



RAPID RISK ASSESSMENT

Ebola virus disease outbreak in North Kivu and Ituri Provinces, Democratic Republic of the Congo – second update

21 December 2018

Main conclusions

As of 16 December 2018, the Ministry of Health of the Democratic Republic of Congo (DRC) has reported 539 Ebola virus disease (EVD) cases, including 48 probable and 491 confirmed cases. This epidemic in the provinces of North Kivu and Ituri is the largest outbreak of EVD recorded in DRC and the second largest worldwide. A total of 315 deaths occurred during the reporting period. As of 16 December 2018, 52 healthcare workers (50 confirmed and two probable) have been reported among the confirmed cases, and of these 17 have died. As of 10 December 2018, the overall case fatality rate was 58%.

Since mid-October, an average of around 30 new cases has been reported every week, with 14 health zones reporting confirmed cases in the past 21 days. This trend shows that the outbreak is continuing across geographically dispersed areas. Although the transmission intensity has decreased in Beni, the outbreak is continuing in Butembo city, and new clusters are emerging in the surrounding health zones. A geographical extension of the outbreak (within the country and to neighbouring countries) cannot be excluded as it is unlikely that it will be controlled in the near future.

Despite significant achievements, the implementation of response measures remains problematic because of the prolonged humanitarian crisis in North Kivu province, the unstable security situation arising from a complex armed conflict and the mistrust of affected communities in response activities. In recent weeks, the suboptimal infection prevention and control measures in healthcare settings, especially unregulated ones, have resulted in cases among health workers (around 10%), which have played an important role in amplifying the transmission.

The response to the Ebola outbreak will face additional challenges during the ongoing election period due to mass-gathering events, and other health emergencies associated with outbreak-prone diseases that could potentially jeopardise the resources available to prevent and control the EVD epidemic.

The probability that EU/EEA citizens living or travelling in EVD-affected areas of the DRC will be exposed to the disease is low, provided they adhere to the precautionary measures recommended below.

There are no international airports in the affected areas of DRC that offer direct flights to EU/EEA Member States, which limits the risk of the virus being introduced into the EU/EEA. The overall risk of introduction and further spread of Ebola virus within the EU/EEA is very low. However, the risk can only be eliminated by stopping transmission at the local level in the DRC.

Options for response

EU/EEA visitors and residents of affected areas

EU/EEA visitors and residents in EVD-affected areas are at low risk of becoming infected in the community if the precautionary measures below are followed:

- avoid contact with symptomatic patients/their bodily fluids, corpses and/or bodily fluids from deceased patients and wild animals, both alive and dead;
- avoid consumption of bush meat;
- wash and peel fruit and vegetables before consumption;
- wash hands regularly using soap or antiseptics;
- ensure safe sexual practice.

Screening of travellers

To reduce the likelihood of EVD being introduced into the EU/EEA, the following options for response can be considered:

- Where exit screening is implemented at an airport, a traveller presenting with symptoms (e.g. fever >38°C) should not be allowed to board a flight.
- A passenger who develops EVD-compatible symptoms while on board of a commercial flight should be isolated and his/her condition ascertained upon arrival. Should the passenger be confirmed as having EVD, contact tracing of passengers should be initiated in accordance with the recommendations for aircraft contact tracing set out in the RAGIDA guidelines¹.
- Travellers who have stayed in a recently affected area should be made aware that if they develop symptoms compatible with EVD within 21 days after arrival in an EU/EEA Member State, they should self-isolate, contact health services and mention potential exposure to the Ebola virus. Secondary transmission to caregivers in the family and in healthcare facilities cannot be ruled out if no measures are taken for infection prevention and control.

Options for information and communication

In order to minimise the time between onset of symptoms and isolation and diagnosis, people who return from Ebola-affected areas should be informed 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;
- how to contact public health authorities for support if infection is suspected (leaflets, phone numbers, telephone hotline).

In addition, healthcare providers in the EU should be informed of and sensitised to:

- 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 imperative 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 when providing care to EVD cases.

¹ ECDC risk assessment guidelines for diseases transmitted on aircraft. Available at: www.ecdc.europa.eu/en/infectious-diseases-public-health/travellers-health/infectious-diseases-aircraft

Source and date of request

ECDC round table request, 17 December 2018.

Public health issue

This is the second update of a rapid risk assessment originally produced on 9 August 2018 [1]. This rapid risk assessment addresses the public health risk associated with the current EVD outbreak in the DRC and its implications for EU/EEA citizens. This update was triggered by the persistence of the EVD transmission in urban areas, reported challenges in documenting chains of transmission and the recent upsurge of clusters of EVD cases surrounding geographically dispersed rural areas in DRC.

Consulted experts

ECDC experts: Agoritsa Baka, Chiara Bellegarde de Saint Lary, Jordi Borrell Pique, Josep Jansa, Kari Johansen, Otilia Mardh, Thomas Mollet, Benedetto Simone, Iona Smith, Bertrand Sudre and Johanna Young.

External experts from EVD-LabNet: Chantal Reusken (EVD-LabNet, RIVM, EMC, the Netherlands), Stephan Günther (EVD-LabNet, BNI, Germany), Antonino Di Caro (EVD-LabNet, EMERGE JA, INMI, Italy).

Experts from the World Health Organization contributed to this risk assessment. Although experts from WHO reviewed the risk assessment, the views expressed in this document do not necessarily represent the views of WHO.

Disease background information

Infections with Ebola viruses originating from Africa cause a severe disease in humans called Ebola virus disease. There are five virus species in the genus *Ebolavirus* (*Filoviridae* family): *Zaire ebolavirus*, *Sudan ebolavirus*, *Reston ebolavirus*, *Tai Forest ebolavirus* and *Bundibugyo ebolavirus* [2–4]. Ebola viruses are Risk Group 4 pathogens (requiring biosafety level-4 laboratory) in relation to the virulence profile and the continued lack of effective prophylaxis or therapy and require special containment measures and barrier protection, particularly for healthcare workers.

The incubation period is usually four to ten days, but can be as short as two days and as long as 21 days. The symptoms usually consist of a sudden onset of fever, malaise, headache, muscle pain and sore throat. This phase can be accompanied or followed by symptoms and clinical manifestations from several organ systems (gastrointestinal, neurological, vascular, cutaneous and respiratory). Severe exhaustion, haemorrhagic manifestations and multi-organ failure occur in the severe form of EVD. The case-fatality ratio for *Zaire ebolavirus* infections is estimated to be between 44–90% and depends largely on the quality of healthcare that can be provided [5].

Ebola viruses are highly transmissible through direct contact with infected blood, secretions, tissues, organs and other bodily fluids from dead or living infected animals or persons [6]. Transmission through infected semen from a male survivor to his female partner has been reported [7]. Transmission via objects contaminated with infected bodily fluids (fomites) is possible [8]. The principal mode of transmission in outbreaks among humans is person-to-person through direct contact with symptomatic or dead cases. Airborne transmission has not been documented. The risk of transmission is low in the early phase of human disease. Burial ceremonies and the handling of dead bodies have had an important role in disease transmission in previous outbreaks, as have healthcare workers caring for EVD cases without appropriate infection prevention and control (IPC) measures.

More information about EVD is available in the [ECDC fact sheet about Ebola and Marburg fevers](#) [4] and the [WHO fact sheets on Ebola virus disease](#) [3].

Diagnostics and diagnostic capacity in EU/EEA

EVD is diagnosed by detection of Ebola virus ribonucleic acid (RNA) in whole blood, plasma, or serum during the acute phase of illness, using reverse transcription polymerase chain reaction (RT-PCR) [9]. Viral RNA can usually be detected up to a few days after the disappearance of symptoms. Viral RNA may also be detected in other body fluids, such as semen, saliva and urine [10]. Throat swabs are suitable for virus detection in deceased patients. Viral RNA has been detected in seminal fluid and in the breast milk of survivors months to years after acute illness, posing a risk for sexual or mother-to-child transmission. Identification of acute infections based on serology is uncommon.

According to the latest 2016 EULabCap survey, only one EU/EEA Member State does not have the capacity (or a formal agreement with external laboratories) to diagnose Ebola virus [11]. The majority of countries (n=22) surveyed by EULabCap are able to perform molecular detection at BSL-3 level or have formal agreements with a BSL-3 laboratory in another EU/EEA Member State. Seven countries were able to perform further characterisation at BSL-4 level [11].

A survey on the status of Ebola virus diagnostics, bio-risk management and quality assurance in European countries was recently published by the EMERGE JA and EVD-LabNet laboratory networks [12]. A complete overview of Ebola virus diagnostic capacity in the EU/EEA can be found in the EVD-LabNet directory [13].

Treatment and vaccine

Supportive care and treatment of specific symptoms improve survival for EVD cases [14]. There are no authorised drugs available for treatment of EVD, however, limited data exist on a number of substances. Among those, a cocktail of monoclonal antibodies (ZMapp) has the most and highest quality data available following a randomised control trial during the 2014–2016 West Africa outbreak [15]. Four other drugs have been considered for treatment or post-exposure prophylaxis [16,17]. On 11 September 2018, WHO convened an expert consultation to consider the use of investigational therapeutics or investigational vaccine(s) for post-exposure prophylaxis (PEP) for frontline healthcare workers potentially exposed to Ebola virus during the current outbreak involving Eastern Democratic Republic of Congo (DRC) [18]. The consultation reviewed the current knowledge, knowledge gaps and the lessons learned on EVD transmission and post-exposure prophylaxis after the West Africa epidemic [10,19,20].

Several Ebola virus vaccine candidates are being evaluated and one phase 3 clinical trial and vaccination campaign results from the 2014 West Africa Outbreak have shown a high level of protection against the *Zaire ebolavirus* species [21]. Additional information is available on WHO's [research and development of vaccines and therapies](#) webpage and via [WHO FAQs on EVD vaccine](#) [22,23]. No vaccine is currently available for tourists visiting the DRC or any other affected areas [24]. Further information is available under [Treatment and vaccines for Ebola virus disease](#) [25].

Surveillance in EU/EEA Member States

Viral haemorrhagic fevers such as EVD are notifiable diseases in the EU/EEA and have to be reported in a timely manner. In 2014, ECDC published an Ebola case definition for reporting in the EU/EEA [26].

Event background information

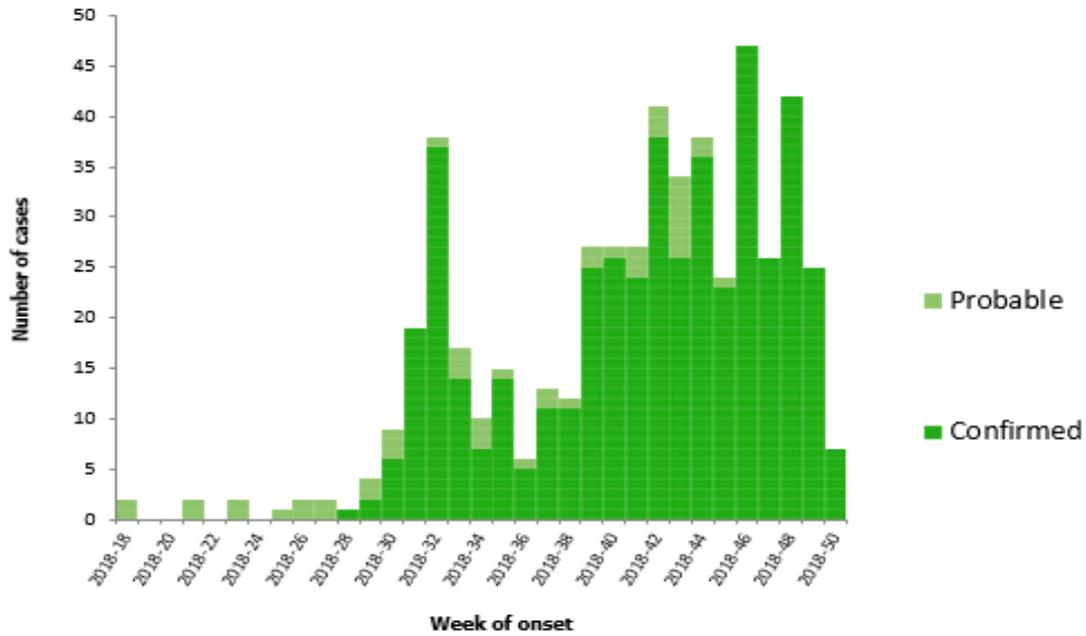
On 1 August 2018, the DRC Ministry of Health reported to WHO an EVD outbreak in the North Kivu province with four laboratory-confirmed cases [27]. This report was triggered by the identification the previous week, on 28 July 2018, of a cluster of 26 cases of acute haemorrhagic fever (with 20 deaths) in Mabalako Health Zone in North Kivu. Further retrospective investigation identified sporadic cases and deaths compatible with EVD since May 2018 [28].

This is the tenth EVD outbreak in the DRC since the discovery of the virus in 1976. The results of the phylogenetic analysis of the causative strain (*Zaire ebolavirus*) revealed that there is no link between the current outbreak and the earlier outbreak in Equateur province [29,30].

Since 11 May 2018 and as of 16 December 2018, the Ministry of Health of the DRC has reported 539 cases of EVD, including 491 confirmed and 48 probable. This epidemic in North Kivu and Ituri Provinces is the largest outbreak recorded in DRC and the second largest worldwide. A total of 315 deaths have occurred during the reporting period (overall case fatality ratio of 58%). Females account for 61% of the confirmed and probable cases, with men accounting for 39%, reflecting an unequal gender distribution. Children below 15 years of age have been reported as one of the most affected groups, accounting for 25% of the total cases [31]. As of 16 December 2018, 52 healthcare workers (50 confirmed and two probable) had been reported among the confirmed cases, 17 of whom had died of EVD. According to MSF and WHO, determining the evolution of the outbreak had been made difficult by the fact that many of the new cases are not linked to any previously known chain of transmission [32,33].

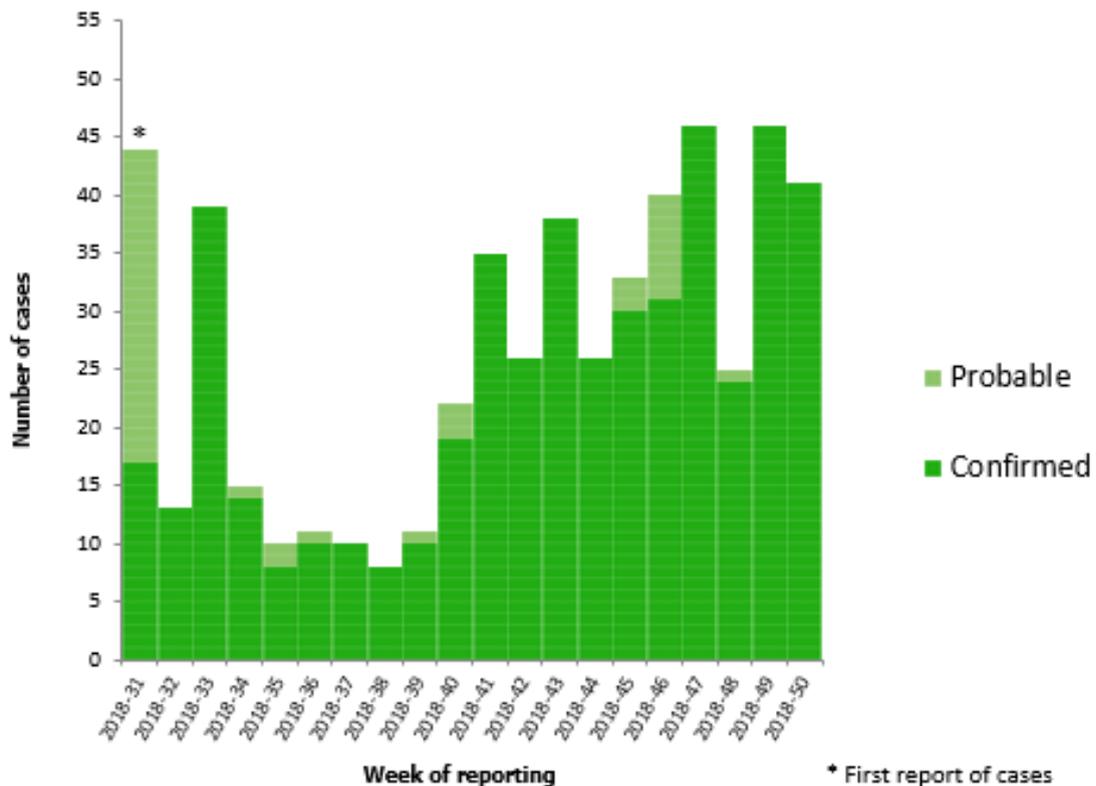
The epidemic curve of confirmed and probable EVD cases is presented by date of symptom onset in Figure 1 and by date of reporting in Figure 2. Figure 2 has cases reported up to 16 December 2018, whereas Figure 1 reports data up to 14 December. It is worth noting that there is often a lag of several weeks in the reporting of cases by date of onset, which is probably why the number of reported cases, as shown in Figure 1, appears to have decreased in recent weeks. Conversely, the epidemic curve by date of reporting, presented in Figure 2, does not seem to suggest a reduction in occurrence of EVD cases in recent weeks.

Figure 1. Distribution of confirmed and probable EVD cases by date of onset of symptoms in North Kivu and Ituri Provinces, DRC, as of 14 December 2018



Note: Due to delays in reporting the number of cases for the last three weeks in the figure are provisional. Source: Adapted from WHO situation report no. 119 [31].

Figure 2. Distribution of confirmed and probable EVD cases by week of reporting in North Kivu and Ituri Provinces, DRC, as of 16 December 2018



Note: As the Ministry of Health of DRC is regularly curating data, these figures are likely to change in the coming days. Source: Adapted from the Ministry of Health of DRC [34].

Twelve health zones in North Kivu Province are reporting EVD cases: Beni, Biena, Butembo, Kalunguta, Katwa, Kyondo, Mabalako, Masereka, Musienene, Mutwanga, Oicha and Vuhovi. In Ituri province, three health zones, Komanda, Mandima and Tchomia, have also reported probable and confirmed cases (see Table 1 and Figure 3). Table 1 below presents the number of EVD cases per health zone in the affected Provinces.

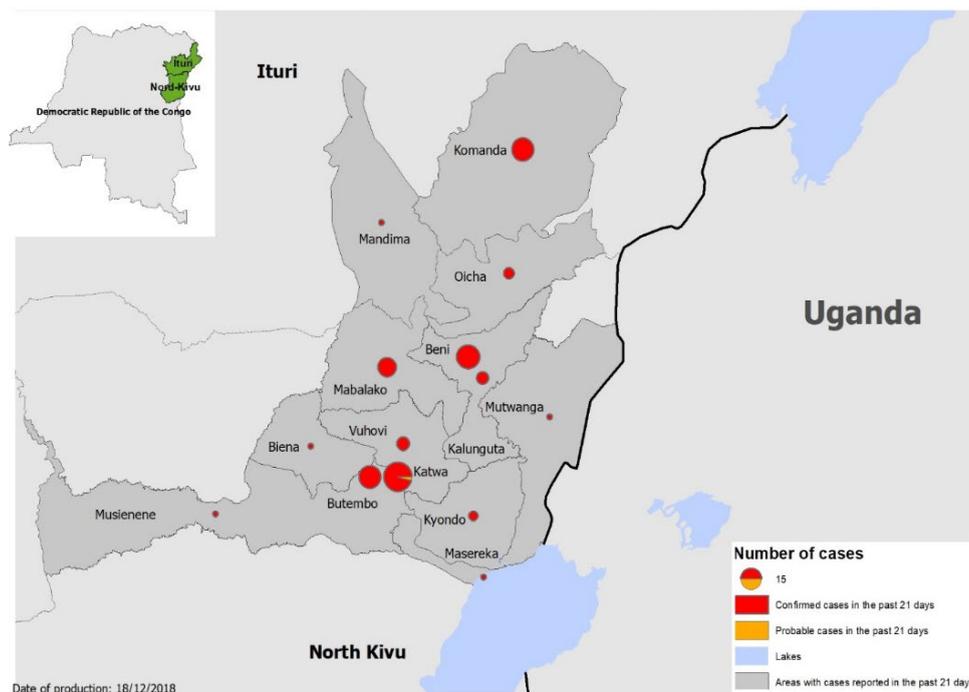
Table 1. Number of EVD cases by health district between 11 May and 16 December 2018

Health district	No. of confirmed cases	No. of probable cases	Confirmed and probable cases		No. of deaths	
			Sum	%	Sum	%
North-Kivu Province	455	45	500	92.8	293	93.0
Beni	207	9	216	40.1	122	38.7
Mabalako	79	16	95	17.6	62	19.7
Katwa	65	4	69	12.8	46	14.6
Butembo	34	0	34	6.3	16	5.1
Kalunguta	34	12	46	8.5	29	9.2
Oicha	8	0	8	1.5	2	0.6
Vuhovi	8	0	8	1.5	3	1.0
Masereka	7	1	8	1.5	3	1.0
Kyondo	6	2	8	1.5	5	1.6
Musienene	3	1	4	0.7	3	1.0
Mutwanga	3	0	3	0.6	2	0.6
Biena	1	0	1	0.2	0	0.0
Ituri Province	36	3	39	7.2	22	7.0
Mandima	17	3	20	3.7	13	4.1
Komanda	17	0	17	3.2	7	2.2
Tchomia	2	0	2	0.4	2	0.6
Total	491	48	539	100	315	100.0

Source: Adapted from the Ministry of Health of DRC [34].

The most affected health zone since the beginning of the outbreak is Beni, with 207 confirmed cases and nine probable cases. However, in the last 21 days, Katwa has reported the greatest number of cases – 27 confirmed and one probable. Within this same time period, Beni has reported 19 new cases, with Butembo and Komanda reporting 17 new cases each. All health zones have reported new confirmed cases within the last 21 days, apart from Tchomia (Figure 3).

Figure 3. Geographical distribution of EVD cases in the last 21 days by health zone, North Kivu and Ituri Provinces, DRC, as of 16 December 2018



Source: Adapted from the Ministry of Health of DRC [34].

The DRC Ministry of Health is implementing a comprehensive response plan in North Kivu and Ituri provinces with the support of WHO and a number of local, national and international partner organisations, NGOs and UN agencies (such as UNICEF, International Organization for Migration (IMO), World Food Programme (WFP), the United Nations Office for the Coordination of Humanitarian Affairs, WHO Global Alert and Response Network (GOARN), the European Civil Protection and Humanitarian Aid Operations (ECHO), the Africa Centres for Disease Control and Prevention, the US Centres for Disease Control and Prevention, Médecins Sans Frontières (MSF), and the Alliance for International Medical Action (ALIMA)). Response activities are based on the pillars of the WHO strategic approach for the prevention and control of EVD outbreaks which aims to establish and strengthen the surveillance, contact tracing and laboratory capacity; implement efficient infection prevention and control measures and case management; promote and insure a wide-ranging community engagement; conduct safe and dignified burials and establish cross-border surveillance and preparedness activities in neighbouring areas [35].

With the support of international partners, Médecins Sans Frontières (MSF) and the Alliance for International Medical Action (ALIMA), Ebola treatment centres (ETC) and transit centres are being established in the affected areas. As of 15 December 2018, Beni has 60 ETC beds (60% occupation rate) and 48 additional beds in a triage centre (83% occupation rate). Additionally, Butembo has 64 beds available (occupation rate of 75%), Mangina has 54 beds available (occupation rate of 19%), Goma has 30 beds available (occupation rate of 20%), and Tchomia has 16 beds available (occupation rate of 0%) [36]. Ministry of Health mobile laboratories are operational in the Provinces of North Kivu, Tshopo and Ituri to facilitate the timely diagnosis of suspected cases [37].

Since May 2018, WHO has convened several ad-hoc R&D Blueprint meetings of scientific experts to evaluate and update the scientific data and information on the investigational therapeutics intended to be used for post-exposure prophylaxis (PEP) and to treat EVD affected patients [18]. As of 11 October 2018, the experts concluded on the need for conducting randomised clinical trials (RCTs) with the most appropriate study design to collect robust scientific evidence on investigational therapeutics used in the treatment of Ebola patients during the current outbreak [38]. The RCTs should assess the safety and efficacy of the monoclonal antibody cocktail ZMapp, the human monoclonal antibody mAb114, a combination of three human monoclonal antibodies REGN3470-3471-3479, and two antiviral molecules Remdesivir and Favipiravir [16,17,37,39]. On 26 November 2018, the Ministry of Health of the DRC announced that a multi drug RCT has begun, coordinated by WHO, led and sponsored by DRC's National Institute for Biomedical Research and in collaboration with international partners [16,40].

Contact tracing activities were initiated on 5 August 2018. Since then, over 27 000 contacts have been registered. As of 9 December 2018, 6 509 contacts remain under surveillance in 12 affected health zones. The rate for the daily follow-up among listed contacts has ranged between 86 and 92% over the reporting period [35].

In the context of the current DRC outbreak in North Kivu the rVSV-ZEBOV Ebola vaccine (Merck, Inc) has been approved for 'compassionate use' [41]. This is an investigational vaccine consisting of an animal Vesicular Stomatitis Virus, which has been genetically engineered to contain a protein from the rVSV-ZEBOV. These vaccination campaigns target healthcare workers, frontline workers, and contacts of the confirmed cases (and their contacts) [42]. Overall between 8 August and 16 December 2018, 48 048 people were vaccinated in Beni (19 017), Katwa (8 619), Mabalako (5 077), Butembo (4 974), Kalunguta (2 208), Mandima (1 663), Komanda (824), Vuhovi (791), Masereka (750), Lubero (700), Oicha (670), Kyondo (607), Mutwanga (599), Bunia (434), Tchomia (355), Musienene (344), Goma (257) Biena (70), Kinshasa (65), Alimbongo (63), Karisimbi (13) and Kisangani (13).

After detecting an outbreak of malaria in Beni, the Ministry of Health and partners ran a malaria prevention campaign which reached 400 000 people with anti-malarial drugs and insecticide-treated mosquito nets for their households. The campaign intended to reduce the malaria transmission and potentially reduce the workload on the Ebola Treatment Centres with regard to the differential diagnostic of suspected EVD cases as many suspected cases turn out to be malaria [35]. In addition, with the support of WHO and partners, the Ministry of Health is concurrently responding to three distinct outbreaks of vaccine-derived poliovirus, as well as cholera, measles and monkeypox outbreaks in the other Provinces.

Activities to promote engagement with the EVD response activities, mostly through news media and social mobilisation in public spaces, are ongoing in several affected communities and neighbouring countries. Despite efforts to sensitise the population, recurrent episodes of community reluctance and resistance have been regularly reported during the past weeks [34,43,44].

Preparedness activities are also ongoing in neighbouring countries. Uganda, which has high cross-border mobility with the DRC, has put in place an EVD preparedness plan, with support from WHO, covering the following areas: coordination, investigation and epidemiological surveillance, laboratory diagnostics and case management, risk communication and cross-border entry screening at all major border points in all very high-risk districts [45]. In Rwanda a preparedness plan has also been established including community surveillance/contact tracing, risk communication, social mobilisation and community engagement, safe and dignified burials and psychosocial support. In addition, infection prevention and control activities have been initiated, such as decontamination/disinfection of public places and households and health facilities [46]. As part of preparedness activities, vaccination campaigns are planned or ongoing in neighbouring countries. In Uganda, vaccination is ongoing and as of 29 November 2018, 1 466

healthcare workers and frontline workers had been vaccinated [47]. In South Sudan vaccination of healthcare workers is scheduled to start in Juba on 19 December 2018 [48].

ECDC threat assessment for the EU

This is the first EVD outbreak of *Zaire ebolavirus* detected in the Provinces of North Kivu and Ituri. Since mid-October, the number of cases per week has reached a plateau, with an average of around 30 new cases still being reported each week, despite remarkable efforts to implement the EVD response measures in such complex settings marked by a long-term humanitarian crisis [49]. There is growing concern that transmission is continuing across geographically dispersed areas, as EVD confirmed cases have been reported from 14 health zones in the past 21 days. Although there has been a general decrease in the intensity of transmission in Beni in recent weeks, the outbreak is intensifying in Butembo and Katwa, and new clusters are emerging in the surrounding health zones (Figure 3).

As a consequence of efforts by the Ministry of Health of DRC and partners overall, the EVD vaccination campaign has successfully managed to vaccinate almost 50 000 individuals in DRC since 8 August 2018. As of 26 November, over 160 patients have been treated with investigational therapeutics and a randomised control trial has been initiated to collect scientific evidence on the safety and efficacy of four drugs in use [50].

Despite significant achievements, the full implementation of response measures remains problematic because of the prolonged humanitarian crisis in North Kivu Province, the unstable security situation arising from a complex armed conflict and the mistrust of the population in relation to the response teams [35]. The main challenges reported are shortcomings in EVD infection prevention and control practices in healthcare facilities; pockets of community reluctance and resistance, and recurrent security incidents hampering access to the population for the rapid response team for early detection and case isolation, exhaustive contact mapping and follow-up and ring vaccination implementation [49].

During the past weeks, the sub-optimal infection prevention and control in healthcare settings, especially unregulated settings, has been illustrated by the large proportion of health worker cases (around 10% of the total of cases). This is considered to have played an important role in amplifying the transmission [33,35]. In addition, non-exhaustive mapping of EVD case contacts has been reported by field actors [32,33]. The substantial number of new cases identified as not being part of the contact tracing and follow-up registers and the difficulties in conducting epidemiological investigations in the current context is hampering the early mapping of active chains of transmission which contribute to EVD transmission in the community.

New cases that have been reported in health zones after an extended period without detection of EVD cases stress the critical need to maintain enhanced EVD surveillance to allow early notification and response to reintroduction of the Ebola virus in previously affected areas. It is expected that new EVD cases will be reported in the coming months and a geographical extension of the outbreak cannot be excluded, given the prolonged humanitarian crisis in the region, the important cross-border population flows with neighbouring provinces and countries, and the observed adverse impact of security incidents on the implementation of response measures. In addition, there is concern that the DRC's upcoming presidential election may give rise to situations that could further hinder the response, and additional health emergencies associated with other outbreak-prone diseases could potentially jeopardise the availability of resources for the prevention and control of the EVD epidemic.

On 28 September 2018, WHO upgraded the assessment of the public health risk to very high at the national and regional levels in relation to the security context and the significant population movements within the region, including between neighbouring countries [51]. However, the global risk was assessed as low. On 17 October 2018, the International Health Regulations (IHR 2005) Emergency Committee advised not to declare this outbreak as a Public Health Emergency of International Concern (PHEIC) but recommended that 'the government of the Democratic Republic of the Congo, WHO, and partners must intensify the current response [...] and should be supported by the entire international community' and that 'failure in intensifying preparedness and response activities would lead to worsening conditions and potential further spread' [52].

Risk to EU/EEA citizens living or travelling in DRC

The probability that EU/EEA citizens living or travelling in EVD-affected areas of the DRC will be exposed to the virus is low, provided they adhere to the recommended precautionary measures outlined above in the section 'Options for response'. To date, no travel- associated EVD cases have been reported among travellers returning to Europe from DRC in 2018.

Staff members of humanitarian, religious and other organisations, and especially healthcare workers who are in direct contact with patients and/or local communities in the affected areas, are more likely to be exposed to the virus. EU/EEA citizens working for humanitarian aid organisations remain at low risk, provided they strictly adhere to the recommended precautionary measures (training on occupational health and safety in EVD-affected areas can be found on the [WHO ePROTECT](#) webpage) [53].

Risk of introduction and spread within the EU/EEA

The most likely route by which the virus could be introduced into the EU/EEA is through infected travellers from affected areas travelling to Europe. Since there are no international airports in the affected areas with direct flights to EU/EEA Member States - meaning a very low volume of travellers from the affected areas travelling to the EU/EEA - and effective exit screening is in place at Goma airport, the risk of EVD-infected individuals arriving in the EU/EEA is very low.

An infected case from one of the EVD-affected areas of the DRC arriving in the EU/EEA (e.g. a returning traveller or medical evacuee) would pose a very low risk of further spread because the majority of the EU/EEA Member States have the capacity to detect and manage imported EVD cases at a very early stage. However, the risk can only be eliminated by stopping transmission at the local level in DRC.

During the substantially larger EVD outbreak in West Africa in 2014 (approximately 28 600 cases and 11 300 deaths), only one local transmission occurred in the EU/EEA (in Spain): a healthcare worker attending to an evacuated EVD affected patient [54].

WHO advises against any restriction of travel and trade to DRC based on the currently available information [35].

Specific risks related to transmission through substances of human origin

A full assessment of the risk of EVD transmission through substances of human origin was published in May 2018 [55,56].

Disclaimer

ECDC issues this risk assessment document based on an internal decision and in accordance with Article 10 of Decision No 1082/13/EC and Article 7.1 of Regulation (EC) No 851/2004 establishing a European centre for disease prevention and control (ECDC). In the framework of ECDC's mandate, the specific purpose of an ECDC risk assessment is to present different options on a certain matter with their respective advantages and disadvantages. The responsibility on the choice of which option to pursue and action to take, including the adoption of mandatory rules or guidelines, lies exclusively with EU/EEA Member States. In its activities, ECDC strives to ensure its independence, high scientific quality, transparency and efficiency. This report was written with the coordination and assistance of an Internal Response Team at the ECDC. All data published in this risk assessment are correct to the best of our knowledge at the time of publication. Maps and figures published do not represent a statement on the part of ECDC or its partners on the legal or border status of the countries and territories shown.

References

1. European Centre for Disease Prevention and Control. Rapid Risk Assessment. Ebola virus disease outbreak in North Kivu and Ituri Provinces, Democratic Republic of the Congo. 2018 [updated 9 August 2018; cited 3 October 2018].
2. Li YH, Chen SP. Evolutionary history of Ebola virus. *Epidemiol Infect.* 2014 Jun;142(6):1138-45.
3. World Health Organization. Ebola virus disease - Fact sheet [Internet]. Geneva: WHO; 2018. Available from: <http://www.who.int/mediacentre/factsheets/fs103/en/>
4. European Centre for Disease Prevention and Control. ECDC fact sheet: Ebola and Marburg fever. Stockholm: ECDC; 2015. Available from: <https://ecdc.europa.eu/en/ebola-and-marburg-fevers/facts/factsheet>
5. Bannister B. Viral haemorrhagic fevers imported into non-endemic countries: risk assessment and management. *Br Med Bull.* 2010;95:193-225.
6. 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.
7. World Health Organization. Interim advice on the sexual transmission of the Ebola virus disease [Internet]. 2016 [cited 18 Dec 2018]. Available from: <https://www.who.int/reproductivehealth/topics/rtis/ebola-virus-semen/en/>
8. Colebunders R, Borchert M. Ebola haemorrhagic fever - a review. *J Infect.* 2000 Jan;40(1):16-20.
9. Reusken C, Niedrig M, Pas S, Anda P, Baize S, Charrel R, et al. Identification of essential outstanding questions for an adequate European laboratory response to Ebolavirus Zaire West Africa 2014. *J Clin Virol.* 2015 Jan;62:124-34.
10. Vetter P, Fischer WA, 2nd, Schibler M, Jacobs M, Bausch DG, Kaiser L. Ebola Virus Shedding and Transmission: Review of Current Evidence. *J Infect Dis.* 2016 Oct 15;214(suppl 3):S177-s84.
11. European Centre for Disease Prevention and Control. EU Laboratory Capability Monitoring System (EULabCap) - Report on 2016 survey of EU/EEA country capabilities and capacities. Stockholm: ECDC, 2018. Available at: <https://www.ecdc.europa.eu/en/publications-data/eu-laboratory-capability-monitoring-system-eulabcap-report-2016-survey-eueea>
12. Reusken CB, Mogling R, Smit PW, Grunow R, Ippolito G, Di Caro A, et al. Status, quality and specific needs of Ebola virus diagnostic capacity and capability in laboratories of the two European preparedness laboratory networks EMERGE and EVD-LabNet. *Euro Surveill.* 2018 May;23(19).
13. EVD-LabNet. EVD-LabNet directory search [cited 3 October 2018]. Available from: <https://www.evd-labnet.eu/evd-labnet-directory-search?genus=417-ebola-virus-generic>
14. World Health Organization. Clinical management of patients with viral haemorrhagic fever: a pocket guide for the front-line health worker. 30 March 2014 [Internet]. Geneva: WHO; 2014. Available from: <http://apps.who.int/iris/handle/10665/130883>
15. PREVAIL II Writing Group. A randomized, controlled trial of ZMapp for Ebola virus infection. *N Engl J Med.* 2016;375(15):1448-56.
16. World Health Organization. Notes for the record: Consultation on Monitored Emergency Use of Unregistered and Investigational Interventions (MEURI) for Ebola Virus Disease (EVD). 2018.
17. World Health Organization. Notes for the record: Technical Elements to Consider for the use of Investigational Therapeutics and Investigational Vaccine for Post-Exposure Prophylaxis for Frontline Healthcare Workers Potentially Exposed to Ebola virus in the Current Outbreak Involving the Eastern Democratic Republic of Congo. 2018.
18. World Health Organization. WHO R&D Blueprint – Ad-hoc Expert Consultation on clinical trials for Ebola Therapeutics [Internet]. 2018 [cited 18 Dec 2018]. Available from: <https://www.who.int/ebola/drc-2018/treatments-approved-for-compassionate-use-update/en/>
19. Brainard J, Hooper L, Pond K, Edmunds K, Hunter PR. Risk factors for transmission of Ebola or Marburg virus disease: a systematic review and meta-analysis. *Int J Epidemiol.* 2015;45(1):102-16.
20. Fischer WA, 2nd, Vetter P, Bausch DG, Burgess T, Davey RT, Jr., Fowler R, et al. Ebola virus disease: an update on post-exposure prophylaxis. *Lancet Infect Dis.* 2018 Jun;18(6):e183-e92.
21. Henao-Restrepo AM, Camacho A, Longini IM, Watson CH, Edmunds WJ, Egger M, et al. Efficacy and effectiveness of an rVSV-vectored vaccine in preventing Ebola virus disease: final results from the Guinea ring vaccination, open-label, cluster-randomised trial (Ebola Ça Suffit!). *The Lancet.* 2017;389(10068):505-18.
22. World Health Organization. Ebola virus disease. Frequently asked questions on Ebola virus disease. Updated 30 October 2018. [Internet]. 2018. Available from: <http://www.who.int/ebola/drc-2018/faq-vaccine/en/>
23. World Health Organization. Emergencies preparedness, response. Research and Development: diagnostics, vaccines and therapies [Internet]. 2018. Available from: <https://www.who.int/csr/resources/publications/ebola/vaccines/en/>

24. World Health Organization. Ebola virus disease. Frequently asked questions on Ebola virus disease vaccine. Updated 18 May 2018. [Internet]. 2018. Available from: <http://www.who.int/ebola/drc-2018/faq-vaccine/en/>
25. European Centre for Disease Prevention and Control. Treatment and vaccines for Ebola virus disease [cited 2018 October 3rd]. Available from: <https://ecdc.europa.eu/en/ebola-and-marburg-fevers/prevention-and-control/treatment-vaccines>
26. European Centre for Disease Prevention and Control. Ebola virus disease case definition for reporting in EU [Internet]. Stockholm: ECDC; 2014. Available from: http://ecdc.europa.eu/en/healthtopics/ebola_marburg_fevers/EVDcasedefinition/Pages/default.aspx
27. Ministère de la Santé de la République Démocratique du Congo. Communiqué de presse - 1 août 2018. [cited 3 Oct 2018]. Available from: https://mailchi.mp/49b37201b847/declaration_ebola_kivu?e=5efd916f1f
28. World Health Organization. Weekly bulletin on outbreaks and other emergencies. Week 31: 28July - 3 August 2018 [cited 3 Oct 2018]. Available from: <http://apps.who.int/iris/bitstream/handle/10665/273631/OEW31-2873082018.pdf>
29. World Health Organization. Disease outbreak news - Ebola virus disease - Democratic Republic of the Congo [cited 6 Aug 2018]. Available from: <http://www.who.int/csr/don/4-august-2018-ebola-drc/en/>
30. Virological. DRC-2018-Viral Genome Characterization [Internet]. 2018 [cited 18 Dec 2018]. Available from: <http://virological.org/t/drc-2018-viral-genome-characterization/230>
31. World Health Organization. Epidémie de la maladie à virus Ebola. Rapport de Situation No. 119. 2018.
32. Médecins Sans Frontières. DRC 2018 Ebola outbreaks. Crisis update - November 2018 [Internet]. MSF; 2018 [cited 2018 Dec 18]. Available from: <https://www.msf.org/drc-2018-ebola-outbreak-crisis-update>
33. Maxmen A. Ebola detectives race to identify hidden sources of infection as outbreak spreads. Nature. 2018;564(7735):174.
34. Ministère de la Santé de la République Démocratique du Congo. EBOLA RDC - Evolution de la riposte contre l'épidémie d'Ebola dans les province du Nord-Kivu et de l'Ituri. 2018 [cited 2018 December 18]. Available from: <https://us13.campaign-archive.com/home/?u=89e5755d2cca4840b1af93176&id=aedd23c530>
35. World Health Organization. Ebola virus disease - DRC - External Situation Report 19 [Internet]. 2018 [cited 2018 Dec 17]. Available from: http://apps.who.int/iris/bitstream/handle/10665/276811/SITREP_EVD_DRC_20181212-eng.pdf?ua=1
36. World Health Organization. Epidémie de la maladie à virus Ebola. Rapport de Situation No. 120. 2018.
37. Ministère de la Santé de la République Démocratique du Congo. Situation épidémiologique. Samedi 4 août 2018. 2018 [cited 18 Dec 2018]. Available from: <https://us13.campaign-archive.com/?u=89e5755d2cca4840b1af93176&id=414faf7935>
38. World Health Organization. WHO R&D Blueprint – Ad-hoc Expert Consultation on clinical trials for Ebola Therapeutics, 11 October 2018 - Geneva, Switzerland. 2018.
39. World Health Organization. Notes for the record: Consultation on Monitored Emergency Use of Unregistered and Investigational Interventions for Ebola Virus Disease (EVD). 2018.
40. World Health Organization. Democratic Republic of the Congo begins first-ever multi-drug Ebola trial [Internet]. 2018 [cited 18 Dec 2018]. Available from: <https://www.who.int/news-room/detail/26-11-2018-democratic-republic-of-the-congo-begins-first-ever-multi-drug-ebola-trial>
41. World Health Organization. WHO supports Ebola vaccination of high risk populations in the Democratic Republic of the Congo Geneva: WHO; 2018 [cited 21 May 2018]. Available from: <http://www.who.int/news-room/detail/21-05-2018-who-supports-ebola-vaccination-of-high-risk-populations-in-the-democratic-republic-of-the-congo>
42. Ministère de la Santé de la République Démocratique du Congo. Situation épidémiologique dans la province du Nord-Kivu et de l'Ituri. Lundi 17 décembre 2018. 2018 [cited 18 Dec 2018]. Available from: <https://us13.campaign-archive.com/?u=89e5755d2cca4840b1af93176&id=089b5462c7>
43. World Health Organization. Ebola virus disease - DRC - External Situation Report 17 [Internet]. 2018 [cited 2018 Oct 3]. Available from: http://apps.who.int/iris/bitstream/handle/10665/273348/SITREP_EVD_DRC_20180725-eng.pdf?ua=1
44. World Health Organization. Ebola virus disease - DRC - External Situation Report 18 [Internet]. 2018 [cited 18 Dec 2018]. Available from: http://apps.who.int/iris/bitstream/handle/10665/276464/SITREP_EVD_DRC_20181205-eng.pdf?sequence=5&isAllowed=y
45. World Health Organization. Uganda and DRC bordering districts agree to intensify cross-border surveillance to tackle Ebola [Internet]. 2018 [cited 18 Dec 2018]. Available from: <https://afro.who.int/news/uganda-and-drc-bordering-districts-agree-intensify-cross-border-surveillance-tackle-ebola>
46. International Federation of Red Cross and Red Crescent Societies. Emergency Plan of Action Operation Update Rwanda: Ebola Preparedness [Internet]. 2018 [cited 18 Dec 2018]. Available from: <https://reliefweb.int/sites/reliefweb.int/files/resources/MDRRW017ou1.pdf>

47. Ministry of Health - Republic of Uganda. Highlights of the Ebola virus disease preparedness in Uganda. 29th November 2018 (12:00 HRS) – UPDATE No 63. 2018 [cited 18 Dec 2018]. Available from: <https://afro.who.int/sites/default/files/2018-12/EVD%20Update%20No%2063.pdf>
48. World Health Organization. South Sudan set to vaccinate targeted healthcare and frontline workers operating in high risk states against Ebola 2018 [cited 18 Dec 2018]. Available from: <https://afro.who.int/news/south-sudan-set-vaccinate-targeted-healthcare-and-frontline-workers-operating-high-risk-states>
49. World Health Organization. Ebola virus disease – Democratic Republic of the Congo. Disease outbreak news: Update 13 December 2018. 2018 [cited 18 Dec 2018]. Available from: <https://www.who.int/csr/don/13-December-2018-ebola-drc/en/>
50. World Health Organization. News Release. Democratic Republic of the Congo begins first-ever multi-drug Ebola trial 2018 [cited 19 Dec 2018]. Available from: <https://www.who.int/news-room/detail/26-11-2018-democratic-republic-of-the-congo-begins-first-ever-multi-drug-ebola-trial>
51. World Health Organization. Ebola virus disease – Democratic Republic of the Congo. Disease outbreak news 27 September 2018 [cited 3 Oct 2018]. Available from: <http://www.who.int/csr/don/27-september-2018-ebola-drc/en/>
52. World Health Organization. Statement on the October 2018 meeting of the IHR Emergency Committee on the Ebola virus disease outbreak in the Democratic Republic of the Congo. 17 October 2018 [cited 19 Dec 2018]. Available from: <https://www.who.int/news-room/detail/17-10-2018-statement-on-the-meeting-of-the-ih-ermergency-committee-on-the-ebola-outbreak-in-drc>
53. World Health Organization. ePROTECT 2018 (EN) 2018 [cited 20 Dec 2018]. Available from: <https://openwho.org/courses/e-protect>
54. World Health Organization. Situation summary - Latest available situation summary, 11 May 2016 [Internet]. 2016 [cited 8 May 2018]. Available from: <http://apps.who.int/gho/data/view.ebola-sitrep.ebola-summary-latest?lang=en>
55. European Centre for Disease Prevention and Control. Rapid Risk Assessment. Ebola virus disease outbreak in Equateur Province, Democratic Republic of the Congo. 2018 [cited 20 Dec 2018]. Available from: <https://ecdc.europa.eu/sites/portal/files/documents/17-05-2018-RRA-first-update-Ebola%20haemorrhagic%20fever-Democratic%20Republic%20of%20the%20Congo.pdf>
56. European Centre for Disease Prevention and Control. Technical document. Risk of transmission of Ebola virus via donated blood and other substances of human origin in the EU. 2014 [cited 20 Dec 2018]. Available from: <https://ecdc.europa.eu/sites/portal/files/media/en/publications/Publications/ebola-risk-transmission-via-donated-blood-substances-human-origin-october-2014.pdf>