RAPID RISK ASSESSMENT

Floods in Bosnia and Herzegovina, Croatia, and Serbia: communicable disease risks

18 June 2014

Conclusions

The recent floods in Bosnia and Herzegovina, Croatia, and Serbia caused substantial damage to the affected areas. During the acute phase (up to one month after the floods), no clusters or outbreaks of communicable diseases were reported to WHO. Recovery phase activities are ongoing (e.g. debris cleaning, disinfection, rodent control), in conjunction with post-disaster needs assessments in the affected areas.

The floods occurred more than a month ago, and the water levels are now returning to normal. Clean water and electricity are being restored in the affected areas. Therefore, there is only a limited risk of waterborne infections and zoonosis outbreaks in connection with the floods in the coming weeks.

Outbreaks of vaccine-preventable diseases are unlikely thanks to high vaccination coverage, but in order to further minimise the risk, efforts should be made to resume disrupted routine immunisation programmes as soon as possible.

Following the floods, there is a risk of increased transmission of vector-borne infections to the populations, mainly of West Nile virus infection, and possibly dengue and chikungunya fever, if the virus is introduced through a viraemic visitor.

Options for prevention and response

In order to minimise infection risks, enhanced surveillance for communicable disease outbreaks should be maintained; laboratory capacity should be adequate to confirm outbreaks of infectious diseases.

Prevention and control of West Nile virus (WNV) infection should be part of an integrated preparedness plan, which should include: general coordination, entomological surveillance, bird surveillance, environmental management and mosquito source reduction, larval control, adult mosquito control, and risk communication.

The following actions should be considered, in line with the ECDC's West Nile virus risk assessment tool:

- Activation of the plan should be based on surveillance data, preferably with four basic indicators: WNV infection in mosquitoes, birds, horses, and humans.
- Larval control (based on e.g. larviciding and source reduction) applied in the pre-outbreak phase, i.e. before human cases occur, in all areas affected by the flooding that are conducive to WNV transmission.
- Adult mosquito control should be considered if human cases are detected or if the surveillance system indicates significant virus activity. Adult mosquito control can reduce the number of infective female mosquitoes which

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are responsible for transmitting the disease between humans; it also reduces mean longevity and the total reproduction capacity of local vector populations.
- Promotion of personal protective measures.
- Timely reporting and coordination of surveillance activities.

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WHO, through the WHO Pesticide Evaluation Scheme (WHOPES), provides guidelines on the use of biocides for public health purposes. Updated information is available from: http://www.who.int/whopes/en/. Guidelines on the use of pesticides and their application are provided in a WHO publication (Ref. WHO/CDS/NTD/WHOPES/GCDPP/2006.1.).

In addition, blood safety measures to reduce the risk of WNV infection through blood transfusion and organ transplantation should be considered:

- Deferral of potentially exposed or infected persons from blood donations; discarding of infectious donations.
- Implementation of laboratory screening methods, such as nucleic acid amplification testing (NAAT).
- Use of pathogen inactivation procedures.
- Asking donors to report any symptoms after donation (enhancement of post-donation information).
- Application of post–transfusion haemovigilance.

Screening and deferral measures are also recommended for organ donors in affected areas. Patients with transplants and other immunocompromised patients living in affected or endemic areas should be advised on the risk of infection with WNV and counselled on the use of protective measures, including avoiding outdoor activity at dawn and dusk when mosquitoes are most active.

In areas affected by the floods and where *Aedes albopictus* is reported, clinicians should be sensitised to the possibility of autochthonous transmission of dengue or chikungunya fever in case of introduction of the viruses by viraemic visitors from endemic areas.

During the transmission season, ECDC provides weekly updates on reported cases of West Nile fever in humans in EU Member States and neighbouring countries; this includes the areas affected by the flooding. The objective is to support the implementation of blood safety legislation in Member States: blood safety authorities in countries which report ongoing WNV transmission should be kept informed.

Source and date of request

Request from the Directorate-General for Health and Consumers, dated 16 June 2014.

Public health issue

The recent floods in Bosnia and Herzegovina, Croatia, and Serbia have the potential to increase the risk of communicable disease occurrence and spread. The aim of this document is to assess the health risk for the local population and for the EU after the acute phase of the flooding in May 2014. Following a request from the European Commission, this assessment will also provide a view on mosquito vector surveillance and control strategies in the affected areas.

Consulted experts

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The World Health Organization (WHO) was consulted on this document. ECDC also consulted:
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Event background information

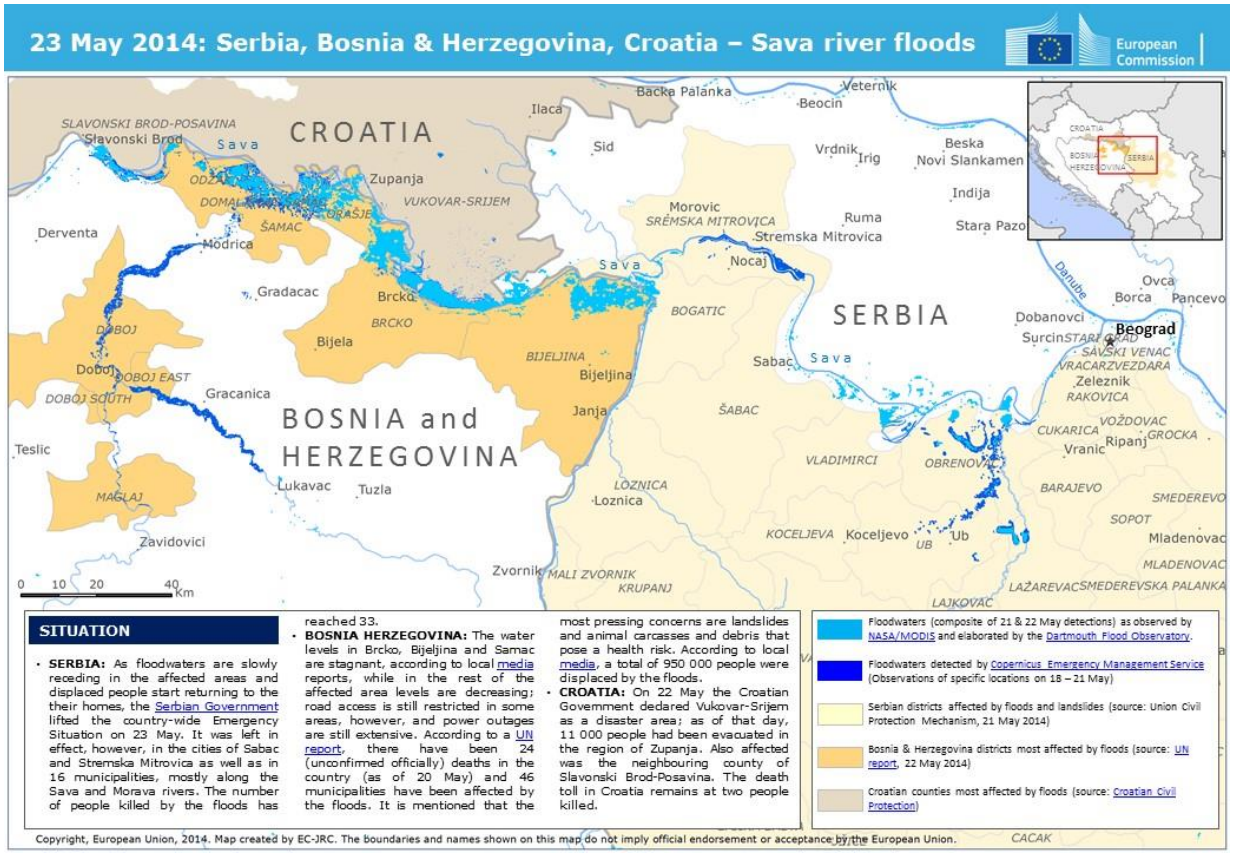
Continuous and heavy rainfall from 14 to 16 May 2014 resulted in extensive flooding in Bosnia and Herzegovina, Croatia, and Serbia, mainly around the Sava river catchment area (Figure 1) [1-4]. It was considered the worst flood since the beginning of record keeping in the region. On 25 May, the World Health Organization's Regional Office for Europe (WHO/EURO) reported that two million people were affected by the flooding, more than 60 000 were displaced, and 60 people died in the three countries [4]. In the affected areas, 61 healthcare facilities were

damaged. Prevention and control measures against infectious diseases were focused on water- and vector-borne diseases, together with psychological support.

The flood water slowly receded and has currently returned to normal water levels in most places [5]. As of 13 June 2014, the number of displaced persons decreased from nearly 60 000 to 22 500 persons in the three countries [6]. Current efforts are focused on the re-establishment of general services (water, centralised wastewater collection/treatment services, transportation and electricity), general cleaning (debris removal, disposal of waste), disinfection and rodent control [6].

According to WHO/EURO, as of 13 June 2014, no outbreaks of communicable diseases have been reported in the affected areas. WHO/EURO also reported that the early response phase had ended, which focused on enhanced epidemiological surveillance, the strengthening of early warning systems for communicable diseases, and the prevention of water- and vector-borne infections. A post-disaster needs assessment is underway for Bosnia and Herzegovina and Serbia. Vector control measures are ongoing in the three countries (aerial spraying of some flood-affected municipalities).

Figure 1. Map of the areas affected by flooding in May 2014



ECDC threat assessment for the local population

Floods have been associated with an increased risk of communicable disease occurrence and spread through displacement of people, changes in the environment, and vulnerability to existing pathogens [7,8].

The main risks for communicable diseases following floods are related to:

- exposure to contaminated drinking water supplies and direct contact to pathogens in flooded area and in remaining sediments, muds and waste;
- expanded breeding sites for mosquitoes and other infectious disease vectors due to standing waters; and
- displacement of affected populations, overcrowding, and disruption in health services [9].

Outbreaks previously associated with floods include enteric infections (mainly waterborne infections), vector-borne infections, zoonosis, and vaccine-preventable diseases [10].

Waterborne infections and zoonoses

Floods can lead to a higher risk of outbreaks of waterborne diseases and zoonoses (particularly leptospirosis), hepatitis A, cryptosporidiosis, giardiasis, shigellosis and diarrheal disease.

Leptospirosis transmission occurs when skin (especially if abraded) or mucous membranes come in contact with water, damp soil or mud that has been contaminated with urine or tissue from infected animals, most commonly rats. Occasionally, transmission occurs through drinking or inhalation of tiny droplets (aerosols) of contaminated water. The disease incubation period is usually 5 to 14 days, ranging from two to 30 days [11]. So far, no leptospirosis cases associated with the floods have been reported [6].

All three countries been endemic (at low to intermediate levels) for hepatitis A virus (HAV) and are therefore prone to HAV outbreaks [12]. HAV may be transmitted through consumption of faecal contaminated water. During floods, HAV outbreaks are usually associated with sewage-contaminated or inadequately treated and disinfected sanitised drinking water. The disease incubation period is usually 28 to 30 days, ranging from two to 15 to 50 days [11]. So far, there have been no reports of hepatitis A clusters or outbreaks associated with the floods [6].

Cryptosporidiosis, giardiasis, shigellosis and other diarrheal disease are transmitted through the faecal-oral route, particularly through contaminated water. Water can be contaminated through sewage overflows (i.e. from centralised sewerage systems and on-site sanitation systems), storm water runoff or agricultural runoff (including spillage of manure). Wells may be more exposed to contamination from surface water during flooding. Distribution and consumption of contaminated water can lead to enteric diseases and large-scale outbreaks depending on the water supply subjected to contamination. Exposure to enteric pathogens generally occurs during the acute phase of the flooding. Most of diseases have incubation periods of 10 days [11]. So far, there have been no reports of bacterial or parasitic disease clusters or outbreak associated with the floods [6].

Due to the possible contamination of water used for agricultural purposes, there may be a limited increase in the risk of contamination of fresh or frozen fruits and vegetables, involving hepatitis A and other foodborne infections associated with the consumption of non-heat-treated foods grown in the affected areas.

Vector-borne infections

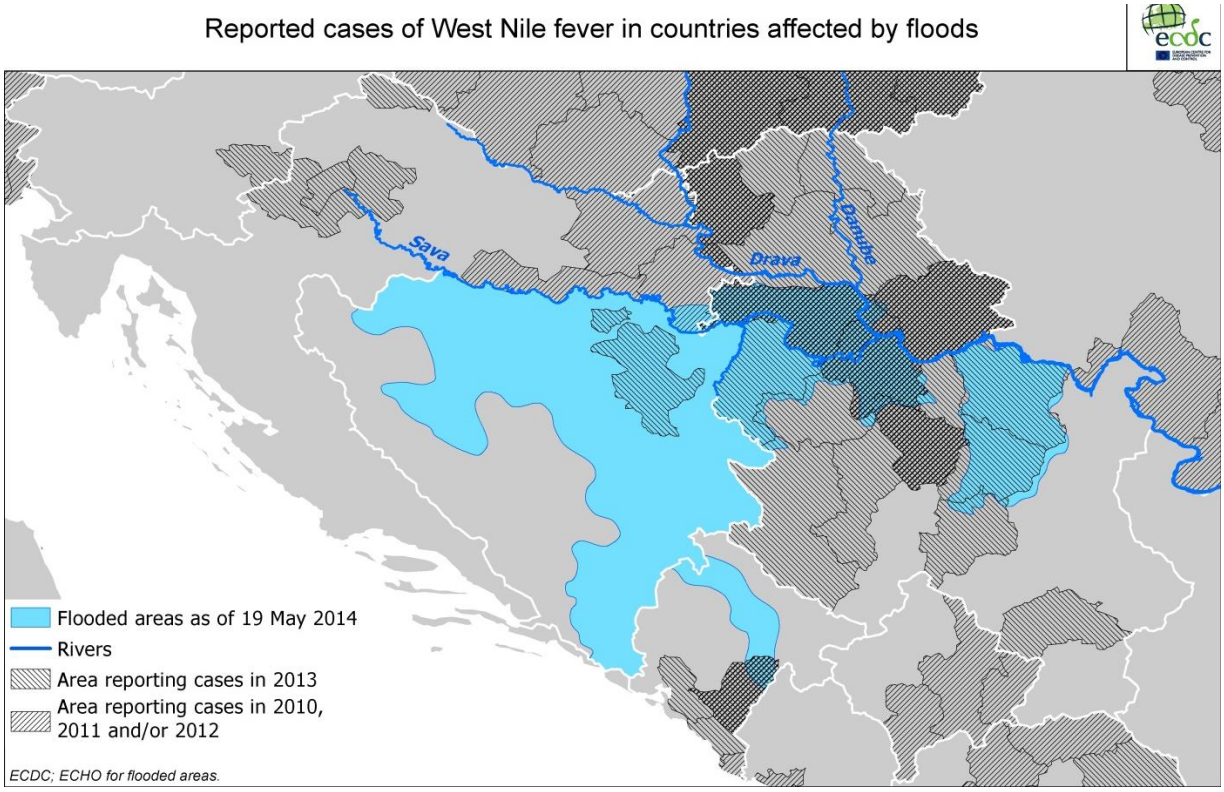
Floods can lead to an increased risk for vector-borne disease transmission through the expansion in the number and range of vector habitats.

- During the initial stage of the flooding, the population density of flood-water mosquitoes such as *Aedes caspius*, *Aedes vexans* and *Aedes sticticus*, will increase, leading to an increased risk of being bitten. These mosquito species are generally responsible for biting nuisance but do not act as vectors of disease in Europe.
- As the water is receding, conditions for mosquitoes such as *Culex* spp improve dramatically. It is anticipated that the number of potential breeding sites for *Culex* mosquitoes will remain high, leading to high populations densities of e.g. *Culex pipiens*, a known vector of e.g. West Nile virus (WNV). West Nile fever is therefore the mosquito-borne disease of the most concern in the affected areas.
- *Aedes albopictus* is present in the north of Bosnia and Herzegovina and population densities might increase as a result of the flooding, increasing the risk for biting nuisance. An increased density of this invasive mosquito species can raise the potential for disease transmission upon introduction of arboviruses (e.g. dengue or chikungunya virus via travellers).

West Nile fever is a disease caused by a *flavivirus*, transmitted by a large range of mosquito species. Outcomes of infection range from asymptomatic (80% of the cases) to severe neuroinvasive disease (1 in every 150 patients), manifested as encephalitis, paralysis, potentially leading to death [13]. The virus has a wide geographical distribution and is found in regions of Africa, Asia, Australia, the Americas and Europe. Two basic types of cycles and ecosystems are identified in Europe: the rural cycle maintained by wild, usually wetland birds and ornithophilic mosquitoes, and the urban cycle involving domestic birds and mosquitoes feeding on both birds and humans, mainly from the complex *Culex pipiens* [14]. The virus can be reintroduced to Europe every year by migratory birds during spring migrations but it is also able to overwinter in Europe, both in birds or mosquitoes.

Since the 1950s, the circulation of West Nile virus has been documented in Europe, with sporadic cases or outbreaks in humans and equids. Currently, WNV appears to be expanding its geographical range in Europe, with more countries reporting cases and more areas in these countries being affected [15].

Figure 2. West Nile fever in areas affected by floods; Bosnia and Herzegovina, Croatia, Serbia, and neighbouring countries, 2010–2013



In the Balkan region, including Bosnia and Herzegovina, Croatia and Serbia, WNV circulation has previously been detected [15]: human cases of West Nile fever have been reported in the past in the three countries affected by floods [16]. In Serbia, positive seroprevalence for WNV infection was detected in humans during the 1970s and again between 2005 and 2010 [17]. In the past two years, the circulation of the virus was confirmed through the detection of autochthonous human cases in Bosnia and Herzegovina (three cases in 2013), Croatia (six cases in 2012 and 20 in 2013) and Serbia (69 cases in 2012 and 302 cases in 2013) [15]. Serbia was particularly affected in 2013 when most of the districts reported cases, including the capital Beograd (171 cases). In 2014, Bosnia and Herzegovina reported its first two probable cases in Republika Srpska.

Environmental factors, including human activities that increase population density and longevity of competent mosquitoes (e.g. heavy rains, floods associated with high temperatures) are known to be associated with large outbreaks of the disease in Europe. In 1996, a major outbreak occurred in Romania where 393 confirmed and probable cases were detected, of whom 352 had neuroinvasive infection. Forty Romanian districts were affected, including Bucharest [18]. During the epidemic, which predominantly affected urban areas (286 cases in Bucharest), many basements in apartment buildings were flooded with sewage leaking due to poorly maintained plumbing [19]. In Greece, a 2010 outbreak in Central Macedonia resulted in 262 cases of West Nile fever, including 197 laboratory-confirmed neuroinvasive infections; the outbreak was preceded by an unusually rainy spring [20] [21].

West Nile virus infection can also be transmitted through transfusion and transplantation.

Other emerging and vector-borne diseases

The countries of the Balkan Peninsula have experienced outbreaks of the emerging and re-emerging diseases over the last 20 years [22]. Outbreaks included tularaemia, Q-fever, anthrax, rabies, viral haemorrhagic fevers, Lyme disease, and tick-borne encephalitis. The flooding will most likely not have any direct implications on these diseases but these diseases are strongly influenced by environmental drivers, and some long-term changes can already be anticipated.

Vaccine-preventable diseases (VPDs)

Data from the WHO/EURO Centralized Information System for Infectious Diseases (CISID) show that vaccination coverage for three doses of diphtheria, tetanus and pertussis (DTP) vaccine is high in the three countries, especially in Croatia and Serbia, which are both above 95% [23].

Regarding other VPDs, vaccine coverage is over 90% for three doses of measles-containing vaccine and for tuberculosis (BCG) in all three countries. Coverage of polio vaccination is over 90% in Croatia and Serbia, and slightly below 90% for Bosnia and Herzegovina.

The risk for VPD outbreaks is considered low due to the high vaccination coverage for the last birth cohorts. It has to be noted, however, that there are some cohorts with medium/low vaccination coverage, predominately those who could not get vaccinated because of the conflict in the Balkans in the early 1990s.

According to WHO, the number of people in shelters has decreased in the past weeks [6], which also might reduce the risk of outbreaks in overcrowded settings.

According to a systematic WHO review on vaccination in humanitarian emergencies, there are strong indicators that emergency situations call for the immediate vaccination against polio and measles [24]. As tetanus cases have previously been associated with floods [25], clinicians and health authorities should be sensitised about the use of tetanus vaccine and/or tetanus immune globulin in case of open wounds because of low or waning immunity; also, women, particularly above the age of 65, tend to have lower vaccination rates than men, who often served in the military where they received a series of vaccinations [26]. Vaccines for epidemic-prone diseases (e.g. hepatitis A and meningococcal meningitis) are recommended only in case of an outbreak. No other vaccines are recommended during emergencies; instead, routine immunisation programmes should resume when conditions stabilise. Taking into account the high vaccine coverage in Bosnia and Herzegovina, Croatia and Serbia, no post-flood vaccination activities will be required [27].

ECDC threat assessment for the EU

With regard to the infectious diseases assessed in this document, there is currently no increased risk of spread from the affected areas to the EU (or even within the EU).

Conclusions

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- Asking donors to report any symptoms after donation (enhancement of post-donation information).
- Application of post–transfusion haemovigilance [30,31].

Screening and deferral measures are also recommended for organ donors in affected areas [32]. Patients with transplants and other immunocompromised patients living in affected or endemic areas should be advised on the risk of infection with WNV and counselled on the use of protective measures, including avoiding outdoor activity at dawn and dusk when mosquitoes are most active.

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