RAPID RISK ASSESSMENT

Outbreak of Ebola virus disease in West Africa

Fifth update, 29 September 2014

Main conclusions and options for risk reduction

Since December 2013 and as of 23 September 2014, 6 573 cases of Ebola virus disease (EVD), including 3 091 deaths have been reported by the World Health Organization (WHO) in affected countries (Guinea, Liberia, Sierra Leone and Nigeria). On 29 August, the Ministry of Health in Senegal reported a confirmed case of EVD in a 21-year-old male who recently arrived from Guinea. No local transmission of EVD is currently reported in Senegal therefore the country is not among the list of affected countries to date. Transmission in the capital cities is of particular concern, owing to their population density and the repercussions for travel and trade.

Recently published projections produced by the different models of the outbreak all indicate a dramatic increasing trend in Guinea, Liberia and Sierra Leone in the coming months. These projections should be regarded as indicative of possible trends and not as exact predictions. Yet, all models point to a substantial increase in the number of cases if control efforts remain unchanged.

The evolving outbreak of EVD over the last weeks increases the likelihood that residents and travellers to the EVD-affected countries will be exposed to infected or ill persons. The risk of infection for residents and visitors to the affected countries through exposure in the community is considered low if they adhere to the recommended precautions.

People visiting friends and relatives in the affected countries tend to have more and closer contacts in the community, and they are more likely than other visitors to participate in burial ceremonies – an activity known to be associated with transmission of the Ebola virus.

Residents and visitors to the affected areas run a high risk of exposure to EVD in healthcare facilities. The risk of being exposed to the Ebola virus is higher for healthcare workers, e.g. volunteers from NGOs who work in settings where appropriate infection control measures have not been implemented.

Risk of importation to the EU is linked to the number of patients presenting with symptoms and seeking medical attention in the EU.

The risk of Ebola viruses spreading from an EVD patient who arrives in the EU as result of a planned medical evacuation is considered extremely low. If a symptomatic case of EVD presents in an EU Member State, secondary transmission to caregivers in the family and in healthcare facilities cannot be ruled out. Once the possibility of EVD has been recognised and, healthcare providers have taken precautions to stop transmission, the risk of spread is reduced to a minimum.

Erratum. Figure 4 was amended on 6 October 2014 to clarify the legend and sources.

Suggested citation:
European Centre for Disease Prevention and Control. Outbreak of Ebola virus disease in West Africa. Fifth update, 29 September 2014. Stockholm: ECDC; 2014.

The options for risk reduction are:

- to reduce the risk of infection by avoiding non-essential travel into the affected areas and strictly following the EVD prevention measures in communities. As there is an increased risk of infection in healthcare facilities, visitors to the EVD affected countries should identify appropriate in-country healthcare resources prior to travelling;
- to reduce the risk of importation of Ebola viruses from affected countries into the EU, the WHO recommendations related to the declaration of a Public Health Event of International Concern (PHEIC) should be applied. Screening at the point of departure (exit screening) in the affected countries is likely to be more effective and less costly than screening of passengers at point of entry in EU/EEA countries (entry screening). Therefore, entry screening in the EU should be considered only for direct flights originating from EVD-affected countries where there is no evidence of effective exit screening; and
- to reduce the risk of transmission within the EU following importation of Ebola viruses, the following options are available: enhance information and communication to travellers departing from EVD-affected countries, raise awareness and sensitise healthcare providers in the EU about EVD, and support them with resources that will help them to identify and manage potential EVD patients.

The following resources support health providers in the EU in the identification and management of potential EVD patients:

- Assessment and planning for medical evacuation by air to the EU of patients with Ebola virus disease and people exposed to Ebola virus: http://www.ecdc.europa.eu/en/publications/Publications/air-transport-EVD.pdf
- Case definitions for Ebola patients in the EU: http://ecdc.europa.eu/en/healthtopics/ebola_marburg_fevers/EVDcasedefinition/Pages/default.aspx
- Algorithm for the laboratory diagnosis of Ebola virus disease: http://ecdc.europa.eu/en/healthtopics/ebola_marburg_fevers/algorithm-evd-diagnosis/Pages/default.aspx
- Algorithm for the initial assessment and management of patients with Ebola virus disease: http://ecdc.europa.eu/en/healthtopics/ebola_marburg_fevers/algorithm-evd-case-assessment/Pages/default.aspx

Source and date of request

ECDC internal decision, 23 September 2014*.

Public health issue

To update the assessment of the risk of importation and transmission of Ebola viruses in the EU associated with the outbreak of Ebola virus disease in West Africa currently affecting Guinea, Liberia, Sierra Leone and Nigeria. This assessment does not cover the ongoing EVD outbreak in the Democratic Republic of Congo.

Consulted experts

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Disease background information

Infections with Ebola viruses originating from Africa cause a severe disease in humans called Ebola virus disease. There are five species of the genus *Ebolavirus* (Filoviridae family): *Zaïre ebolavirus, Sudan ebolavirus, Reston ebolavirus, Taï Forest ebolavirus* and *Bundibugyo ebolavirus* [1-3]. The current outbreak in West Africa is caused by *Zaïre ebolavirus*. A concurrent EVD outbreak was declared on 26 August 2014 in the Democratic Republic of Congo. The two outbreaks are not connected [4].

* The current EVD outbreak was first assessed in an ECDC rapid risk assessment entitled 'Outbreak of Ebola haemorrhagic fever in Guinea', dated 23 March 2014 [12]. Detailed information about the Ebola virus and the epidemiology of EVD can be found in the first update, entitled 'Outbreak of Ebola virus disease in West Africa', published on 8 April 2014 [13]. A second update was published on 9 June 2014 [14], a third update was published on 1 August 2014, and a fourth update was published on 4 September 2014.

Ebola viruses are biosafety level-4 pathogens (BSL-4; risk group 4) and require special containment measures and barrier protection, particularly for healthcare workers. The viruses can survive in liquid or dried material for many days [5].They are inactivated by gamma irradiation, heating for 60 minutes at 60 °C or boiling for five minutes, and are sensitive to sodium hypochlorite (bleach) and other disinfectants [6]. Freezing or refrigeration will not inactivate Ebola viruses [7-9].

The incubation period (the period between infection and first symptoms) is usually four to ten days but can be as short as two days and as long as 21 days. The case-fatality ratio for *Zaïre ebolavirus* infections is estimated to be between 44% and 90% [10].

Ebola viruses are highly transmissible by direct contact with infected blood, secretions, tissues, organs and other bodily fluids from dead or living infected persons. Transmission via inanimate objects contaminated with infected bodily fluids (fomites) is possible [11]. The principal mode of transmission in human outbreaks is person-to-person transmission through direct contact with a symptomatic or dead EVD case. Airborne transmission has not been documented. The risk for transmission is considered low in the early phase of human disease (prodromal phase) [4]. Burial ceremonies and handling of dead bodies play an important role in transmission [2]. Ebola virus genome has been detected in semen up to 91 days after onset of disease [12], and replicative Ebola virus has been detected in semen 41 days after onset of disease [13,14].

Table 1. Levels of risk of transmission of Ebola viruses according to type of contact with an infected patient

Type of contact	Type of contact
Low risk	Casual contact with a feverish but ambulant and self-caring patient, e.g. sharing a sitting area or public transportation; receptionist tasks.
High risk	• Close face-to-face contact (e.g. within one meter) without appropriate personal protective equipment (including eye protection) with a probable or confirmed case who is coughing, vomiting, bleeding, or who has diarrhoea; or has had unprotected sexual contact with a case up to three months after recovery; • direct contact with any material soiled by body fluids from a probable or confirmed case; • percutaneous injury (e.g. with needle) or mucosal exposure to bodily fluids, tissues or laboratory specimens of a probable or confirmed case; • participation in funeral rites with direct exposure to human remains in or from affected area without appropriate personal protective equipment; • direct contact with bush meat or bats, rodents, primates, living or dead in/from affected areas.

Treatment and vaccine

Early and supportive treatment can improve the chances of recovery [15]. However, no specific treatments or vaccines are presently available for EVD. Potential Ebola therapies and vaccines were reviewed during a WHO consultation on 4–5 September 2014 [16].

There was consensus that the use of whole blood therapies and convalescent blood serums needs to be considered as a matter of priority [17].

Among the candidate treatments under consideration, three experimental treatments were identified: ZMapp, a combination of three humanised monoclonal antibodies which block or neutralise the virus; TKM-Ebola, a RNA-based drug; and Favipiravir, a RNA polymerase inhibitor already proposed for novel influenza infections. These candidate treatments have shown great promise in monkey models. Some of these treatments have already been used in a few Ebola patients, but this did not provide the opportunity to draw any conclusions about the efficacy of these drugs. The availability of some of these treatments is very limited (e.g. there is a shortage of ZMapp, due to its long production process).

The two most advanced vaccines were identified: a recombinant vesicular stomatitis virus vaccine (VSV-EBO), which induces an EVD-specific immune response, and a non-replicative chimpanzee adenovirus type 3 vaccine (ChAd-EBO) containing the gene for the EVD surface protein. Phase 1 and 2 trials are being initiated in the USA, in Africa and Europe. If proven safe, a vaccine could be available in the coming months for priority use in healthcare workers.

The European Medicines Agency (EMA) has started to review available information on Ebola treatments currently under development.

Event background information

On 22 March 2014, the Guinea Ministry of Health notified WHO about a rapidly evolving outbreak of EVD [18]. Investigations indicated that the first cases occurred in December 2013. Institut Pasteur in Lyon, France, confirmed a clade of *Zaïre ebolavirus* that is related but distinct from the viruses that have been isolated from previous outbreaks in central Africa, and clearly distinct from the *Taï Forest ebolavirus* that was isolated in Côte d'Ivoire from 1994–1995 [2,19,20]. Data from Sierra Leone show that the present outbreak is most likely linked to one single introduction from wildlife. Genetic variations of Ebola virus have been described during the current outbreak, showing the need to monitor targeted genome sequences to ensure that the selected primers for RT-PCR assays fit with the circulating strains [19,21].

The first cases were reported from south-eastern Guinea and the capital Conakry. By May 2014, the first cases were reported from Sierra Leone and Liberia [22,23] to where the disease is assumed to have spread through the movement of infected people over land borders. At the end of July 2014, a symptomatic case travelled by air to Lagos, Nigeria, where he infected a number of healthcare workers and airport contacts before his condition was recognised to be EVD. This cluster in Nigeria, initiated by air travel of an infectious person, had resulted in tertiary cases in Nigeria and a new cluster in Port Harcourt, Rivers State, with three confirmed cases [24] [25]. Consequently, Rivers State is considered as an affected area in addition to Lagos.

On 29 August, the Ministry of Health in Senegal reported a confirmed case of EVD in a 21-year-old male native of Guinea. He arrived in Dakar, by road, on 20 August and was hospitalised on 26 August after having initially been treated for malaria. On 27 August 2014, the Ministry of Health was informed that the patient was a contact of a known Ebola patient in Guinea, and the patient was immediately isolated [26]. No local transmission of EVD is currently reported in Senegal, and the country was not added to the list of affected countries. On 22 September 2014, all contacts of the cases in Senegal had completed the 21-day follow-up, with no further cases of EVD reported [27].

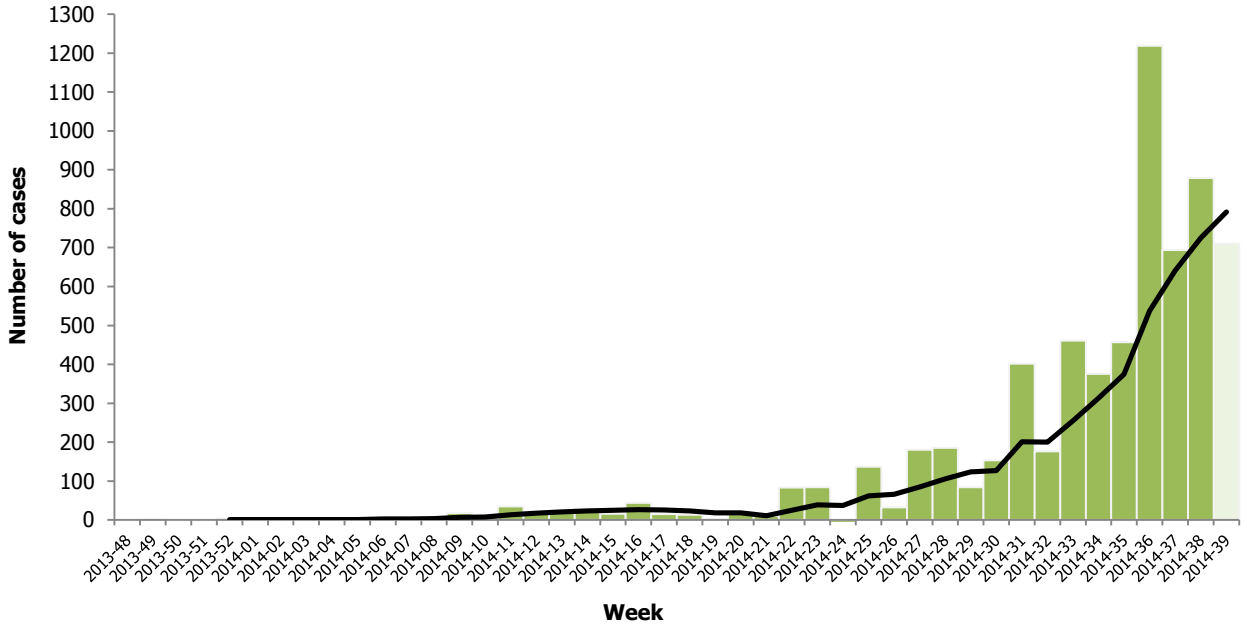
This is the first outbreak of EVD in West Africa and the 25th outbreak globally since the disease was discovered in 1976 in Zaïre. It is unprecedented in size, in geographical distribution, and in affecting densely populated urban areas. The outbreak has not yet reached its peak and it is still evolving. WHO declared the outbreak a Public Health Event of International Concern (PHEIC) on 8 August 2014 [28] and confirmed on 22 September that the 2014 Ebola outbreak in West Africa continued to constitute a Public Health Emergency of International Concern.

At its meeting on 18 September, the United Nations Security Council recognised the EVD outbreak as a 'threat to international peace and security' and unanimously adopted a resolution (Resolution 2177 (2014)) on the establishment of an UN-wide initiative which focuses assets of all relevant UN agencies to tackle the crisis. This was only the second disease in history that has reached the attention of the Security Council.

Epidemiological update

Since December 2013 and as of 23 September 2014, 6 574 cases of EVD, including 3 091 deaths, have been reported by WHO (Figure 1) [29]. The breakdown by affected countries is presented in Figure 1 and Table 2. One confirmed case was reported in Senegal in a 21-year-old male who recently arrived from Guinea.

Figure 1. Distribution of reported cases of EVD by week, in Guinea, Sierra Leone, Liberia, Nigeria and Senegal, weeks 48/2013 to 39/2014, n= 6 574 (data published 26 September 2014*)



** The bar for week 39/2014 does not represent a complete week. The solid green line represents the outbreak trends based on a five week moving average plotted on the fifth week of the moving average window. The figure includes one imported case in Senegal.*

Table 2. Total number of cases and deaths in West African EVD-affected countries, as of 23 September 2014 [29]

Country	Total number of cases	Total number of deaths
Guinea	1 074	648
Sierra Leone	2 021	605
Liberia	3 458	1 830
Nigeria	20	8
Total	**6 573**	**3 091**

Note: Above numbers are subject to change due to ongoing reclassification, retrospective investigation, and availability of laboratory results.

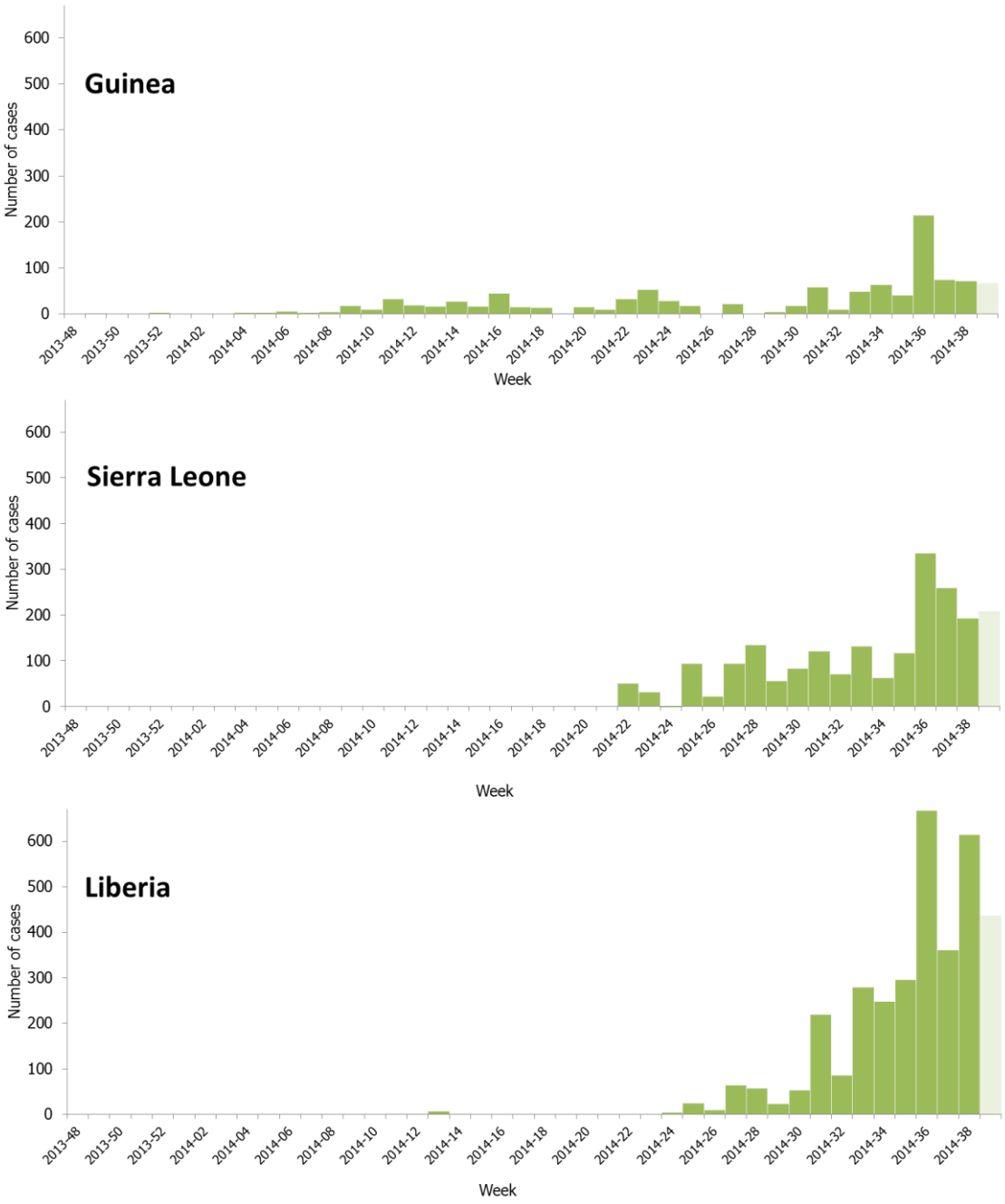
A study published by the WHO Ebola response team estimated that among 4 010 cases with known clinical outcome in Guinea, Liberia and Sierra Leone the case-fatality rate was 70.8% (95% CI: 68.6–72.8%); no difference between the countries was observed [30]. This is currently the best estimate of the fatality rate for these three countries.

The same study estimated the doubling time of the epidemic at 15.7 days in Guinea, 23.6 days in Liberia, and 30.2 days in Sierra Leone. The estimated incubation period was 11.4 days and serial interval 15.3 days, similar to estimates for previous outbreaks.

Situation in Guinea, Sierra Leone and Liberia

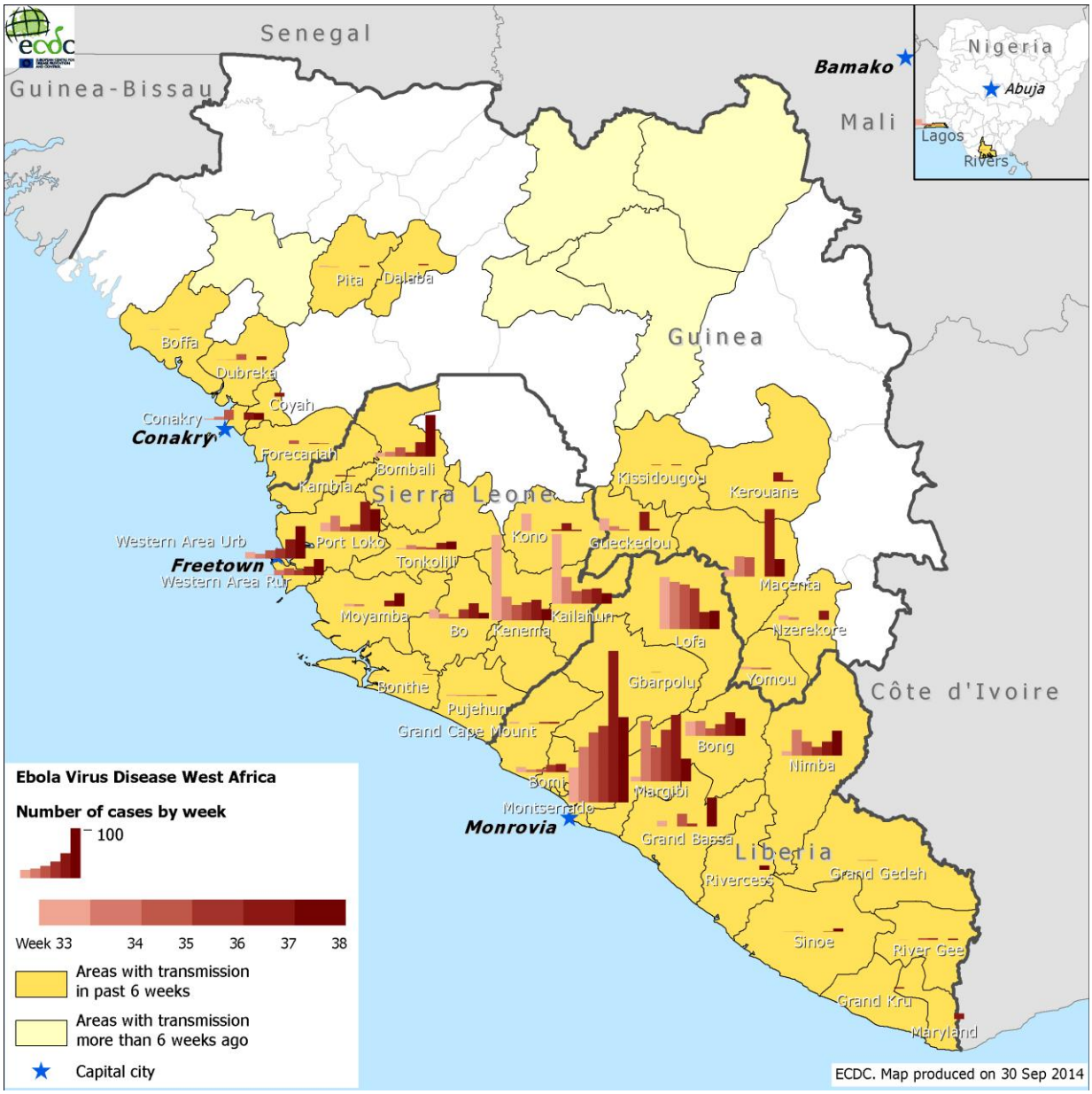
Guinea, Liberia and Sierra Leone are experiencing widespread intense transmission as per WHO categorisation. The outbreak is still evolving in these three countries (Figures 2 and 3). Officially reported figures are believed to be underestimated [31].

Figure 2. Distribution of cases of EVD by week of reporting in the three countries with widespread and intense transmission (as of week 39/2014*)



** The bar for week 39/2014 does not represent a complete calendar week.*

Figure 3. Distribution of cases of EVD by week of reporting in Guinea, Sierra Leone and Liberia (as of week 38/2014)



Source: Data from ministry of health reports

Situation in Nigeria and Senegal

Nigeria

As of 26 September 2014, 20 cases and eight deaths were notified [29]. Eight-hundred-and-forty seven of 872 contacts (92.7%) have completed the 21-day follow-up (349 contacts in Lagos, 498 contacts in Port Harcourt). All contacts in Lagos have now completed the 21-day follow-up. Twenty-four (96%) of the 25 contacts are still being monitored in Port Harcourt.

Table 3. Number of cases, deaths and contacts investigated in Nigeria, as of 23 September 2014

Country	Cases	Death	Date of last confirmed case	Number of contacts investigated	Number of contacts who have completed 21-day follow-up	Number of contacts who have not completed 21 day follow-up
Lagos	16	6	5 Sep 2014	349	349	0
Port-Harcourt	4	2	1 Sep 2014	523	498	25
Total	**20**	**8**		**872**	**847**	**25**

Source: WHO [29]

Senegal

One confirmed case in a 21-year-old male native from Guinea was notified on 29 August 2014 [32]. The case was put in isolation on 28 August 2014. Contact tracing activities had identified 74 contact persons; all have completed a 21-day follow-up period, with no further cases of EVD reported. None of the monitored contacts were healthcare workers.

Situation among healthcare workers

On 24 September 2014, WHO published the outcome of an investigation on EVD cases among healthcare workers [33]. Table 4 details the distribution of cases and deaths in the four affected countries.

WHO indicates that there is no evidence to suggest a recent increase in the incidence of infections of healthcare workers. In Nigeria, 11 of 20 cases, and 5 of 8 deaths, were reported among healthcare workers.

A crude estimate of the proportion of cases and deaths among healthcare workers is given in Table 4.

Table 4. Number of Ebola cases and deaths in healthcare workers as of 21 September 2014

Country	Cases (% of total reported cases)	Deaths (% of total reported deaths)
Guinea	67 (6.2)	35 (5.4)
Sierra Leone	113 (5.6)	82 (13.6)
Liberia	184 (5.3)	89 (4.9)
Nigeria	11 (55.0)	5 (62.5)
Total	**375 (5.7)**	**211 (6.8)**

Source: WHO [29]

Concurrent Ebola virus disease outbreak in the Democratic Republic of Congo

On 26 August 2014, the Ministry of Health of the Democratic Republic of the Congo (DRC) notified WHO of an outbreak of EVD in the Equateur province [34]. The index case was a pregnant woman who died from unidentified haemorrhagic fever in a local hospital. She had butchered an animal hunted by her husband. As of 24 September 2014, there have been 70 cases (30 confirmed, 26 probable, 14 suspected), including eight healthcare workers. A total of 42 deaths were reported, including eight healthcare workers [29].

A 21-day follow-up period was completed for 628 out of 939 contacts. As of 24 September, 311 contacts are being monitored, including 290 (93%) that were seen on that date.

None of the cases had a travel history to the EVD-affected countries in West Africa or a history of contact with individuals from the affected areas. The species causing the outbreak has been identified as *Zaire ebolavirus.* The strain was found to be 99% homologous to the Kikwit 1995 strain and therefore different form the *Zaire ebolavirus* strain circulating in West Africa [35]. This viral species has caused six previous outbreaks in DRC since 1976. The case-history of preparing bush meat suggests a direct zoonotic introduction in a remote area of the Equateur province and provides additional evidence that this outbreak is not connected to the West African outbreak.

Forecast of the epidemic

A number of models have been developed making short-, medium- and long-range predictions of the evolution of the outbreak. These models differ in the methods used and the date up to which data have been included. In addition, the probability of spread to other countries has been modelled.

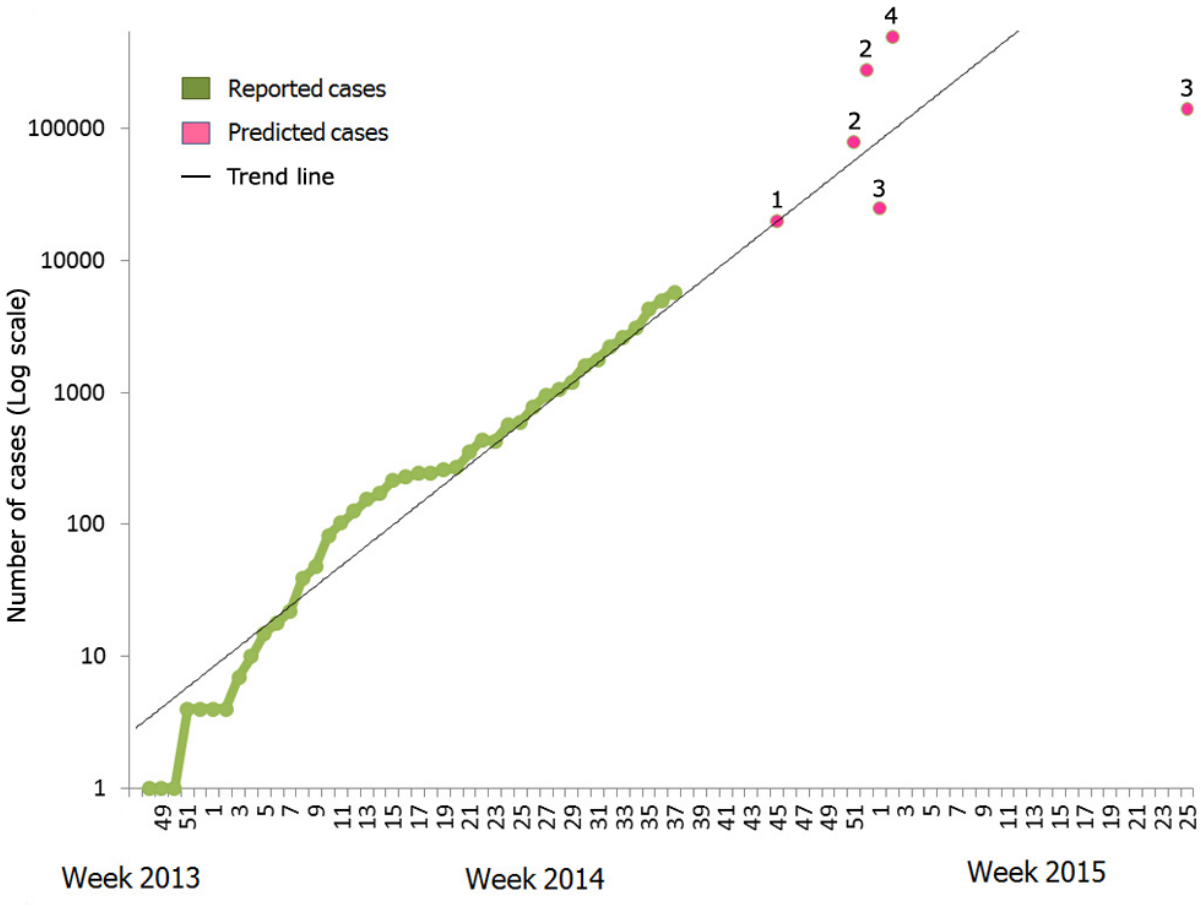
Based on these models, the basic (R_0) and effective (R_t) reproduction number of the current epidemic have been estimated between 1.51 and 2.53 [36-39], which is consistent with previous EVD outbreaks [40-42].

A study published by the WHO Ebola Response Team describes the epidemiological characteristics of the cases up to September 2014 and proposes estimates for Guinea (R_t=1.81), Liberia (R_t=1.51), and Sierra Leone (R_t=1.38).

WHO forecasts more than 20 000 cases (5740 in Guinea, 9890 in Liberia, and 5000 in Sierra Leone) by the beginning of November 2014 [30]. Nishiura et al. [39] forecast between 77 181 and 277 124 affected persons by the end of 2014 (Figure 4). The US CDC forecasts between 550 000 and 1.4 million cases by the end of January 2015. The latter considers a correction factor for underreporting of 2.5 (Figure 4) [43]. The WHO Ebola Response Team does not contradict this forecast, but both WHO and CDC stress that these are predictions based on the assumption of no improvement in control measures.

The long-range predictions are important for planning the allocation of scarce resources and the estimation of the burden on local and international healthcare, public health, and humanitarian structures.

Figure 4. Cumulative reported and predicted case count, Ebola epidemic, West Africa



Source: 1. WHO Ebola Response Team [30]; 2. Nishiura H et al. [39]; 3. Fisman D et al. [37]; 4. Meltzer MI, et al. (CDC) [43].

Outbreak response in the EVD-affected countries

The goal of the Ebola outbreak response is to interrupt all chains of human-to-human transmission. The principle strategies for achieving this are:

- to instruct community leaders about the disease, ways of transmission and how to protect against infection, and to engage them in communicating this information to community members;
- to quickly identify and isolate suspected EVD cases for confirmation by laboratory diagnosis and supportive treatment;
- to identify all contacts of each EVD case, actively monitor their health for the maximum incubation period of 21 days, and isolate, diagnose and treat all contacts who develop symptoms;
- to minimise the risk of transmission in healthcare settings through the consistent and appropriate use of personal protective equipment (PPE) and handling of hospital waste;
- to ensure safe removals and burials of deceased EVD cases;
- to raise public awareness and promote adherence to protective behaviour [2,44].

Successful implementation of these strategies depends on building and maintaining public trust in government response measures and ensuring cooperation from the affected families and their communities.

Transmission to healthcare workers

Healthcare workers are at high risk of exposure to Ebola viruses during an outbreak. The risk of the exposure resulting in infection depends on the availability and consistent use of PPE. Transmission to healthcare workers has occurred after close contact with EVD patients. This includes settings where infection control precautions were in place but not strictly adhered to [45]. Healthcare workers are potentially exposed not only through direct contact with cases but also through contaminated hospital materials, medical waste and diagnostic samples. However, the risk of healthcare-associated Ebola virus infections can be controlled by consistent and appropriate use of infection control precautions and strict barrier nursing procedures [46].

Isolation of patients, barrier nursing and other Ebola viruses control measures are burdensome for healthcare staff, particularly in hot and humid climates, and it can be difficult to ensure compliance over time.

The increase of patients who need to be cared for over the past two months has meant that more healthcare workers are exposed to Ebola viruses in their daily work.

Medical evacuations from EVD-affected countries

A number of Ebola virus infected people have been evacuated from the EVD-affected countries.

Table 5. Medical evacuation from EVD-affected countries up to 25 September 2014

Date of evacuation	Evacuated from	City (country) of evacuation	Profession	Outcome	Confirmed	Citizenship
2 August	Liberia	Atlanta (USA)	Healthcare worker	Discharged	Yes	US
5 August	Liberia	Atlanta (USA)	Healthcare worker	Discharged	Yes	US
6 August	Monrovia, Liberia	Madrid (Spain)	Healthcare worker	Death	Yes	Spanish
24 August	Sierra Leone	London (United Kingdom)	Healthcare worker	Discharged	Yes	British
27 August	Sierra Leone	Hamburg (Germany)	Epidemiologist	Unknown	Yes	Senegalese
4 September	Liberia	Omaha (USA)	Healthcare worker	Discharged (?)	Yes (?)	US
9 September	Liberia	Atlanta (USA)	Healthcare worker	Discharged (?)	Yes (?)	US
14 September	Sierra Leone	Leiden (Netherlands)	Healthcare worker	Discharged	No	Dutch
14 September	Sierra Leone	Leiden (Netherlands)	Healthcare worker	Discharged	No	Dutch
19 September	Liberia	Paris (France)	Healthcare worker	Stable	Yes	French
22 September	Sierra Leone (Lunsar)	Madrid (Spain)	Healthcare worker	Death	Yes	Spanish
22 September	Sierra Leone	Geneva (Switzerland)	Healthcare worker	Stable	Suspect	Non-Swiss
28 September	Sierra Leone	Washington, DC (USA)	Healthcare worker	Stable	Suspected	US

International travel and transport to EVD-affected countries

Almost all EU/EEA countries have issued temporary travel advice against non-essential travel to EVD-affected countries. A number of international airlines have curtailed or discontinued flights to the EVD-affected countries. Restrictions in international transport have already resulted in delays in the shipment of medical-related supplies to the affected population, including personal protection equipment. In addition, the affected countries are starting to experience shortages of basic supplies.

ECDC threat assessment

The measures implemented so far have failed to control the outbreak. The failure to control this outbreak, which is unprecedented in its scale, is not due to any increased pathogenicity of the Ebola virus: the clinical course of infection and the transmissibility of the virus are similar to previous EVD outbreaks [30]. As in earlier EVD outbreaks, transmission seems to be primarily driven by direct contact with EVD cases and dead bodies. There is no evidence that the recommended infection control measures are inappropriate to ensure protection.

It is expected that the rate of new cases will continue to rise in Guinea, Liberia and Sierra Leone in the coming weeks and possibly months. The complexity of the outbreak, the weak public health systems in the affected countries, and the magnitude of this outbreak make it difficult to predict when the spread is likely to peak and start to decelerate.

Projections made by the different models indicate a dramatic increasing trend in the three countries in the coming months. These predictions need to be interpreted with caution for two main reasons:

- Predictions are based on available surveillance data that can only be interpreted by taking into account the performance of the surveillance system which has generated the data. There are reports from areas in the affected countries where hospitals have closed, health centres are overwhelmed, patients are treated at home, and contact tracing and monitoring is inadequate. Therefore, a decrease in the number of newly reported cases could signify either a positive effect of the interventions to control the epidemic or a decrease in the performance of the surveillance system. Similarly, an increase in the number of cases could not only result from increased transmission but also from improved surveillance [47].
- Predictions rely on the underlying assumption that the outbreak continues to evolve at the same pace, which is unlikely for a disease whose transmission depends on behaviour and implemented control measures.

Therefore, all projections should be regarded as indicative of possible trends. If the outbreak continues with the current dynamics, without effective measures in place, a potentially explosive evolution is expected, with serious consequences for the region. Moreover, a significant rise in the number of cases would increase the risk of spread to neighbouring and other countries. The effects on the economy and trade are already tangible and would be even harsher should the situation continue to develop at this pace. The models also indicate that the peak of the outbreak has not been reached.

The increasing severity of the outbreak also makes it likely that there will be more long-distance exportations of EVD cases by air.

In Senegal, all contacts have now completed 21-day follow-up, with no further cases of EVD. In Nigeria, 25 contacts are still being monitored in Port Harcourt, but as to date no further transmission was reported. If these contacts will remain negative for a period of six weeks, i.e. two times the incubation period, these countries can be removed from the list of affected areas.

Risk of exposure to EU residents and travellers in affected countries

Risk of exposure in the community

The upsurge in the number of new EVD cases over the last weeks, the existence of urban transmission, and the fact that not all chains of transmission are known, increase the likelihood that residents and travellers to the EVD-affected countries will be exposed to infected or ill persons. The risk of infection for residents and visitors to the affected countries through exposure in the community is considered low if they adhere to the recommended precautions. Infection cannot be ruled out when people have mucosal contact, or contact when having a skin abrasion, with Ebola virus-contaminated surfaces, items, or hands.

People visiting friends and relatives in the affected countries tend to have more and closer contacts in the community, and they are more likely than other visitors to participate in burial ceremonies – an activity known to be associated with transmission of the Ebola viruses.

Risk of exposure in healthcare settings

Residents and visitors to the affected areas run a high risk of exposure to EVD in healthcare facilities. The level of this risk is related to how well the infection control measures are being implemented in these settings and the nature of the care required. While the risk is very low for a consultation requiring non-invasive tests and prescription of oral drugs, it may be increased if invasive procedures are required.

In the current outbreak, the proportion of infected healthcare workers in proportion to the total number of cases was 6.2% in Guinea, 5.6% Liberia and 5.3% Sierra Leone. It was significantly higher in Nigeria. This may be explained by infections that occurred through the first EVD cases when Ebola was not suspected/confirmed.

In past outbreaks, the proportion of infected healthcare workers among cases was 6% (1999 in Uganda) and 26% (1999 in the Democratic Republic of the Congo). Of particular concern during this outbreak is the fact that healthcare workers keep getting infected, at a time when effective standard procedures for the prevention of healthcare-associated transmission could have long been implemented [33].

The infection risk is not limited to hospitals that provide care to known EVD cases because infectious cases may initially seek medical attention at any healthcare provider. Furthermore, the risk of exposure in healthcare settings also exists in areas that have not yet reported cases because it can be assumed that not all cases of EVD are immediately detected and reported.

The risk of being exposed to Ebola viruses is higher for healthcare workers, e.g. volunteers from NGOs which provide assistance in settings where no infection control measures have been implemented. The risk is particularly high for healthcare workers who carry out invasive medical procedures or provide care to EVD patients.

Risk of importation to the EU

People infected with EVD may arrive in the EU by direct or indirect flights from affected countries or on board of freighters or passenger ships. A remote possibility is a chain of transmission along the routes used by undocumented migrants who end up on the southern shore of the Mediterranean and attempt to reach Europe by sea. Although the probability of this event is very small, the consequences could be significant in detention centres and on board ships at sea.

EVD cases may travel while incubating the disease and therefore not present with symptoms at the time of arrival, or may arrive sick because they developed symptoms while travelling. Ebola virus disease can develop quickly, and cases are not always aware that they have been exposed to Ebola virus. Incubating cases do not show symptoms and cannot be detected through screening at points of exit or entry. They may be unaware of exposure or deny it, and when presenting to an EU healthcare facility, clinicians may not suspect EVD.

Patients presenting with symptoms and seeking medical attention in the EU

There is a possibility that persons who were exposed to Ebola virus and developed symptoms on a commercial flight to seek medical attention in the EU. It is highly likely that such patients would report to a healthcare facility upon arrival in the EU and then be isolated to prevent further transmission.

Travel and transport risk assessment

A traveller on board an airplane may be already ill or become ill during the flight, showing symptoms compatible with EVD. In this situation, the possibility of transmission to co-passengers and crew should be assessed using the ECDC RAGIDA guidelines [8].

If an investigation concludes that the passenger has symptoms compatible with EVD and was exposed to EVD in the past 21 days, all passengers and crew who report direct contact, as well as all passengers seated one seat away from the sick person, should be monitored for 21 days. In addition, all passengers, crew members and cleaning staff who had direct contact with the suspected case's bodily fluids or potentially contaminated fomites such as contaminated clothing, towels, or other utensils, should be investigated and monitored.

Any person who was exposed to Ebola viruses and develops symptoms while on board a freighter/passenger ship sailing to the EU should be declared in a Maritime Declaration of Health form and in accordance with article 37 of the 2005 International Health Regulations [48]. Affected crew members or passengers should be taken care of appropriately in order to prevent any further spread of the disease.

Risk related to biosafety

There is a theoretical risk that a biological sample is sent to an EU laboratory for further testing, without proper indication of a possible connection to Ebola virus. Strict compliance with sample shipment regulations and universal precautions in the receiving laboratory should mitigate this risk [49].

Risk of transmission through substances of human origin

According to the EU Blood Directive [50], current geographic deferrals for malaria also exclude residents and travellers from EVD-affected countries from donating blood.

Risk of spread of Ebola virus in the EU following importation

The risk of Ebola virus spreading from an EVD patient who arrives in the EU as result of a planned medical evacuation is considered extremely low. The risk of spread is minimal when recommended infection-prevention and control measures are followed and the staff who organise the evacuation – and the staff at the institution who receives the evacuated EVD patient – are well trained.

If a symptomatic case of EVD presents in an EU Member State, secondary transmission to caregivers in the family and in healthcare facilities cannot be ruled out, particularly if presenting with symptoms exposing bodily fluids (bleeding, diarrhoea) before an Ebola virus infection is suspected and infection control measures are implemented. Once the possibility of EVD has been recognised and the healthcare providers have taken precautions to stop transmission, the risk of spread is reduced to a minimum.

Options for risk reduction

The focus of this document is on individual protection and the various options for mitigating the risk of importation and spread in the EU.

Reduction of the risk of infection

Avoiding travel to affected areas

The most obvious option to decrease the risk of importation from affected areas is to advise travellers to defer their travel to these affected countries until the outbreak is controlled there. Thirty EU/EEA countries have recommended this option for their citizens; 26 recommend that non-essential travel should be avoided or postponed, and four advise against all travel in the affected areas. WHO does not recommend any travel or trade restrictions to countries involved in this outbreak [51].

Preventing infection in communities

Visitors and residents in EVD-affected areas face a low risk of becoming infected in the community if the following precautions are strictly followed:

- Avoid contact with symptomatic patients and their bodily fluids.
- Avoid contact with corpses and/or bodily fluids from deceased patients.
- Avoid contact with wild animals (including primates, monkeys, forest antelopes, rodents and bats), both alive and dead, and consumption of 'bush meat'.
- Wash hands regularly, using soap or antiseptics.

Generic precautions for travelling in West African countries also apply to the prevention of EVD infection:

- Wash and peel fruit and vegetables before consumption.
- Practice 'safe sex'.
- Avoid habitats which might be populated by bats, such as caves, isolated shelters, or mining sites.

Preventing infection in healthcare settings

There is an increased risk of exposure and infection in healthcare facilities. Options for prevention and control of this risk include:

- Avoid non-essential travel to EVD-affected areas and countries.
- Identify appropriate in-country healthcare resources in the EVD-affected countries prior to travelling there.
- Ensure that your travel insurance covers medical evacuation in the event of any illness or accident in order to limit exposure to local health facilities.

However, recent events in the affected countries have demonstrated that it may not always be possible to comply with the above precautions and this is the rationale behind many countries' advice against non-essential travel to Liberia and Sierra Leone.

Reduction of the risk of importation to the EU

Options in affected countries

On 8 August 2014, WHO declared the Ebola virus disease outbreak in West Africa a Public Health Emergency of International Concern (PHEIC) in accordance with the International Health Regulations. On 22 September, WHO confirmed that the 2014 Ebola outbreak in West Africa continued to constitute a Public Health Emergency of International Concern. Following the declaration of the PHEIC, WHO recommended the following measures for affected Member States, which are expected to reduce the risk for importation to the EU:

- Affected countries are requested to conduct exit screening of all persons at international airports, seaports and major land crossings for unexplained febrile illness consistent with potential Ebola infection. There are indications that exit screening has been implemented in Conakry and prevented 47 feverish travellers from boarding an aircraft [52].
- There should be no international travel of Ebola cases or contacts of cases, unless the travel is part of an appropriate medical evacuation. To be fully effective, this measure should restrict asymptomatic contacts of EVD cases from leaving the EVD-affected country on an international flight until the 21-day incubation period has passed. As the ratio of contacts to cases is high, this measure represents a significant logistic challenge. It may also prevent expatriate professionals engaged in outbreak control from leaving the EVD-affected country if they have been exposed to Ebola viruses.

The implementation of this measure could imply:

- the screening of all air passengers departing from EVD-affected countries for history of contact with EVD cases; and
- the impounding or revocation of passports from contacts who develop symptoms and suspected and confirmed EVD cases.

The measures listed above can only be implemented in EVD-affected countries, and there is no evidence that they are effective.

Screening passengers with thermal scanners aims at detecting febrile travellers. The likelihood of a febrile passenger to be an infectious case of EVD would, however, be very low given the relatively low incidence of EVD in the general population of the affected countries, and the much higher incidence of other febrile illnesses (such as malaria). It could potentially prevent a febrile EVD case from boarding a flight but it would not detect an incubating passenger who has not yet developed fever.

Further exit screening information in the affected countries will remain of interest in order to monitor the risk of importation of potential EVD cases to non-affected countries.

Options for EU countries

Screening at the point of departure (exit screening) in affected countries is likely to be more effective and less costly than screening at the point of entry in EU/EEA countries (entry screening). Therefore, entry screening in the EU appears not to be cost-effective and should only be considered for direct flights originating from affected countries where there is no evidence of effective exit screening.

Reduction of the risk of transmission within the EU following an importation

The risk of EVD transmission is dependent on the early detection of suspected EVD cases imported into the EU. The time window of highest risk of potential transmission ranges from the onset of first symptoms and the detection by healthcare professionals. Once a case is detected and appropriate Ebola infection control measures are implemented, the risk of transmission becomes very low. Interventions for reducing the risk of spread from an imported case in the EU should therefore aim to narrow this window.

Information and communication

Interventions with the potential to reduce the number of contacts and shorten the interval between onset of symptoms and implementation of appropriate infection control include the following measures:

- Informing travellers departing from EVD-affected countries and travellers arriving in the EU on direct flights from EVD-affected countries about:
  - the possibility of exposure to Ebola while in the affected countries;
  - the clinical presentation of the disease and the need to seek immediate medical care if symptoms develop;

  - the need to immediately disclose their travel history when seeking medical care, and to preferably do so before arriving at a healthcare facility;
  - the need to indicate possible contact with sick individuals or wild animals while in the EVD-affected country; and
  - how to contact public health authorities for support if infection is suspected (leaflets, phone numbers, telephone hotline).

- Informing and sensitising healthcare providers in the EU about:
  - the possibility of EVD among returning travellers from affected areas;
  - the clinical presentation of the disease and the need to inquire about travel history and contacts with family and friends visiting from EVD-affected countries;
  - the availability of protocols for the ascertainment of possible cases and procedures for referral to healthcare facilities;
  - the need for strict implementation of barrier management, use of personal protective equipment and disinfection procedures, in accordance with specific guidelines and WHO infection control recommendations [38,39] when providing care to suspected EVD cases.

- Supporting health providers in the EU with resources that will help them to identify and manage potential EVD patients:
  - Assessing and planning medical evacuation by air to the EU for patients with Ebola virus disease and people exposed to Ebola virus: http://www.ecdc.europa.eu/en/publications/Publications/air-transport-EVD.pdf
  - Case definitions for Ebola patients in the EU: http://ecdc.europa.eu/en/healthtopics/ebola_marburg_fevers/EVDcasedefinition/Pages/default.aspx
  - Case identification and case management algorithms: http://ecdc.europa.eu/en/healthtopics/ebola_marburg_fevers/algorithm-evd-diagnosis/Pages/default.aspx and http://ecdc.europa.eu/en/healthtopics/ebola_marburg_fevers/algorithm-evd-case-assessment/Pages/default.aspx

Investigation of possible cases

In parallel to the early detection of potential EVD cases corresponding to the criteria for 'patients under investigation' (http://ecdc.europa.eu/en/healthtopics/ebola_marburg_fevers/EVDcasedefinition/Pages/default.aspx), additional investigations of common aetiologies of febrile illness upon return from tropical areas should be performed, with priority given to malaria diagnosis. However, malaria positivity does not exclude an EVD infection. It is expected that a significant number of people will be tested for EVD in the EU/EEA, but the likelihood of identifying and confirming an EVD case is very low (low positive predictive value) because most people who meet the criteria for patient under investigation for EVD will have other infections explaining their symptoms.

Medical evacuations

There are increasingly frequent reports about expatriate healthcare workers being repatriated from EVD-affected countries for monitoring after exposure to Ebola viruses. Such repatriations should be executed as soon as possible after the potential exposure, while the risk of transmission is still minimal should the exposed person turn out to be infected.

A document entitled 'Assessment and planning for medical evacuation by air to the EU of patients with Ebola virus disease and people exposed to Ebola virus' provides decision-makers with additional information when there is a perceived need to evacuate by air an infected or exposed person from an Ebola-affected country to an EU Member State. The decision to evacuate must be based on: the likelihood of the person being infected with Ebola virus; the potential benefits of evacuation for the concerned person/patient; the risks associated with medical evacuation by air for the person/patient; and the risk of transmission to the crew and accompanying medical staff [53].

The possibility of timely medical evacuation is likely to be an important factor in the decision when international healthcare workers consider joining a mission to an EVD-affected country. This applies particularly to personnel who are asked to engage in contact tracing, patient care and other outbreak control activities which involve exposure to infected people. It is anticipated that medical evacuation needs will grow over the coming months as the outbreak continues and the number of expatriate healthcare workers engaged in outbreak control increases.

References

1. European Centre for Disease Prevention and Control. ECDC fact sheet: Ebola and Marburg fever [internet]. ECDC; 2014 [cited 2014 Mar 20]. Available from: http://www.ecdc.europa.eu/en/healthtopics/ebola_marburg_fevers/pages/index.aspx.

2. World Health Organization. Ebola virus disease (Fact sheet N°103) [internet]. WHO Media centre; 2014 [updated Apr 2014; cited 2014 Mar 20]. Available from: http://www.who.int/mediacentre/factsheets/fs103/en/.

3. Li YH, Chen SP. Evolutionary history of Ebola virus. Epidemiol Infect. 2014 Jun;142(6):1138-45.

4. Office for the Coordination of Humanitarian Affairs Democratic Republic of Congo. Point d'information sur la maladie a virus Ebola en RDC. [internet]. 2014 [cited 2014 sep 1]. Available from: http://www.rdc-humanitaire.net/attachments/article/4924/EBOLA%20-%20Update%20du%2030%20ao%C3%BBt%202014%20-%20No.%205.pdf.

5. Piercy TJ, Smither SJ, Steward JA, Eastaugh L, Lever MS. The survival of filoviruses in liquids, on solid substrates and in a dynamic aerosol. J Appl Microbiol. 2010 Nov;109(5):1531-9.

6. Public Health Agency of Canada. Ebola virus. Pathogen Safety Data Sheet - Infectious substances [internet]. Public Health Agency of Canada.; 2010 [cited 2014 Mar 31]. Available from: http://www.phac-aspc.gc.ca/lab-bio/res/psds-ftss/ebola-eng.php.

7. Chepurnov AA, Chuev Iu P, P'Iankov O V, Efimova IV. [The effect of some physical and chemical factors on inactivation of the Ebola virus]. Vopr Virusol. 1995 Mar-Apr;40(2):74-6.

8. European Centre for Disease Prevention and Control. Risk assessment guidelines for diseases transmitted on aircraft (2nd edition) [internet]. 2010 [cited 2014 Sept 30]. Available from: http://ecdc.europa.eu/en/publications/publications/1012_gui_ragida_2.pdf.

9. World Health Organization. A Guide for Shippers of Infectious Substances [internet]. 2013 [cited 2014 Sep 30]. Available from: http://www.who.int/ihr/infectious_substances/en/.

10. Bannister B. Viral haemorrhagic fevers imported into non-endemic countries: risk assessment and management. Br Med Bull. 2010;95:193-225.

11. Colebunders R, Borchert M. Ebola haemorrhagic fever--a review. J Infect. 2000 Jan;40(1):16-20.

12. Rowe AK, Bertolli J, Khan AS, Mukunu R, Muyembe-Tamfum JJ, Bressler D, et al. Clinical, virologic, and immunologic follow-up of convalescent Ebola hemorrhagic fever patients and their household contacts, Kikwit, Democratic Republic of the Congo. Commission de Lutte contre les Epidemies a Kikwit. J Infect Dis. 1999 Feb;179 Suppl 1:S28-35.

13. Bausch DG, Towner JS, Dowell SF, Kaducu F, Lukwiya M, Sanchez A, et al. Assessment of the risk of Ebola virus transmission from bodily fluids and fomites. J Infect Dis. 2007 Nov 15;196 Suppl 2:S142-7.

14. Martini GA, Schmidt HA. [Spermatogenic transmission of the "Marburg virus". (Causes of "Marburg simian disease")]. Klin Wochenschr. 1968 Apr 1;46(7):398-400.

15. World Health Organization. Clinical management of patients with viral haemorrhagic fever: a pocket guide for the front-line health worker. 30 March 2014. World Health Organization,, 2014.

16. World Health Organization. Potential Ebola therapies and vaccines [internet]. 2014 Sep 3 [cited 2014 Sep 30]. Available from: http://www.who.int/csr/disease/ebola/ebola-new-interventions-02-sep-2014.pdf?ua=1.

17. World Health Organization. Statement on the WHO Consultation on potential Ebola therapies and vaccines 2014. Available from: http://www.who.int/mediacentre/news/statements/2014/ebola-therapies-consultation/en/.

18. World Health Organization. Ebola virus disease in Guinea [internet]. 2014 Mar 23 [cited 2014 Sep 30]. Available from: http://www.who.int/csr/don/2014_03_23_ebola/en/.

19. Baize S, Pannetier D, Oestereich L, Rieger T, Koivogui L, al. e. Emergence of Zaire Ebola Virus Disease in Guinea. N Engl J Med [Internet]. 2014 Apr 16. Available from: http://www.nejm.org/doi/full/10.1056/NEJMoa1404505.

20. Muyembe-Tamfum JJ, Mulangu S, Masumu J, Kayembe JM, Kemp A, Paweska JT. Ebola virus outbreaks in Africa: past and present. Onderstepoort J Vet Res. 2012;79(2):451.

21. Gire S, Goba A, Andersen K, Sealfon R, Park D, Kanneh L, et al. Genomic surveillance elucidates Ebola virus origin and transmission during the 2014 outbreak. Science [Internet]. 2014 Aug 28 [cited 2014 Sep 30]; 345:[1369-72 pp.]. Available from: http://www.sciencemag.org/content/345/6202/1369.full.

22. Centers for Disease Control and Prevention. Ebola in Liberia [internet]. 2014 [cited 2014 Aug 26]. Available from: http://wwwnc.cdc.gov/travel/notices/alert/ebola-liberia.

23. Centers for Disease Control and Prevention. Ebola in Sierra Leone [internet]. 2014 [cited 2014 Sep 30]. Available from: http://wwwnc.cdc.gov/travel/notices/alert/ebola-sierra-leone.

24. SOS international. Ebola in Africa: Nigeria. [Internet]. 2014 [updated Sept 3 2014; cited 2014 Sept 3]. Available from: https://www.internationalsos.com/ebola/index.cfm?content_id=418&language_id=ENG.

25. Rosemary Nwisi. Woman tests positive to Ebola as Nigeria seeks drug from Japan. The Nation. 2014 Sep 1 [cited 2014 Sep 30]. Available from: http://thenationonlineng.net/new/woman-tests-positive-to-ebola-as-nigeria-seeks-drug-from-japan/.

26. World Health Organization. Ebola virus disease – Senegal. [internet]. 2014 [cited 2014 Sep 2].

27. World Health Organization. Ebola response roadmap update [internet]. 2014 Sep 22 [cited 2014 Sep 30]. Available from: http://apps.who.int/iris/bitstream/10665/134449/1/roadmapupdate22sept14_eng.pdf?ua=1.

28. World Health Organization. WHO Statement on the Meeting of the International Health Regulations Emergency Committee Regarding the 2014 Ebola Outbreak in West Africa. [internet]. 2014 [cited 2014 Aug 29]. Available from: http://who.int/mediacentre/news/statements/2014/ebola-20140808/en/.

29. World Health Organization. Ebola Response Roadmap [internet]. 2014 Sep 26 [cited 2014 September 30]. Available from: http://apps.who.int/iris/bitstream/10665/135029/1/roadmapupdate26sept14_eng.pdf?ua=1.

30. WHO Ebola Response Team. Ebola Virus Disease in West Africa — The First 9 Months of the Epidemic and Forward Projections. N Eng J Med [Internet]. 2014 Sep 23 [cited 2014 Sep 30]. Available from: http://www.nejm.org/doi/full/10.1056/NEJMoa1411100.

31. World Health Organization. Unprecedented number of medical staff infected with Ebola [internet]. 2014 [cited 2014 Aug 25]. Available from: http://www.who.int/mediacentre/news/ebola/25-august-2014/en/.

32. Ministère de la Santé et de l'Action Sociale S. Epidémie de la maladie à virus Ebola, Situation du 22 septembre 2014 [internet]. 2014 [cited 2014 Sept 25]. Available from: https://wca.humanitarianresponse.info/fr/system/files/documents/files/SITREP-SENEGAL-22Sep-2014.pdf.

33. World Health Organization. Ebola Response Roadmap Situation Report [internet]. 2014 Sep 24 [cited 2014 September 30]. Available from: http://apps.who.int/iris/bitstream/10665/134771/1/roadmapsitrep_24Sept2014_eng.pdf?ua=1.

34. World Health Organization. Ebola virus disease – Democratic Republic of Congo [Internet]. 2014 [29/08/2014]. Available from: http://www.afro.who.int/en/clusters-a-programmes/dpc/epidemic-a-pandemic-alert-and-response/outbreak-news/4263-ebola-virus-disease-drc.html.

35. UNOCHA. Update in the Ebola virus disease in DRC. 2014 [updated Aug 30 2014; cited 2014 Aug 30]. Available from: http://www.rdc-humanitaire.net/attachments/article/4924/Ebola%20Update%20of%2030%20August%202014%20-%20No%205%20ENG.pdf.

36. Althaus CL. Estimating the reproduction number of Ebola Virus (EBOV) during the 2014 outbreak in West Africa. PLOS Currents Outbreaks [Internet]. 2014 [cited 2014 Sept 2]. Available from: http://currents.plos.org/outbreaks/article/estimating-the-reproduction-number-of-zaire-ebolavirus-ebov-during-the-2014-outbreak-in-west-africa/.

37. Fisman D, Khoo E, Tuite A. Early epidemic dynamics of the West African 2014 Ebola Outbreak: estimates derived with a simple two-parameter model. PLOS Currents Outbreaks [Internet]. 2014 Sep 30 [cited 2014 Sept 2]. Available from: http://currents.plos.org/outbreaks/article/obk-14-0036-early-epidemic-dynamics-of-the-west-african-2014-ebola-outbreak-estimates-derived-with-a-simple-two-parameter-model/.

38. Gomes MFC, Pastore y Piontti A, Rossi L, Chao D, Longini I, Halloran ME, et al. Assessing the International Spreading Risk Associated with the 2014 West African Ebola Outbreak. PLOs Currents Outbreaks. 2014.

39. Nishiura H, Chowell G. Early transmission dynamics of Ebola virus disease (EVD), West Africa, March to August 2014. Euro Surveill. 2014 Sep 11 214;19(36).

40. Chowell G, Hengartner NW, Castillo-Chavez C, Fenimore PW, Hyman JM. The basic reproductive number of Ebola and the effects of public health measures: the cases of Congo and Uganda. J Theor Biol. 2004 Jul 7;229(1):119-26.

41. Legrand J, Grais RF, Boelle PY, Valleron AJ, Flahault A. Understanding the dynamics of Ebola epidemics. Epidemiol Infect. 2007 May;135(4):610-21.

42. Lekone PE, Finkenstadt BF. Statistical inference in a stochastic epidemic SEIR model with control intervention: Ebola as a case study. Biometrics. 2006 Dec;62(4):1170-7.

43. Meltzer MI, Atkins CY, Santibanez S, Knust B, Petersen BW, Ervin ED, et al. Estimating the Future Numbers of Cases in the Ebola Epidemic - Liberia and Sierra Leone, 2014-2015. MMWR Morb Mortal Wkly Rep. 2014;63:1-14.

44. Muyembe-Tamfum JJ, Kipasa M, Kiyungu C, Colebunders R. Ebola outbreak in Kikwit, Democratic Republic of the Congo: discovery and control measures. J Infect Dis. 1999 Feb;179 Suppl 1:S259-62.

45. Borchert M, Mutyaba I, Van Kerkhove MD, Lutwama J, Luwaga H, Bisoborwa G, et al. Ebola haemorrhagic fever outbreak in Masindi District, Uganda: outbreak description and lessons learned. BMC Infect Dis. 2011;11:357.

46. Francesconi P, Yoti Z, Declich S, Onek PA, Fabiani M, Olango J, et al. Ebola hemorrhagic fever transmission and risk factors of contacts, Uganda. Emerg Infect Dis. 2003 Nov;9(11):1430-7.

47. Plachouras D, Sudre B, Testa M, Robesyn E, Coulombier D. Letter to the editor: Early transmission dynamics of Ebola virus disease (EVD), West Africa, March to August 2014. Eurosurveillance [Internet]. 2014 Sep 18 [cited 2014 Sep 30]; 19(37). Available from: http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=20907.

48. World Health Organization. International health regulations (2005) - 2nd ed. [Internet]. Geneva: WHO; 2005 [cited 2014 Sept 30]. Available from: http://whqlibdoc.who.int/publications/2008/9789241580410_eng.pdf?ua=1.

49. World Health Organization. Guidance on regulations for the transport of infectious substances 2013–2014 [internet]. 2013 [cited 2014 Mar 31]. WHO/HSE/GCR/2012.12]. Available from: http://apps.who.int/iris/bitstream/10665/78075/1/WHO_HSE_GCR_2012.12_eng.pdf.

50. European Commission. Commission Directive 2004/33/EC of 22 March 2004 implementing Directive 2002/98/EC of the European Parliament and of the Council as regards certain technical requirements for blood and blood components [internet]. 2004 [cited 2014 Sep 30]. Available from: http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32004L0033&from=EN.

51. World Health Organization. 2014 Ebola Virus Disease (EVD) outbreak in West Africa - Travel and transport risk assessment: Recommendations for public health authorities and transport sector 2014 [cited 2014 29 July 2014]. Available from: http://www.who.int/ith/updates/20140421/en/.

52. StarAfrica. Aéroport de Conakry : 47 passagers refoulés à cause du nouveau dispositif sanitaire [internet]. 2014 [cited 2014 Sep 2]. Available from: http://fr.starafrica.com/actualites/aeroport-de-conakry-47-passagers-refoules-a-cause-du-nouveau-dispositif-sanitaire.html.

53. European Centre for Disease Prevention and Control. Assessment and planning for medical evacuation by air to the EU of patients with Ebola virus disease and people exposed to Ebola virus [Internet]. Stockholm: European Centre for Disease Prevention and Control; 2014 [cited 2014 Sept 30]. Available from: http://www.ecdc.europa.eu/en/publications/Publications/air-transport-EVD.pdf.