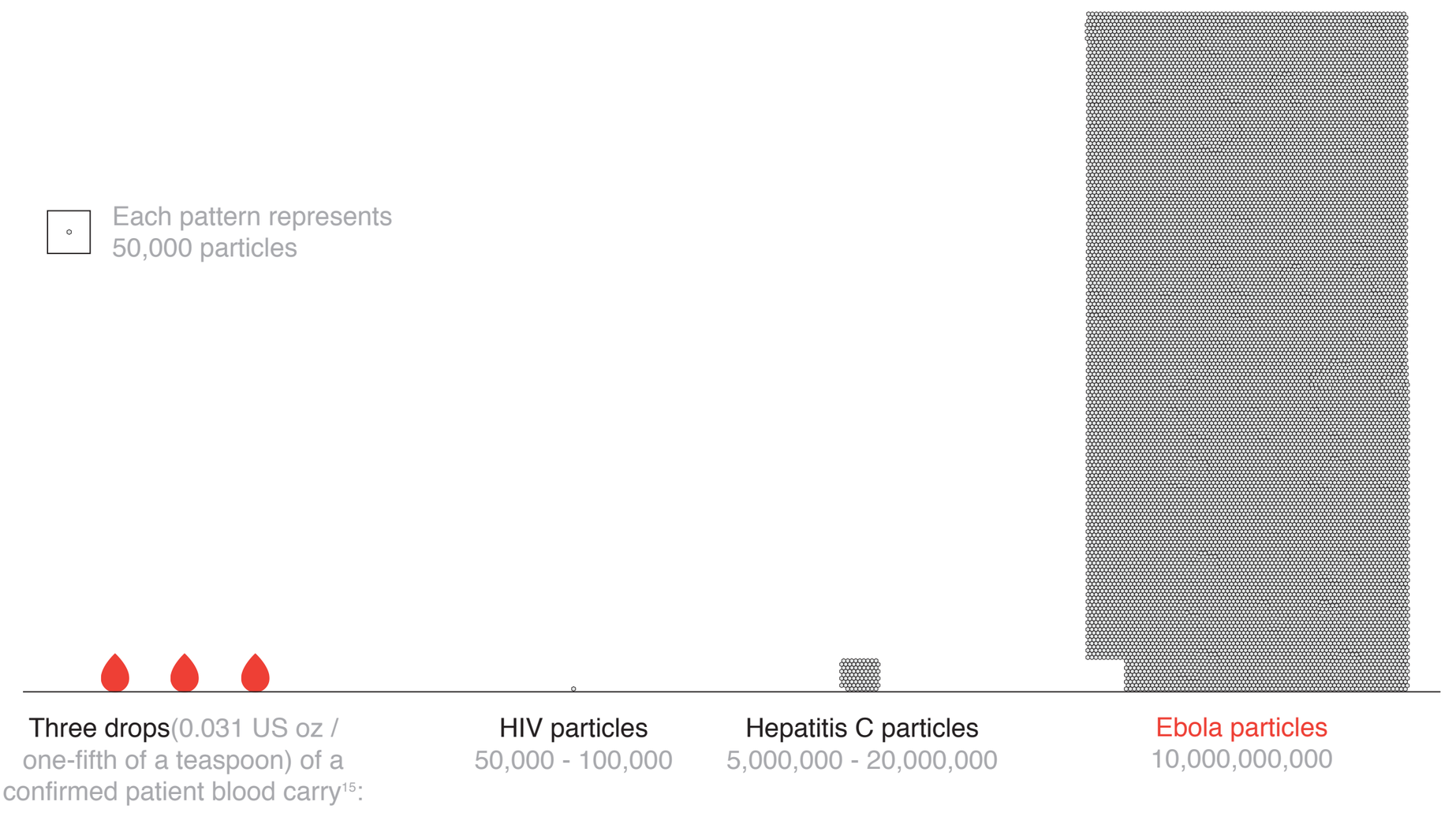
In Africa, infection has been documented through the handling of the following infected animals found ill or dead in the rainforest: [12]

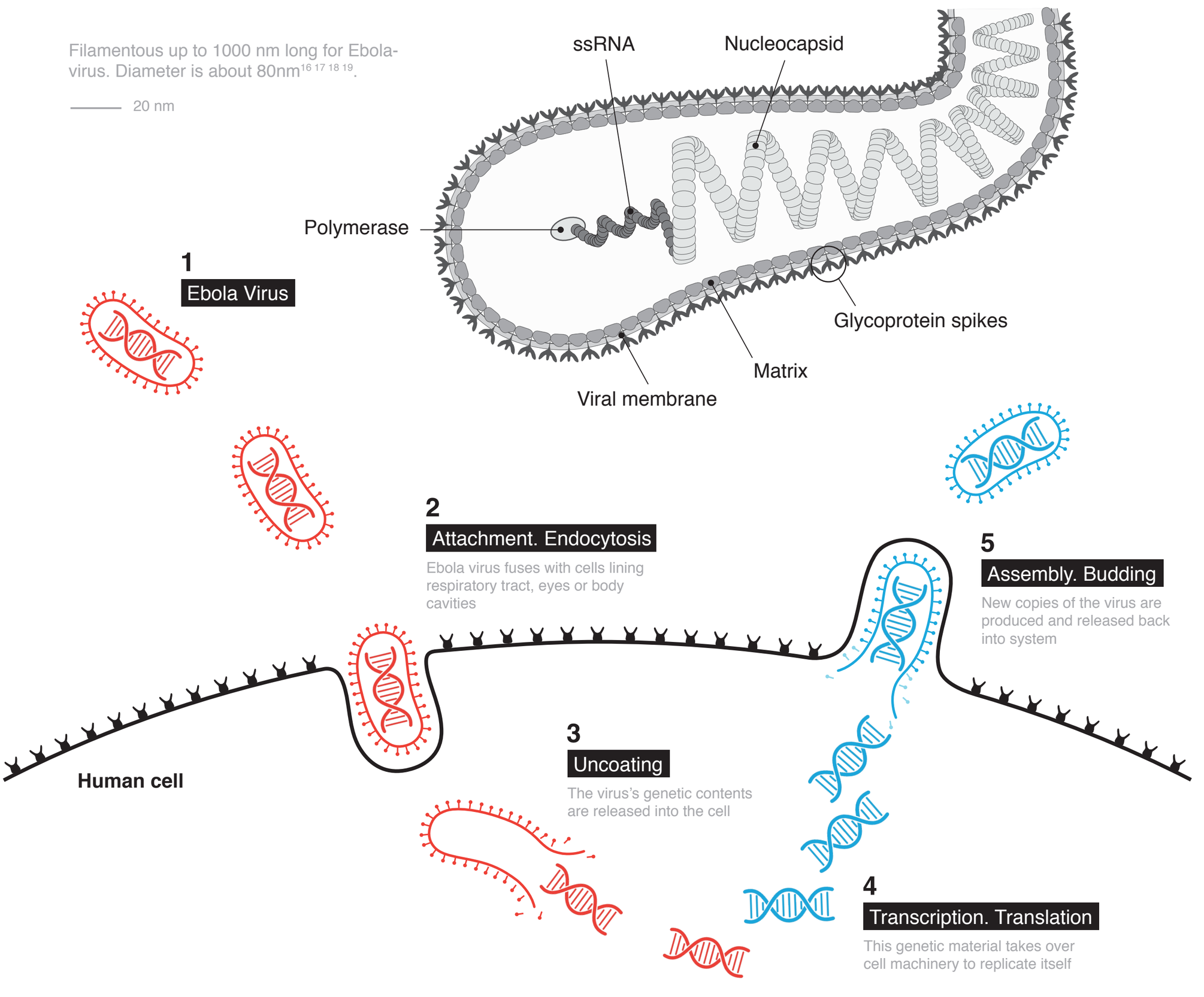


Ebola then spreads in the community through human-to-human transmission, with infection resulting from direct contact (through broken skin or mucous membrane) with the blood, secretions, or other bodily fluids, or with the organs of infected people, and indirect contact with environments contaminated with such fluids. The virus can survive in liquid or dried material for a number of days.[13 14]

The following are the most common methods of EVD transmission between people:





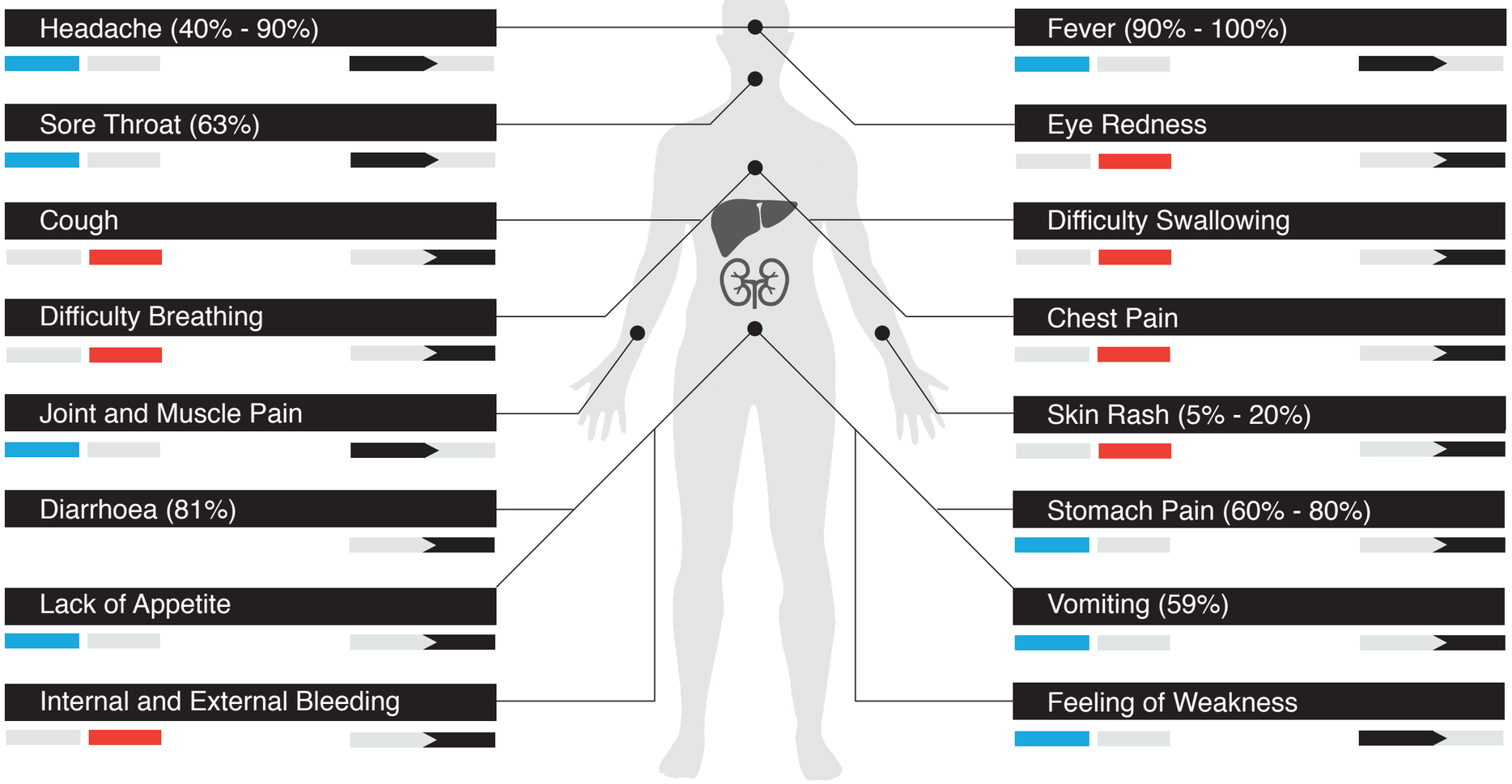


The virus spreads to cell types throughout the body by binding glycoprotein to receptors on cell surfaces. Infected cells detach from blood vessels, causing massive hemorrhage. Loss of blood leads to kidney and liver failure.

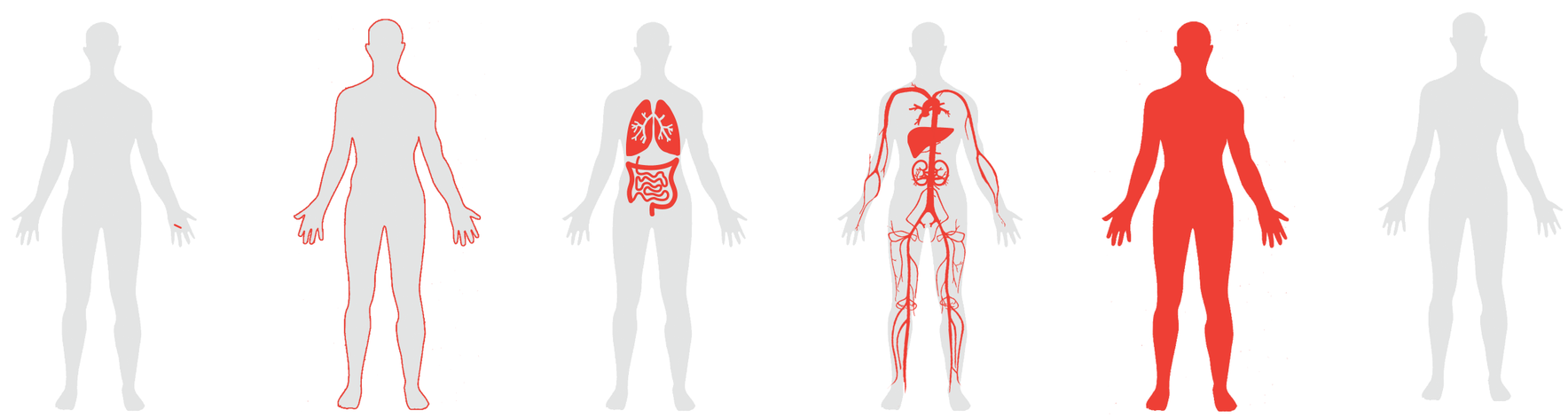
Symptoms of Infection

Ebola is a severe acute viral illness often characterized by the sudden onset of fever, intense weakness, joint and muscle pain, sore throat and headache. These symptoms are then followed by more severe complications, along with decreased function of the liver and kidneys. Around this time, affected people may begin to bleed both within the body and externally. The incubation period is 2 to 21 days. Humans are not infectious until they develop symptoms. It is unclear why some patients can survive and others die from this disease, but patients who die usually have a poor immune response to the virus.

The full list of potential symptoms includes:[20] [21] [22]



Typical time frame and symptoms development[23]:



Infected	10 days after infection	13-15 days	15-17 days	18 days: death	Survival
The virus may enter through the mouth, eyes, nose, a break in the skin or through sexual intercourse. The most common incubation period is about 10 days.	The patient shows sudden flu-like symptoms, which are similiar for common diseases such as: • Fever • Fatigue • Headache • Muscle pain • Malaria	One average, the patient is hospitalized 5 days after showing symptoms. New symptoms include: • Diarrhea • Loss of appetite • Chest pain • Coughing • Eye inflammation	The body's immune response and damage to the vascular system cause blood to leak from the veins. Around 18% of patients begin to show unexplained bleeding such as: • Blooding in stool • Vomiting blood • Coughing up blood • Bleeding gums	About 70% of infected patients die, usually from multi-organ failure or shock. On average, death occurs 8 days after the onset of symptoms and 4 days after hospitalization.	Survival is believed to be dependent on an early, strong immune response and constant hydration, with improvement after the first week. Recovered patients often remain hospitalized for 1-2 weeks, facing a long convalescence and long-term health problems.

Diagnosis and Treatment

Ebola diagnosis requires ruling out other diseases, which may include malaria, typhoid fever, shigellosis, cholera, leptospirosis, plague, rickettsiosis, relapsing fever, meningitis, hepatitis, and other viral hemorrhagic fevers.

Once these have been ruled out, Ebola virus infections can be diagnosed definitively in a laboratory through several types of tests:[24]

- Antibody-capture enzyme-linked immunosorbent assay (ELISA)
- Antigen-capture detection tests
- Serum neutralisation test
- Reverse transcriptase polymerase chain reaction (RT-PCR) assay
- Electron microscopy
- Virus isolation by cell culture

To confirm the diagnosis, blood test samples are tested for viral antibodies, viral RNA, or the virus itself.

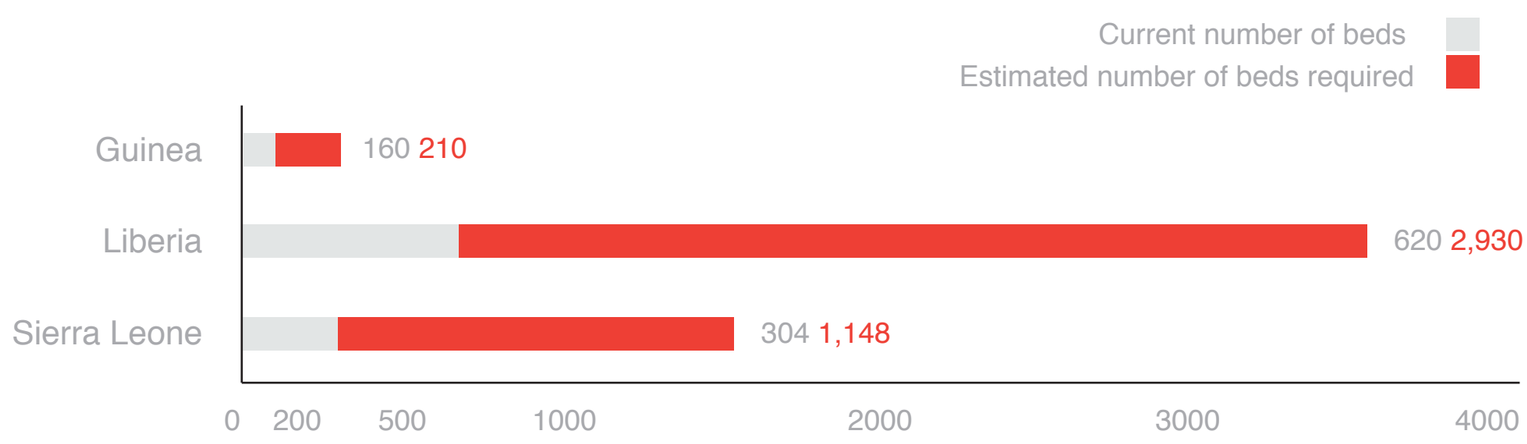
There is no licensed vaccine or specific treatment available for Ebola. A range of potential treatments including blood products, immune therapies, and drug therapies are currently being tested, but none are availble for clinical use. Tests of new Ebola drugs could take place as early as November 2014.[25]

The lack of vaccines or specific treatments is part of what makes the mortality rate so high. The death rate from Ebola ranging from 25% to 90%, depending on the strain, but the current outbreak has a mortality rate of about 70%(as of 23 September 2014).[26]

The course of treatment for infected patients involves supportive care: providing relief of symptoms while the body fights the infection. Intravenous fluids, antibiotics, and oxygen are usually employed. Treatment may also include the use of medications to control fever, help the blood clot, and maintain blood pressure. Even with such supportive care, death occurs in 50 to 90 percent of cases.

- Intravenous (IV) fluids to maintain fluids and electrolytes (sodium, potassium, and chloride)
- Oxygen and devices that help with breathing
- Medications to control fever, help the blood clot, and maintain blood pressure
- Antibiotics to prevent secondary infections from bacteria
- Good nursing care.

Current bed capacity for patients in countries with active cases as of 8 Oct 2014 [27]



- ZMapp, a monoclonal antibody vaccine. The limited supply of the drug has been used to treat a small number of individuals infected with the Ebola virus. Although some of these have recovered the outcome is not considered statistically significant. ZMapp has proved highly effective in a trial involving rhesus macaque monkeys.
- TKM-Ebola, an RNA interference drug.
- Favipiravir, a drug approved in Japan for stockpiling against influenza pandemics. The drug appears to be useful in a mouse model of the disease and Japan has offered to supply the drug if requested by the WHO.
- In September, an experimental vaccine, currently known as the NIAID/GSK vaccine, commenced simultaneous Phase 1 trials in Oxford and Bethesda. The vaccine was developed jointly by GlaxoSmithKline and the NIH. If this phase is completed successfully, the vaccine will be fast tracked for use in West Africa. In preparation for this, GSK is preparing a stockpile of 10,000 doses.[28]

Prevention and Control

Good outbreak control relies on a coordinated set of interventions including case management, surveillance and contact tracing, reliable laboratory services, safe burials, and social mobilization. Community engagement is key to successfully controlling outbreaks. Raising awareness of risk factors for Ebola infection and protective measures that individuals can take is an effective way to reduce human transmission. Risk reduction messaging should focus on several factors:

Avoid physical contact with people showing symptoms of the Ebola virus.

Wash your hands regularly with clean water and soap.

Keep away from fruit bats, monkeys, dead animals, and bush meat.

Thoroughly cook all animal products before consumption.

Inform health authorities immediatly in case of contact with expected or confirmed Ebola case.

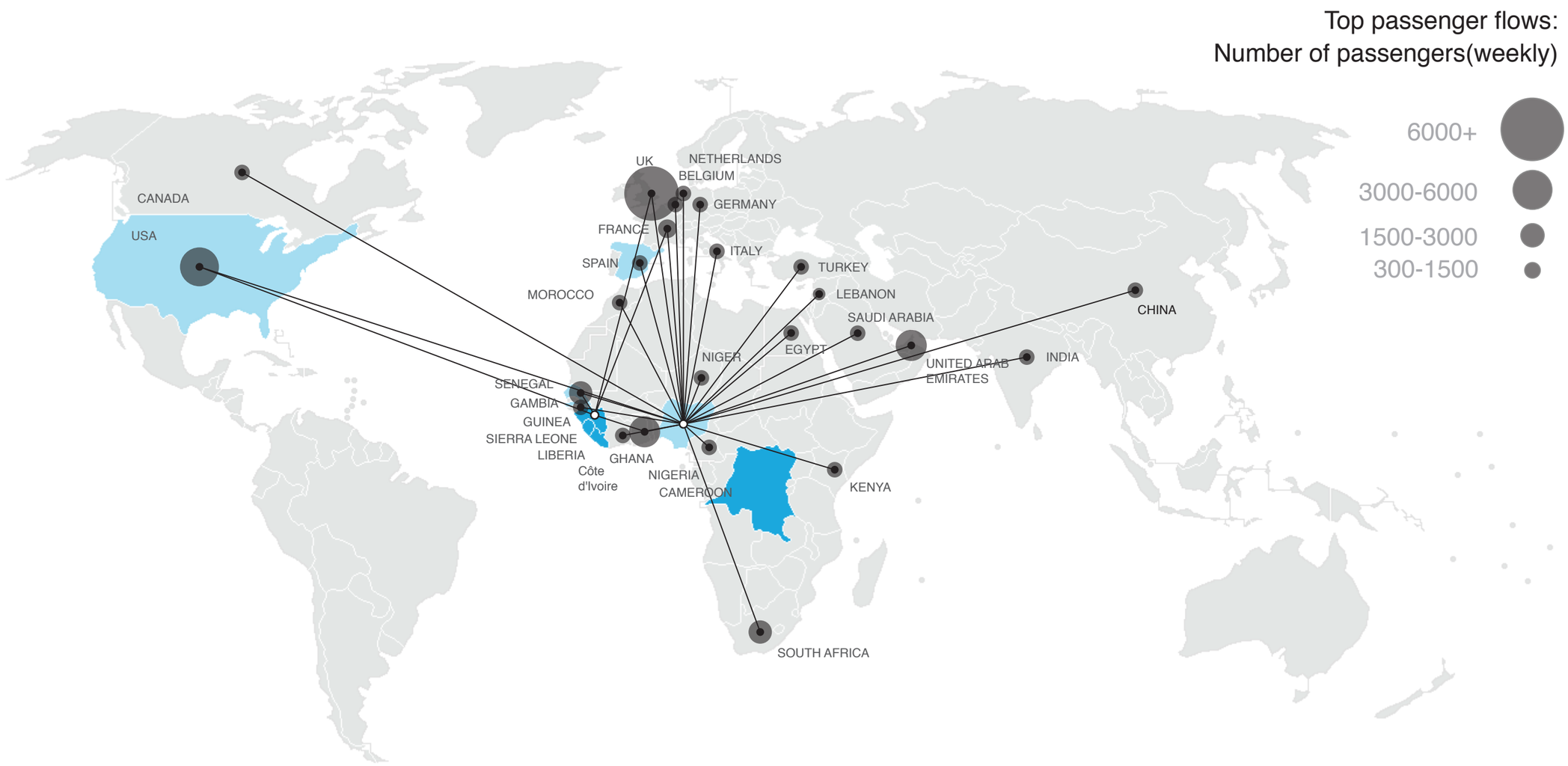
Travel to areas where there is an Ebola outbreak only in case of urgent need.

Contact tracing involves finding everyone who comes in direct contact with a sick Ebola patient. Contacts are watched for signs of illness for 21 days from the last day they came in contact with the Ebola patient. If the contact develops a fever or other Ebola symptoms, he or she is immediately isolated, tested, treated, and the cycle starts again—all of the new patient's contacts are found and watched for 21 days, and so on.

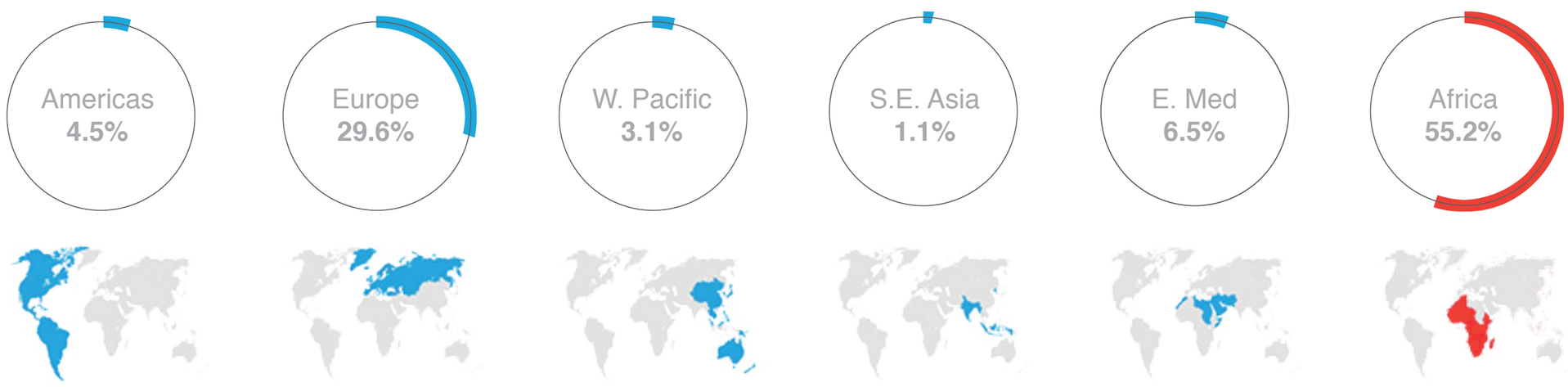
Potential of Spreading Internationally

There are major concerns that the EVD outbreak could spread, particularly to Europe and the United States. The main concern centres around air travel, which is thought to the primary potential route for the virus to spread across international and continential borders.

Air traffic connections from West Africa to the rest of the world. While Guinea, Liberia and Sierra Leone don't have many flights outside the region, Nigeria is well-connected to Europe and the U.S.[29]



Below are the final destinations of airline travelers departing from Guinea, Liberia and Sierra Leone in the month of August 2014 (source: WHO):[30]



The figures show that travel from Sierra Leone, Guinea, and Liberia within the continent of Africa is much more prevalent than travel elsewhere.

This data, coupled with the fact that outbreaks persist in countries with poor sanitation and a shortage of resources to contain them (rather than resource-rich places like the US and the UK), leaves public health officials relatively unconcerned about Ebola becoming a big problem in the developed world.

Far more concerning is the potential for the disease spreading within Africa, which is what public health officials are really worried about.

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