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EMERGING INFECTIOUS DISEASES NOT COVERED BY ROUTINE VACCINATION IN EUROPE IN 2010-2015 - THE REVIEW OF WHO AND ECDC NOTIFICATIONS FOR THE NATIONAL IHR FOCAL POINT IN POLAND

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ABSTRACT

The National IHR Focal Point is a center set up by each Member State of the World Health Organization (WHO) in accordance with the International Health Regulations (2005). The International Health Regulations (IHR) were adopted on 23 May 2005 at the World Health Assembly and entered into force since 15 June 2007 as the legal instrument designed to help protect all countries from uncontrolled international spread of diseases and other urgent public health threats. According to Article 2 of IHR the purpose and scope of these Regulations are to prevent, protect against, control and provide a public health response to the international spread of disease in ways that are commensurate with and restricted to public health risks, and which avoid unnecessary interference with international traffic and trade. Primarily, the scope of IHR is to establish a system of early warning (in accordance with Article 6 and 7) with the functioning in each country National IHR Focal Point which is available at any time to communicate with WHO IHR Contact Points and other entities. The tasks of the National IHR Focal Point in Poland which was appointed by the Minister of Health and runs in the Department of Epidemiology, National Institute of Public Health - National Institute of Hygiene from 1 September 2007 are the notification of events that may constitute a public health emergency of international concern occurring in Poland or abroad and the dissemination of this information to the WHO, other National IHR Focal Points or competent authorities responsible for public health. The task of the National IHR Focal Point in Poland is also the dissemination of WHO and ECDC notifications, including recommendation and risk assessment documents. The aim of this work is the review of WHO and ECDC notifications received by National IHR Focal Point in Poland in the period from 2010 to 2015 which were related to emerging infectious diseases not covered by routine vaccination programs or for which there are no effective vaccines that have occurred in the WHO European Region. The review includes verotoxin-producing *Escherichia coli* O104: H4 infections, MERS-CoV infections, Ebola virus disease, malaria, dengue fever, West Nile fever, chikungunya and cholera.

Key words: *emerging infectious diseases, the National IHR Focal Point*

INTRODUCTION

The term *emerging infectious diseases* means infectious and parasitic diseases where the incidence has increased over the last twenty years and could increase in the near future in the area (1). Emerging infectious diseases also includes diseases caused by emerging or newly discovered pathogens or pathogens with a new spectrum of drug resistance as a result of the evolution of an already existing and well-known pathogen or spread of a completely new, unknown pathogen. Of the currently known human pathogens 12% are etiologic agents of emerging diseases. In the last 35 years there have been identified almost 90 new pathogens (2). Among more than 1,400 pathogens identified, 177 are factors of emerging diseases. It is estimated that 70% of human diseases that have occurred over the past 30 years are zoonotic (3). Particularly dangerous is the emergence

of an entirely new infection in humans, for example as a result of transmission of infection from animals to human population as for example HIV infection or SARS coronavirus infection leading to the occurrence of Severe Acute Respiratory Syndrome. Re-emergence of diseases previously identified in the area that emerged there after reducing their incidence or after complete eradication in the area is considered to be particularly important for public health (1).

The occurrence and spread of emerging diseases is influenced by many factors. These factors include: adaptation processes of microorganisms directly dependent on changes in their genetic material, demographic processes, urbanization, industrialization, human and animal transport development, the transfer of disease vectors and even intentional human actions, like for example the use of pathogens for bioterrorism. Additional causes are socio-economic factors that may have an impact on public health measures which may result in changes in the range of occurrence of vectors and pathogens (1, 3).

MATERIALS AND METHODS

The work presents the selection of highly infectious diseases considered to be emerging in accordance with the above definition and which occurred in the period from 2010 to 2015 in the WHO European Region. This review was prepared on the basis of WHO and ECDC notifications related to emerging diseases, which were submitted to the National IHR Focal Point in the period from 2010 to 2015. The review includes diseases not covered by routine vaccination programs or for which there are no effective vaccines. The diseases list is presented chronologically according to the date of the first notification received by the National IHR Focal Point in the period from January 2010 to November 2015.

RESULTS

The review includes verotoxin-producing *Escherichia coli* O104: H4 infections, MERS-CoV infections, Ebola virus disease, malaria, dengue fever, West Nile fever, chikungunya and cholera.

DENGUE FEVER

The first information about indigenous dengue fever in Europe reached the National IHR Focal Point in 2010. Dengue fever is caused by a virus which belongs to the Flaviviridae family. It is transmitted by mosquitoes of the genus *Aedes haemagogus*. There are 4 serotypes of the virus that cause Dengue: DEN-1, DEN-2, DEN-3 and DEN-4. Infections are mostly asymptomatic. In symptomatic form fever over 38°C, headache in the forehead, pain in the muscles, bones and joints, and a characteristic rash are most common symptoms. Recovery from infection by one provides lifelong immunity against that particular serotype. Subsequent infections by other serotypes increase the risk of developing severe dengue with hemorrhagic syndrome which can lead to shock and death.

Outbreaks of dengue fever were first described in the late eighteenth century and occurred in Asia, Africa and North America. The first case of dengue hemorrhagic fever was recorded in 1953 during the outbreak in the Philippines. Outbreaks of dengue fever are endemic and relatively often occure in tropical and subtropical areas of Asia, Africa and South and Central America. Endemic area of the disease is also the eastern region of the Mediterranean. Recent outbreaks of dengue fever in Europe took place in 1927-28 in Greece. In Europe, the disease is reported mainly among travelers returning from endemic areas of disease (21). Single indigenous cases of dengue fever cases were recorded in France (two cases in 2010, four in 2014 and two in 2015) and in Croatia (one case in 2010) in the areas where the vector (*A. albopictus*) was present.

Cases were reported in the south-eastern part of France, in the Provence-Alpes-Cote d'(in August and September of 2010 and in 2014) (22) and in the region of Languedoc-Roussillon (in August 2015). All cases from 2010 and 2015 and one from 2014 were caused by serotype DEN-1 virus, while the other three cases from 2014 by serotype DEN-2.

According to the ECDC, the importation of the virus in 2015 is possibly linked to the person who came from French Polynesia and became ill after returning in July 2015. The case of Croatia was related to a man of German origin, whose infection occurred in August 2010. (23).

In October of 2012 a large outbreak of dengue fever occurred, affecting people in the Portuguese archipelago of Madeira, which belongs to the European territories and was contained in March 2013. These were the first autochthonous cases of dengue found in the archipelago since 1920. According to data from the ECDC during the outbreak 2168 cases were reported of which 1080 laboratory-confirmed. There were no deaths. Most cases have been identified in Funchal city, which is the main port on the island. Cases of dengue fever have also been found among inhabitants of continental Europe, after returning from the archipelago to their countries of residence. Travelers who become infected were the citizens of: Portugal, Great Britain, Germany, Sweden, France, Finland, Denmark, Austria, Norway, Croatia, Slovenia, Spain and Switzerland. It is

well known that during the winter months live activity of vector mosquito drops down, and that was there reason why from the week 47 of 2012 a sharp decline in number of infections related to the virus was observed in Madeira. The spread of this mosquito to the islands of Madeira and the adjacent areas of the Mediterranean cannot be ruled out. Due to the Madeira outbreak appropriate procedures have been implemented in regards to safety in blood donation and transplantation, and local authorities have taken preventive measures including disinfection and desinsection in aircraft and combat mosquitoes at ports and airports (24).

CHIKUNGUNYA

First notification of chikungunya has been received by the National IHR Focal Point in 2010. Chikungunya is a disease caused by an alphavirus of the Togaviridae transmitted by *Aedes* sp. mosquitoes. The reservoir of this virus are monkeys, cattle, rodents and birds which differs this disease from dengue fever for which the reservoir are the only primates. Chikungunya virus causes a disease characterized by sudden onset of fever, the appearance of skin lesions with strong pain in muscles and joints. The rheumatic symptoms may worsen and last for many months. The asymptomatic cases represent more than 75%. The disease can lead to complications such as myocarditis, hepatitis and neurological disorders (25). Chikungunya cases are endemic mainly in Southeast Asia, East Africa and South and Central America. Numerous cases occurred in 2005 in India and Malaysia and in 2013 in Indian Ocean islands (Reunion, Mauritius and Mayotte).

For the first time In America chikungunya appeared in December 2013 on Saint Martin, the caribbean island. Chikungunya cases fastly spread to the other Caribbean Islands and then to the Central, North and South America. As of 14 August 2015 there was 496 suspected and 807 confirmed cases including 64 fatal cases reported to American Health Organization (PAHO). In total, since the beginning of the emergence of outbreak in the Americas, there was 1 640 252 reported cases (25).

The cases of chikungunya reported in Europe concern mainly people returning from endemic areas, mostly from India. The first autochthonous cases in Europe were identified around Rimini in Italy in 2007 from where there was reported 217 cases. The autochthonous chikungunya cases in Europe were also identified in France in the Var department, the Provence-Alpes-Cote d'Azur region in 2010 among two people (26) and in Montpellier, the Languedoc-Roussillon region in 2014 among 14 people (27). It was found that cases from Montpellier lived in the area in which a case of chikungunya was imported from Cameroon. According to the Rapid Risk Assessment of the ECDC on 20 August 2015 the risk for onward transmission in Europe is linked to importation of virus by viraemic patients in areas with competent vectors. In Europe, there are *Aedes albopictus* mosquitoes in mainland Europe, primarily around the Mediterranean and *Aedes aegypti* mosquitoes on Madeira. In July 2015, suspected autochthonous chikungunya case was found for the first time in Spain time in Spain in a person who has not traveled to the endemic areas and for who probably was infected in the Valencia province in this country. Test results confirmed parvovirus infection with and ultimately ruled out Chikungunya virus infection (25).

CHOLERA

There were also sent notifications about cholera to the National IHR Focal Point during the described period. Cholera is an acute diarrhoeal infection caused by the bacterium *Vibrio cholerae* from serological groups: O1 and O139. The group O1 is divided into two biotypes: classical and El Tor, and each has two distinct serotypes: Inaba and Ogawa. Case – fatality rate due to cholera among untreated persons reaches 50%, among the properly treated persons approximately 1%. Much more often than symptomatic infection there is absent of symptoms. Infected people become carriers but usually only transiently, and infected people who do not show symptoms may excrete the bacteria with faeces for 7-14 days from the moment of infection. The disease is characterised by sudden onset and rapid course: diarrhea (rice-water stools) and strong vomiting often leading to dehydration. Reservoir for the *Vibrio cholerae* are people and fecal contamination of water sources. People caught cholera by swallowing water that was contaminated with bacteria or by eating contaminated food that became contaminated by vomit of infected persons, afflicted or carriers. Widespread of epidemic cholera outbreaks happen quite often in developing countries of Central Africa, South-east Asia and Central America. Unfavourable socioeconomic conditions in the particular country, poor water and sanitation infrastructure, cataclysms and natural disasters are conducive to the formation of conditions which are favourable for cholera outbreaks (28).

The first described cholera pandemic took place at the beginning of the 19th century and started in India. The last one, the seventh pandemic began in 1961 and expanded from Indonesia. In recent years, starting from 2010, the outbreak of cholera in which the deaths occurred was reported in countries such as: Haiti, the Dominican Republic, Cuba, Venezuela, Iraq, Nepal, Pakistan, Iran, Bangladesh, Burma, Laos, Cambodia, Vietnam, Afghanistan, India, China, Nigeria, Sierra

Leone, Kenya, Uganda, Zimbabwe, Zambia, Angola, Somalia, Ethiopia, Ivory Coast, Democratic Republic of the Congo, the Republic of the Congo (Congo), Mozambique, Ghana, Guinea, Mali, Ukraine and Niger.

Among notifications about cholera which were sent to the National IHR Focal Point, worthy of note are those related with epidemic of cholera in Haiti, which began in October 2010. A medical examination of patients in these outbreaks showed the presence of cholera serogroup O1, biotype El Tor and serotype Ogawa. As a result of epidemiological investigations it was established that the main source of infection might be water from nearby rivers. Initially, it was reported on the areas of the Artibonite River. Over the next weeks was notified an increase in the number of infected people and deaths in total which occurred in 10 different departments. From 2010 to March 21, 2015 in Haiti were reported about 735,000 cases of which 8,761 were deaths (29).

The outbreak of cholera in the Dominican Republic began in November 2010, where the index case was a person who came there from Haiti. From the beginning of the outbreak in the Dominican Republic, there were notified 32,257 suspected cases, including 487 deaths.

In 2012-2013 years in Cuba 678 cases of cholera were reported, including 3 deaths. It was found that 12 of them who staying in Cuba were foreign nationals (they were from Germany, Italy, the Netherlands, Spain, Chile and Venezuela).

In 2012, the outbreaks of cholera, which were notified by the WHO and sent to the National IHR Focal Point, occurred also in Ghana (more than 160 cases), the Democratic Republic of the Congo (more than 3,500) and Sierra Leone (over 18,500). In 2013, also Mexico notified cases of cholera and until the end of 2015 it was 198 cases, including 1 death, and most of them were recorded on the territory of the state of Hidalgo. In 2015, this country not found new cases of cholera.

In 2015, the National IHR Focal Point received information about an outbreak of cholera in Tanzania. As of 11 October 2015 were reported 4,323 cases, including 67 deaths. Most of them (72%) occurred in Dar es Salaam. In 2015, the outbreak of cholera in Africa was also reported in Burundi, Cameroon, the Democratic Republic of the Congo, Ghana, Kenya, Mozambique, Nigeria, Southern Sudan and Uganda. Overall in Africa were identified more than 32,000 cases, including about 500 deaths (28).

At the end of August 2015, was reported an outbreak of cholera in Iraq. As of 8 October 2015, were reported 1,263 laboratory confirmed cases of cholera in total. At the beginning of October in Kuwait were reported 6 laboratory confirmed cholera cases, caused by the same serotype Inaba which was a cause of infections in Iraq. Among them, the five infections occurred in people who stayed in Iraq.

Over the past 5 years, in Europe was notified the outbreak of cholera caused by serotype Ogawa. It took place in 2011, in Ukraine, in the Donetsk Region, where were identified 33 cases. This information the National IHR Focal Point received from ECDC.

VEROTOXIN-PRODUCING *E. COLI* O 104:H4 INFECTIONS

The first notification about epidemic infections of verotoxin-producing *E.coli* subtype O 104:H4 reached the National IHR Focal Point in May 2011, when they have been reported in Germany for the first time.

This subtype, previously isolated from health animals and humans, did not cause any epidemic before. Infection with verotoxin-producing subtype could lead to damage the capillaries, causing bloody diarrhea and damage of internal organs e.g. kidneys when haemolytic uraemic syndrome occurs (4).

Epidemic of verotoxin-producing E.coli subtype O 104:H4 in Germany was one of the most important event monitored by the National IHR Focal Point ever. First information about increased number of infections with bloody diarrhea or haemolytic uraemic syndrome (HUS), was sent by German side to the National IHR Focal Point on 22nd of May 2011. 30 aces were reported initially, but then the number kept increasing systematically.

There have been 3140 cases of infections of this with this strain identified in the world since mid May of 2011, with 3052 just from Germany. Among all infected individuals, HUS occurred in 905 cases, including 852 in Germany. Due to the epidemic 49 people have died in Germany. Infections also occurred in other EU countries among people who visited Germany in May or June 2011.

All together in other EU countries, (excluding Germany) 125 cases have been reported and one death caused by renal failure due to HUS (4).

Local Sanitary Stations from Poland reported to the National IHR Focal Point 58 suspected cases of which 3 were laboratory confirmed and the subtype detected was the same as in the outbreak in Germany. The first infection was reported in Poland on the 27th of May 2011. The case was a female German resident, in who the first symptoms appeared during her travel to Poland.

Epidemiological and laboratory investigations indicated that the source of infection were imported Egyptian fenugreek seeds used for the cultivation of sprouts. According to European experts, the cost associated with the outbreak for the European Union was estimated at several hundred million euro (5).

MALARIA

The first information about the autochthonous cases of malaria in Europe, in Greece, the National IHR Focal Point received in August 2011. Malaria is caused by *Plasmodium* parasites and in natural conditions is transmitted by infected female *Anopheles* mosquito. The most common symptom of malaria is fever, but there can also occur other recurrent symptoms, such as: headache, chills, muscle aches and malaise. The most severe form of malaria is caused by *Plasmodium falciparum* (14).

Malaria endemic areas are tropical and subtropical areas of Asia, Africa, South and Central America and the islands of the Southwest Pacific. The disease was eradicated in Europe, North America, Australia and most of the territory of the former USSR. In the European Union was eliminated in the 1970s last century (14). Currently, in the EU and EEA there are mainly notified malaria cases imported from endemic areas. In 2012 (the last year of available epidemiological data) were reported 5,161 cases in the EU and EEA. Among these cases 26 were considered as autochthonous cases (15).

Malaria infections which occurred in the country, in Europe, occur sporadically and these are associated with biting by an mosquito at the airport or some hidden in the baggage or blood transfusion (16). In 2011, were found autochthonous cases of infection of *Plasmodium vivax* in Spain and also in Belgium, which was caused by *P. falciparum* in people who have not travelled outside the region of their residence (15).

From 2009, autochthonous cases of malaria are notified in Greece, which was considered in 1974 by WHO as a malaria-free area. In the 2009-2013 years there were reported 76 autochthonous cases: 7 in 2009, 4 in 2010, 42 in 2011 and 20 in 2013. In 2014, was no notification about autochthonous case, but in 2015, was one infected person, who have probably been infected in the region of Thessaly (17). The majority of reported cases of malaria concerned with people from the Prefecture of Laconia situated on Peloponnese Peninsula. The outbreak of autochthonous cases in Greece has raised anxiety throughout the European region associated with the danger of endemization malaria in other European countries (18). The risk of occurrence of malaria infection in Laconia was primarily concerned with the resident population, workers or visitors of this region of Greece. Due to the fact that in areas where were found malaria cases lived a large number of immigrants coming from endemic malaria areas (Asian countries, such as, e.g., Pakistan, Afghanistan, Bangladesh), it was hypothesised that in certain areas of Greece, the mosquitoes of the *Anopheles* genus, could be infected with the *Plasmodium vivax* through contact with afflicted immigrants. After 2012, the number of autochthonous cases in Greece declined and due to this fact, malaria poses low threat to people visiting Greece (17)

According to a recent WHO report *Fact sheet on the World Malaria Report 2014,* published in 2014, it was estimated that in 2013 was about 198 million cases of malaria in the world including 584,000 deaths. It is assumed that 90% of all deaths due to malaria is occurring in Africa.

WEST NILE FEVER

The National IHR Focal Point in Poland has been receiving West Nile Fever (WNF) notifications since 2011. Disease is caused by West Nile Virus (WNV) which transmitted by mosquitos. Most of the human cases are asymptomatic (around 80%). Less than 20% of the cases are mild (fever, headache, muscle pain and rash). Around 1% of the cases are severe and infection can cause meningitis or encephalitis. WNF can be fatal. Main WNV reservoir are birds, and virus cause infection among birds, mammals and humans. Human infection may occur as a result of mosquito bites. WNV is transmitted by different mosquito species but mainly by Culex sp. mosquitos.

WNV infection in human was described for the first time in 1937 in West Nile Province in Uganda. During the fifties of the twentieth century WNF cases were reported in Egypt and Israel and lately in the sixties WNV circulation was reported in different countries in Africa, Asia, Europe and in Australia. In Europe WNV was isolated for the first time in 1964 in Volga Delta in USSR and in France. In 1999 WNF cases were reported for the first time in New York State in USA, where WNV infection caused mass deaths among native bird species and lately diseases and deaths among humans and other animal (mainly horses). Since the 2000 epidemic starts to spread into other US States, in 2002 virus was reported in Canada and in 2003 in Mexico. The biggest WNF outbreaks with more than few hundred cases occurred in Romania in 1996 and in Russia (Volga Delta) in 1999 (19). In Poland the presence of specific WNV antibodies were confirmed among birds as a result of the research performed in Mazovia Province in 1995-1996 (20).

From 2010 to 2015 the IHR Focal Point in Poland was informed about WNF cases occurred in Austria, Greece, Italy, Romania, Spain, Albania, Macedonia, Croatia, Kosovo, Serbia, Slovenia, Bosnia and Herzegovina, Montenegro, Czech Republic, Turkey, Russia, Ukraine and Hungary. Among EU Member States the highest number of cases is observed in Greece: 262 cases including 35 deaths in 2010, 100 cases in 2011, 161 cases in 2012, 86 cases in 2013 and 15 cases in 2014. In 2012 in Italy 50 cases were reported including

5 cases among asymptomatic blood donors. This fact deserves our particular attention.

During the summer of 2015, for the first time from 2010, probable case was observed in Portugal. The case lived in Almancil in the municipality of Loulé, in the Algarve region which is the area where migrant birds – the possible reservoir of the virus are present.

People traveling into the areas where WNF cases are reported should be aware of the risk of infection. European Commission published recommendation on blood safety related to infection transmitted by mosquitos. According to information provided by the national consultant in the field of clinical transfusion in Poland giving blood by people returning from countries with the risk of WNF infection is restricted (15).

MERS-COV INFECTIONS

The new event constituting public health threat is acute respiratory syndrome caused by Middle East Respiratory Syndrome Coronavirus (MERS-CoV) was reported for the first time in the September 2012. MERS-CoV is a member of the same group of viruses as a SARS Coronavirus which was etiological agent of the SARS (Severe acute respiratory syndrome) outbreak occurred in 2002 and 2003 (8,422 cases including 916 deaths). Until September 2012 human MERS-CoV cases have not been identified. The first two human cases were Qatari and Saudi Arabian citizens (6).

Globally, on 19 October 2015 a total number of 1,599 laboratory-confirmed cases of infection with MERS-CoV including at least 574 related deaths have been reported to WHO. Most of the cases occurred in the Middle East. All of the cases which have been reported outside of the Middle East had recent travel history to the Middle East or contacted with a case who travelled in the Middle East. MERS-CoV cases were identified in 26 countries including 8 European countries (7).

Most of the cases have been identified in Saudi Arabia. In the Middle East cases were reported from following countries: Saudi Arabia, United Arab Emirates, Qatar, Jordan, Oman, Kuwait, Egypt, Yemen, Lebanon and Iran. In Africa cases occurred in Tunisia and Algeria; in Asia in Malaysia, Philippines, South Korea, Thailand and China. Two cases were reported in USA and 13 in European countries: 4 cases including 3 deaths in United Kingdom, 3 cases including 2 deaths in Germany, 2 cases including 1 death in France, 1 case in Italy, 1 case in Greece and 2 cases in Netherlands (6).

The most probable source of the virus for humans are camels - dromedaries (6). Virus can be found in dromedary's upper respiratory tract, feces, urine and milk. Under certain condition virus can be transmitted from person to person, among close contacts including family, healthcare workers and other patients.

In 2015 a MERS-CoV outbreak occurred in South Korea. The index case was 68-years old men returning from the Middle East. After his return and before confirmation of MERS-CoV infection he visited 3 healthcare facilities in Seoul. Secondary cases among patients contact were identified. On the 12 October number of the cases in this outbreak was 186 including 36 deaths. This is the biggest MERS-CoV outbreak reported outside of the Arabian Peninsula. In the South Korea MERS-CoV infections were observed only among patient, family members, visitors in the hospital and healthcare workers who have been in contact with MERS-CoV confirmed case in the one of the six healthcare facility related with the index case (8).

According to ECDC risk assessment most of the MERS-CoV cases are reported from the Middle East, especially from Saudi Arabia. Sporadic importation of the MERS-CoV case to the European Union cannot be ruled out. The key to prevent and limit the spread of infection are timely diagnosis and implementation of infection control measures including using personal protective equipment by healthcare workers. Proper preparation of the healthcare facilities and raising awareness among healthcare workers are also important (6).

EBOLA VIRUS DISEASE

The first notification concerning outbreak in West Africa sent by WHO was received by the IHR Focal Point in Poland in March 2014. Ebola virus disease (EVD) is a disease caused by viruses from the Filoviridae family. It could be caused by such species of the virus as: *Sudan ebolavirus, Zaire ebolavirus, Taï Forest ebolavirus, Bundibugyo ebolavirus* as well as *Reston ebolavirus*. First four species are responsible for the development of the disease in humans, while *Reston ebolavirus* is known to cause illness only in monkeys. No clear reservoir of the virus was discovered so far, however it is suspected that the most likely would be fruit bats. First symptoms of EVD are of flu like characteristics, followed by those characteristic for hemorrhagic fever, e.g. bleeding from natural cavities and multi organ failure as a result. Mortality rate for EVD is 50-90%, which decreases in case of introducing supportive caret and hospitalization (9).

Ebola virus disease is an endemic disease, however in terms of time and place it emerges in the form of epidemic outbreaks. First documented EVD outbreak took place in Zaire (Democratic republic of Congo) in 1976, in Yambuktu region. In this outbreak 318 cases, of which 280 appeared to be fatal, were reported. In the same year an outbreak caused by a different strain

was reported in Sudan. Further outbreaks of this disease were reported in Gabon (1994, 1996 and 2001), Congo (2001, 2002 and 2003), Uganda (2000, 2007 and 2012), again in Democratic Republic of Congo (in 1995, 2001, 2007, 2012, and 2014), and Sudan (1979 and 2004) (10).

The biggest EVD outbreak, concerning both the number of cases and region it has spread over, took place in 3 countries of Western Africa: Guinea, Sierra Leone and Liberia. The index case in this outbreak is suspected to be a 2 year old child who consumed bush meat. First WHO reports (sent in march 2014) indicated cases from eastern Guinea and the city of Conakry. After these preliminary reports further cases were reported from Liberia and Sierra Leone. According to information from ECDC's risk assessment the source of infection in this outbreak was not found, however a contact with the bodies of dead animals (acquired from the forest for consumption), as well as with their bodily fluids and secretions is suspected. Most of the secondary cases were among persons who had direct contact with sick people or the bodies of the deceased (e.g. during the funerals). It is a first documented outbreak in this part of Africa, however (according to ECDC's Risk Assessment dated on 23rd March 2014) it is not an unexpected event, since Guinea is situated in the same forest ecosystem, in which some proofs of Ebola virus transmission was already found. (11).

Cases were mainly reported from Sierra Leone (14 061, including 3 955 deaths). Liberia (10 672, including 4 808 deaths) and Guinea (3 803, including 2 535 deaths). WHO declared those countries as states in which the transmission of the virus is widespread and established. According to WHO, at present Liberia is the country which is free of EVD. Cases being a part of this outbreak were reported also from 7 additional countries such as: Mali (8 cases, including 6 deaths), Nigeria (20 cases, including 8 deaths), Senegal (1 case), Spain (1 case), USA (4 cases, including 1 death), Great Britain (1 case) and Italy (1case). At present all of those additional countries are declared by WHO as being free of EVD (11, 12, 13). In total, according to WHO report from 28th of October 2015, the number of cases in this outbreak is 28 575, including 11 313 deaths. In 2014 another Ebola virus disease outbreak was reported from Democratic Republic of Congo (DRC). However this one was not in any way connected to the outbreak in Western Africa. In DRC outbreak 66 cases were reported, including 49 deaths, and in November 2014 it was declared as being terminated (12).

Similarly to other outbreaks, in the course of the outbreak in Western Africa, the main transmission was human-to-human, and no proof of the change in the virus virulence was found. As probable causes of both the large number and the spread of cases in this outbreak, inadequate procedure following and not sufficient preventive measures were recognized (12).

SUMMARY

Emerging infectious diseases in humans, especially those that are not covered by routine vaccination programs or for which there are no effective vaccines can be included to the most current public health threats. The presence of infections caused by previously unknown pathogens as well as the re-emergence of diseases occurring in recent years in some European countries, has been found in the period from 2010 to 2015 in Europe. Travelers to European countries, where the occurrence of emerging infectious diseases has been found, should be aware of the ongoing threat.

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