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Spreading Ebola Virus from Primary Sources through the Bush Meat and
its Impact in West Africa

Bachelor thesis

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Abstract

This presented bachelor thesis is focused on the spreading of the Ebola virus (EBOV) from the primary sources through the bush meat and its impact on the society. This impact can have this disease, mainly if the Ebola virus disease (EVD) can extend to other areas. In the thesis an analysis of socio-economic environment is included, the latest biggest outbreak of the disease between the years 2013 and 2016, monitoring the period of the outbreak by World Health Organization (WHO) and Centres for Disease Control and Prevention (CDC). The questionnaire survey on the African cultural eating and hygiene habits that could be related to bush meat and EVD spreading, was also carried out. Questionnaire was used as an additional material. In general was found out that most of the respondents have a good hygiene habits and buy meat mainly from informal sector. The main goal of the thesis is to find out the initial appearance of the EBOV and its spreading through the different possible ways. Gained knowledge could be used by WHO and other organizations for evaluation of the next outbreaks.

Key words

Ebola, virus, epidemics, bush meat, vector, West Africa

Abstrakt

Předložená bakalářská práce se zabývá šířením viru Ebola od primárních zdrojů přes tzv. maso od divokých zvířat (*bush meat*) a jejím dopadem, v případě rozšíření původce onemocnění do dalších oblastí. V bakalářské práci je zahrnuta analýza socio-ekonomického prostředí po posledním největším propuknutí nemoci mezi roky 2013 a 2016, monitorování této periody epidemie WHO (Světovou zdravotnickou organizací) a CDC (Centrem pro kontrolu nemocí). V práci byl použit průzkum, který se týkal africké kultury stolování a hygieny, která by mohla být spojena s klíčovým primárním rizikovým faktorem masem z buše. Průzkum byl použit jako doplňkový materiál. Obecně bylo zjištěno, že většina respondentů má dobré hygienické návyky a kupuje maso z neformálního sektoru. Hlavním cílem práce je popis šíření původce onemocnění různými možnými cestami. Získané zkušenosti mohou být využity pro zhodnocení vzniku a průběhu další případné epidemie v afrických zemích.

Klíčová slova

Virus Ebola, epidemie, maso z buše, vektor, Západní Afrika

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LIST OF ABBREVIATIONS

ALIMA	Alliance of International Medical Action
AU	African Union
CDC	Centres for Disease Control and Prevention
DFID	Department for International Development
DNA	Deoxyribonucleic acid
DRC	Democratic Republic of Congo
EBOV	Ebola virus
EVD	Ebola virus disease
GDP	Gross domestic product
IFRC	International Federation of Red Cross
IMS	Incident Management System
IPC	Infection Prevention and Control
IPC	Infection Prevention and Control
MBGV	Marburg virus
MOHs	Ministry of health
MSF	Medicins Sans Frontieres
NGO	Non-governmental organization
OXFAM	Oxford Committee for Famine Relief
RNA	Ribonucleic acid
UK	United Kingdom
UNDG	United Nations Development Group
UNICEF	United Nations International Children's Emergency Fund
USA	United States of America
UVRI	Uganda Viral Research Institute
WHO	World Health Organization

1. INTRODUCTION

In 1994, West Africa experienced Ebola virus disease (EVD) for the first time, when a dead chimpanzee in Cote d'Ivoire was found with Tai Forest virus. It was the first time and only once when West Africa had EVD, before the latest biggest epidemic outbreak between years 2013-2016 (CDC,2016). This outbreak had a significant impact on political, economic, social and other sectors in Western Africa. The thesis focuses on the three main countries from this areas; Guinea, Liberia and Sierra Leone which were affected by EVD outbreak in 2013. From the last epidemic, many people were infected and plenty of them have died. The approximate number that world have experienced reached 11,325 of deaths (CDC, 2016).

Each country had different development and process of epidemiology between 2013 and 2016; the main difference was in a number of infected people, speed of the epidemic and number of deaths. Guinea had its first confirmed case in March 2014 and the epidemic ended at the end of the December 2015. However, there were still registered a sporadic cases in 2016. Guinea had 3,811 suspected cases and 2,543 deaths caused by EVD. In Liberia was first confirmed case in March 2014, number of suspected cases 10,675 with 4,809 of deaths. In Sierra Leone first confirmed case was reported in May 2014. Country reported 14,124 suspected cases and 3,956 deaths, with indication of end in November 2015. The number of deaths is considerably different from country to country, for example, epidemics in Sierra Leone started as the latest, but its number of confirmed cases and deaths is the highest (CDC, 2016).

There is no exact evidence how the outbreak of epidemic has in each concrete country started. However, there were several conditions that were connected and led to the epidemics outbreaks. First; starting from hospitals, health centres that were not prepared for the EVD and not even in that big scale. The main reason for the epidemic was, that for a long time there was no awareness about EVD. The EVD has similar symptoms as other African common diseases (tuberculosis, yellow fever or others). Infected patients were treated on these other diseases. Incubation period is 2 to 21 days and that is the reason why the transmission was fast and in big scale.

The thesis also determinates the second condition, which is the primary source of epidemics and different types of spreading. By the primary sources are assumed fruit bats, chimpanzees, gorillas, and other mammals, which can have sign of the Ebola virus (EBOV). EBOV can be spread through them in form of bush meat (meat from wild animal) or other ways. Next types of transmission are transmission from animal to human or from human to human, which was case of West Africa and various types of spreading (through the blood, secretion, handling with death person of EVD, etc.) and some more. It is important for thesis to clearly understand and know the process of condition that led to the outbreak. Understanding to all conditions can help to monitor the EVD and possibly prevent from the new epidemic.

Overall, the EVD had a negative impact mainly on population; however it caused problems also in other fields. Following chapters of thesis discusses the impact in social, economic and political spheres. The EVD outbreak in social sphere caused mainly children that lost their parents during the outbreak (approximately 16,600 children from Guinea, Liberia and Sierra Leone) lost one or both of parents caused by EVD and around 3% of them had to be placed out of a family or community (UNICEF, 2016).

Another impact of EVD caused the economic situation in all mentioned countries, where international trade decreased and small business enterprises loss. The World Bank estimated the impact on economy in following countries by \$2,8 billion (World Bank, 2016). Education was also affected – all schools had to be closed and opened once the epidemic was ended. Political sphere was hit and caused distrust among the people and government.

In addition, there are international organizations in Africa that focus on decreasing of hunting wild animals. The reason was to decrease trade with wild animals and safe animal species. On the other side, by decreasing of hunting, there could be a possibility of spreading of EBOV from the meat to humans. Furthermore, the trade could be another way how the EBOV can be spread.

External actors played also role during the epidemics between 2013 and 2016. Media disseminated unbalanced information about EVD, which misrepresent the reality and caused panic among the people.

To summarize, thesis focuses on recognizing the EVD from its beginning and prevent population for the next possible epidemic in this scale. For the thesis was used questionnaire to collect information about eating habits, types and sources of buying meat. The subject deals with the main factor of the EVD and spreading EBOV through the bush meat, in order to understand and recognize the conditions in the future and, if necessary, identify the illness and prevent any further outbreak.

2. AIM

The main aim of the bachelor thesis is to find out the currently known sources of the EVD in African endemic countries which are related to the bush meat. Moreover, the other aim is to recognize the primary sources of EBOV. Firstly, it was necessary to clarify events that preceded its origin, the following spread of the EBOV and spread of reported cases. This thesis likewise pursues circumstances that are followed by the outbreak of the EVD and its negative consequences for economic, social, political and other spheres. Furthermore, the thesis incorporates comparison of confirmed cases with the EBOV in African countries in different periods of time. However, preventing solutions how the spread of EBOV could be eliminated and/or broken.

3. LITERATURE REVIEW

3.1. Ebola virus disease (EVD)

“A probable suspected case of Ebola was defined as an illness characterized by a history of acute fever in a person who has had contact with a person with a probable or suspected case definition in the past 21 days.”

J. Perry, T. Sayndee

EVD is one of the most dangerous diseases in the world. It is highly transmissible and it can even kill almost 90% of infected patients. In the areas that are infected the disease causes panic. Mortality moves between 25% and 90% in order to EBOV strain and seriousness (Lekari-bez-hranic, 2017). EVD is a serious illness which is often fatal if there is no available treatment. EVD occurred for the first time in 1976 in Democratic Republic of Congo (DRC) and neighbouring regions and later on, appeared in village near to river named Ebola, and from this river the disease took the name (WHO, 2017).

The latest EVD outbreak is not that far from now. The cases were notified in March 2014, which led to largest and complex outbreak since the time when EVD was firstly discovered. The spread was really huge and started in Guinea through the Sierra Leone and Liberia. By the travellers from Nigeria, USA, Senegal was the disease spread and the big epidemics had started (WHO, 2017).

EBOV is able to infect humans and non-human primates (chimpanzees, monkeys and gorillas). According to Stimola (2011): “Viruses are microscopic biological agents that infect the cells of other organisms where they replicate, or make more of themselves. Without these host cells, a virus can do nothing”. Transmitted to other words, viruses are dependent upon their hosts for them to survive. To explain it a bit deeper: all organisms comprise coded genetic material which is used for making all proteins that organism need for surviving. Cells of humans contain DNA that we can call as double-stranded material. Cells decode DNA into single-stranded RNA that is used for building of human proteins. However, viruses are not able to make their own proteins and they need host cells to help them. Moreover viruses have to infect the cells of another organism in order to copy them. EBOV has genetic material that takes another form of RNA, it enters human and/or non-human primates cells and use one of surface protein

to trick human cell in order that virus is not harmful. When the EBOV enters the cell, it turns its negative RNA into many of positive RNA, however instead of making proteins; cells start to produce EBOV proteins. In other words; EBOV turns infected cells into EBOV factories and are spread through the whole organism.

3.1.1. Types of Ebola virus (EBOV) and symptoms

There are many different types of EBOV that are divided into families. EBOV can be included into a family, which is called *Filoviridae* that means “thread virus”. This name was given because of the shape of the EBOV which looks like a long string with loops on the end. Sometimes it can be found Cheerion with a tail or shepherd’s crook as a name for the shape of the EBOV (Stimola, 2011).

Figure.1: Ebola virus (EBOV)



Source: Timmer, 2014

EBOV has four subtypes: Sudan, Zaire, Reston and Ivory Coast where Sudan and Zaire are carry responsibility for more than 95% of all cases and deaths. The term “Ebola” is used to refer Sudan and Zaire EBOV subtypes, but an important fact is that the “Ebola” term refers to a genus, nor really a specific virus. Ebola-Sudan can be found mostly in mixed savannah-forest environments, and has 40-50% case mortality rate. Ebola-Zaire occurs in tropical forests and is the most virulent. It has 80-90% case mortality rate (Hewlett and Hewlett, 2008).

Symptoms of the EVD can include similar symptoms as the normal flu, but after the basic ones the EVD comes more serious. Among the common symptoms can be included fever, headache, muscle and joint aches, which can be followed by lack of appetite. However, there are less common symptoms that are pretty typical for EVD, for example exanthema, red eyes, sore throat, chest ache, cough, difficulty of breathing

and swallowing and the final phase is represented by bleeding inside and outside of the body (Kidula, 2014). The incubation time period is two to twenty-one days with the initial symptoms of the EVD which are characterized by sudden fever, weakness, headache, and muscle pain. The next stage consists of vomiting, sore throat, rash, diarrhoea, and thorax pain. The final stage brings delirium, hiccups and bleeding under the skin and from the nose, mouth, intestines and other openings. It is very difficult to diagnose all stages, mainly the early stages of EVD, because the early signs and symptoms may be same as other common tropical diseases, for example bacterial infection or malaria. Patients usually die within seven days after first sign of the symptom (Hewlett and Hewlett, 2008).

3.1.2. Transmission and prevention of Ebola virus (EBOV)

The EBOV is not distributed by air, thus EVD should not be much contagious, and it can be conveyed only through the sick person's body fluids, however EBOV is highly infectious. Initial changeover is known under the term of spillover event, which means that the further transmission can happen when the sympathizer or carer come into the contact with the patient who is sick and comes to the contact with its body fluids. The necessary intervention has to be done by quarantine of patients to prevent spreading (Richards, 2016).

EBOV has many different ways, how it can be spread. Some of them are known and can be similar to other dangerous viruses, but as the other illness, also this one has some other ways, which are important to know. Spreading through the blood and secretion within the direct contact, can remain infectious. Among other dangerous type is counted using needles, where EBOV can be found or also syringes that are used to treat EBOV-infected patients. Moreover, another type of spread is handling with infected person. It is extended mainly in developing countries, where is physically handled with person who has died on EVD. Among other critical behaviour eating of not properly cooked (heat treated) bush meat, which could be the main case for this thesis. Eating meat especially originating from monkeys, fruit bats, chimpanzees or any other wild free-living animals that could be infected is the key reason. As the least but probably not last case, can be found eating some fruits that animals, such as fruit bats or any wild animal has already partly eaten (Kidula, 2014).

The crucial step is, when outbreak control pays attention to applying a package of interventions such as good management, good laboratory service, safe burials and social mobilisation, and higher rise of awareness of risk. The reduction relies on the risk of wildlife-to-human transmission where contact with monkeys, fruit bats or infected animals and the consumption of their meat in raw condition. Manipulating with animals should be handled with proper gloves, protective clothing and meat and blood should be cooked before the consumption (WHO, 2017).

Another adopting measurement would be reduction of risk of human-to-human transmission particularly with infected people with clinical symptoms. Gloves and other appropriate clothes and protective equipment should be used with manipulating of patients and taking care of them. Moreover, hand washing straight after the visiting hospital or patients is required. However, risk of sexual transmission is always high. That is the reason why is important to be aware of unsafe sex and do a proper hygiene even for the next 12 months, from onset of symptoms or until the tests from EBOV are negative (WHO, 2017).

As the next crucial step could be containment measure includes prompt and safe burial of dead patients. Also a person who may have been in contact with infected person has to be monitored for 21 days. It is important to have separate healthy and sick people from the future spread and the importance of maintaining clean environment and very good hygiene (WHO, 2017).

3.1.3. Incubation period and treatment of Ebola virus disease (EVD)

Incubation period of EVD ranges in period between 2–21 days. EVD usually starts with high fevers, headaches, muscle pain, weakness and sometimes with conjunctivitis. Symptoms often increase its intensity which is followed by eye discharge, vomiting and there could be recognizable fall in blood pressure with permanent fevers. Infected person starts to bleed. However, the bleeding begins in gastrointestinal tract, thus the disease is confusingly changed with dysentery or typhoid. This suspicion is dispelled in the stage where infected patient starts to bleed from all body orifices (openings) and starts to vomit blood. Massive blood bruising occurs because of the bad blood circulation and coagulation. Infected patient also bleeds from the mouth and surface of the tongue starts to peel off because of the loss of the mucous membrane. This skin

breaks cause severe pain. The heart is weak and due to the blood circulation blood clot circle to the brain. EVD moreover affects eyes and patient could become blind, next stage is followed by bleeding from the eyes. Generally there come about irrecoverable damage of all internal organs. In case of pregnancy, spontaneous miscarriage occurs, when the foetus is infected. If the foetus survives, baby is born with the red eyes and blood is dripping from the nose (Tropicke-nemoci, 2017).

Death is caused because of the failure of all organs, where body starts to decompose. Body fluids are highly infectious. In the latest stages of the disease, infected patient suffers from epileptic seizures and falls into shock. If the patient survives, it depends on the physical condition and on the type of the virus (Tropicke-nemoci, 2017).

Before and during the biggest epidemics, there was no vaccination to prevent of kill EBOV. From 2016, according to WHO there was developed vaccine by Public Health Agency of Canada and should provide protection against EVD. Vaccine works in way of replacing genes from harmless virus with gene encoding EBOV surface protein. Vaccine should produce immunity for humans. In Guinea, during the year 2015, this vaccine called rVSV-ZEBOV was tested on 11,841 inhabitants. No case was reported among the 5,837 people who received vaccine after 10 or more days from vaccination. To compare with other side, after the vaccination, there was occurrence of 23 cases of those, who did not receive the vaccine. Outbreak of EVD in 2013 - 2016 highlighted the need of vaccine, although sporadic cases since 1976. It is needed to say that in the analysis were included only cases that occurred ten days after vaccination to account for EBOV incubation period (WHO, 2016).

3.2. Ebolavirus (EBOV) ecology

In the following part of the thesis will be talked about different types of transmission and about fact that are connected with the contagion of EVD. This disease belongs to zoonosis which means that in the disease are involved humans and animals. Exact types of possible transmission are following (CDC, 2017):

- Animal-to-Animal Transmission

For the EBOV fruit bats represent typical reservoirs. Fruit bats that are carriers of EBOV can transmit it to other animals, such as to antelopes, monkeys and apes as the group, but also directly to humans, especially hunters.

- Spillover Event

So-called spillover event emerges when human or some animal (antelope, fruit bats, apes, and monkeys) get infected with the EBOV by the contact with reservoir host, where the contact can appear by the various occasions. It can occur through the hunting or butchering meat of infected animal for eating.

- Human-to-Human Transmission

The human transmission can be quite fast. When is the first human infected, the transmission of the EBOV is spread to other humans due to contact with any body fluids, blood or body of death person who died of EVD. That could be a case of traditional funeral practises, unprotected health care workers or any unprotected contact with body fluids.

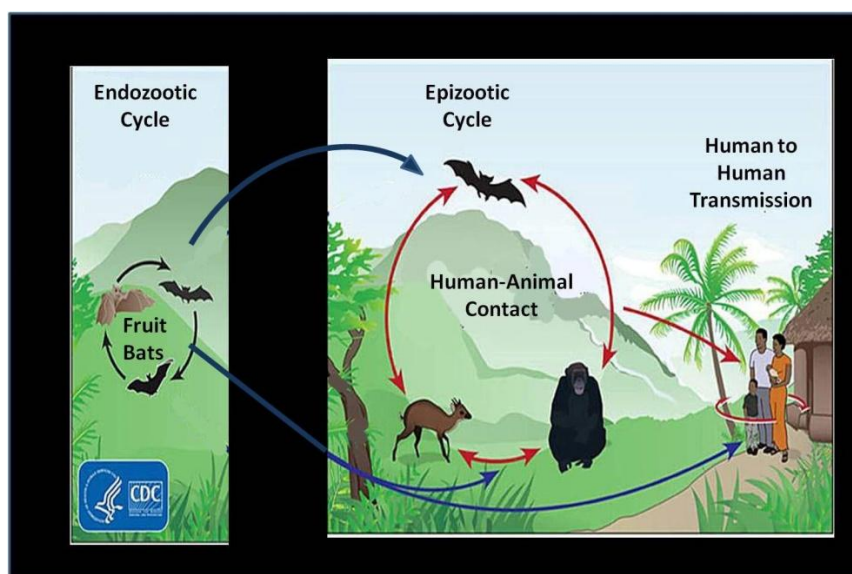
- Survivor

Some survivors (patients overcoming the EVD) can report muscle aches, tiredness or other after-effects, but face a new challenges after a recovery. They can also face stigma after their re-entering of community.

3.2.1. Epizootic cycle of Ebola virus disease (EVD)

There is no study that confirms for 100% the natural reservoir host of EBOV. However, scientists believe according to their studies that the primary sources of infection (EBOV) result from some contact with infected animal for example fruit bats, monkeys or other apes. The Fig.2 shows the cycle of transmission between animal to animal through the epizootic cycle and through the food chain. Humans can get infected through the contact with infected fruit bat or other wild animals that could be infected from other animal or human-to-human transmission that occurs quite often, it is a predominant feature of epidemics (CDC, 2017).

Figure 2: Ebolavirus ecology



Source: CDC, 2016

3.3. Basic information about the endemic regions

To know some general information related to the most affected West African countries, general facts are described below for the each country.

3.3.1. Guinea

The first chosen country for this thesis is Guinea which is situated between Guinea-Bissau and Sierra Leone and on the side lands North Atlantic Ocean. Total area is 245 857 km². Climate remains similar to the neighbouring countries and it is hot and humid with the monsoonal-type rainy season from June to November and dry season from December to May with north-easterly winds. Country can be proud of different natural resources like gold, diamond, iron ore, bauxite, etc. Guinea is inhabited by 12 093 359 people within the year 2016. Ethnic groups are divided on 33.9% of Fulani, 19.1% Soussou, 6% Kissi and others smaller once. Official language is French; however, each ethnic group has its own language. In religion section could be found 86.7% of Muslims, 8.9% Christians, and the others. Guinea is presidential republic with the capital city Conakry. Country gained independence from France on October 1958. Same as most of the African countries is this one also-poor. Apart others, the biggest

threats for the economy was EVD epidemic and also low international commodity prices (CIA, 2017).

3.3.2. Liberia

Liberia is located in Western Africa where the borders is North Atlantic Ocean and is located between Sierra Leone, Cote d'Ivoire and Guinea. Area in total is measured by 111,369 km². The climate in Liberia is tropical, humid and hot. There are dry winters where the days are hot and during the night are cold. On the other hand summers are cloudy and wet with heavy rains. By the July 2016 the number of inhabitants can be calculated to 4 299 944 people with different ethnic groups, such as Kpelle (20.3%), Bassa (13.4%), Grebo (10%) etc. Religion is mainly Christian with 85.6%, Muslim 12.2% and others. Fertility rate shows nearly 5 children per one woman. However, almost more than 60% are under the age of 25. Official language is English. Liberia is presidential republic with the capital city of Monrovia. The country gained independence in 26.7.1847. Liberia has low income and relies on assistance from foreign countries. Moreover it is the country which is endowed with mineral resources, forests, water and climate is favourable to agriculture. GDP per capita in 2016 was \$900 (CIA, 2017).

3.3.3. Sierra Leone

Sierra Leone's bordering countries are Guinea and Liberia and it also borders with North Atlantic Ocean. Total km² area is 71, 740. The climate is tropical, hot and humid where summer has rainy season (May–December) and in winters are dry (December–April). The overall population counts 6 018 888 people within the year 2016 with ethnic groups of Temme (35%), Mende (31%) and other small once. The official language is English however Mende and Temme are also used with their ethnic groups. Religion is from 60% Muslim's, 10% Christian and the rest of 30% indigenous beliefs (animists). Situation of population is similar as in the previous country where more than 60% population is under the age 25 years. Sierra Leone is presidential republic with the capital city of Freetown. Its independence gained on April 1961 (from the UK). Economy is really poor, and almost 50% of the working-age population engages in subsistence agriculture. However, the growth has been done by mining, mainly the iron

mining. Apart of others there is export of diamonds, and iron ore. Quite significant influence on economy had EVD outbreak in 2015 (CIA, 2017).

3.4. Background of the Ebola virus disease (EVD) in the countries

As it was already mentioned, EBOV is serious illness which is very often fatal, if there is no treatment. The first outbreaks and appearance of EVD was in 1976 (WHO, 2017). After the first epidemic, which had started in 1976 could be counted as a considerable form next four stages with the biggest significant epidemic in 2014. However, apart from the bigger epidemic, there is still occurrence of sporadic cases. Furthermore the numbers reflect only cases that were confirmed by laboratory (CDC, 2016).

3.4.1. The first Ebola virus disease (EVD) epidemic

The first outbreak of Ebola started in August 1976 in Zaire (nowadays Democratic Republic of Congo). The patient whose name was Mabalo visited the local hospital in Yambuku (Mission Hospital) in Zaire. He just came seeking some treatment for a high fever. He had been travelling around north part of Zaire and just returned from the mission trip. He assumed that he was contracted malaria, as it was quite typical illness for Africa. Patient Mabalo was treated with a drug against malaria and was sent home to rest. Despite of the hospital's treatment and the best effort, traveller succumbed to his illness. He died on September 8, 1976 and until then, this primary case or in the other words, the earliest case that was identified during the outbreak of EVD, is known. According to the regional tradition, Mabalo's body was prepared with local rituals by bare hands. It was prepared by his wife, mother and many others relatives and family friends. Through the following weeks from Mabalo's death, around 18 of his friends and family members who were involved in preparing body for funeral died, because of the infection (Smith, 2009).

EBOV as it was already mentioned occurred for the first time in Yambuku. Spreading of the disease was followed by personal contact with using of contaminated syringes and needles in hospitals. The outbreak in the period 1976 and 1979 affected mainly Zaire EBOV in Democratic Republic of Congo with 318 infected cases and Sudan EBOV in South Sudan with 284 cases. During this period these two regions were the

most infected. However, there was also sporadic appears of cases such as in England or in Zaire (CDC, 2016). Exact numbers and cases could be seen on the Table 1.

Table 1: First EVD epidemic (1976 - 1979)

Year(s)	Country	Ebola subtype	Reported number of human cases	Reported number in % of deaths among cases
1976	Zaire (DRC)	Zaire virus	318	280 (88%)
1976	Sudan (South Sudan)	Sudan virus	284	151 (53%)
1976	England	Sudan virus	1	0
1977	Zaire	Zaire virus	1	1 (100%)
1979	Sudan (South Sudan)	Sudan virus	34	22 (65%)

Source: CDC(2016), own processing

3.4.2. The second Ebola virus disease (EVD) epidemics (1994 - 1996)

The second epidemics started with Zaire virus in Gabon where EBOV occurred in gold-mining camps situated in the rain forest. When the symptoms appeared, first thoughts were heading towards yellow fever. EVD was then identified in 1995. In Gabon were 31 casualties out of 52. The higher number experienced Democratic Republic of Congo with 250 deaths out of 315. An epidemic was spread from case-patient (worker in the forest) through the family and hospitals. Outbreak in Gabon started with chimpanzee that was found dead in the forest and was eaten by people who were hunting for food. Some of the hunters become ill from the animal and after that was disease spread through personal contact with family members and others (CDC, 2016).

Some sporadic cases also occurred and were reported, such as in South Africa (two cases), and Russia with 1 case that was because of the laboratory contamination (CDC, 2016). Main cases are shown in Table 2.

Table 2: Second EVD epidemic (1994 - 1996)

Year(s)	Country	Ebola subtype	Reported number of human cases	Reported number (%) of deaths among cases
1994	Gabon	Zaire virus	52	31 (60%)
1994	Côte d'Ivoire (Ivory Coast)	Tai Forest virus	1	0
1995	DRC (Zaire)	Zaire virus	315	250 (81%)
1996	Gabon	Zaire virus	60	45 (74%)
1996	Russia	Zaire virus	1	1 (100%)

Source: CDC (2016), own processing

3.4.3. The third Ebola virus disease (EVD) epidemic (2000 - 2009)

Following epidemics had started in part districts of Uganda in 2001. Associated risks of EBOV were connected to funerals of case-patients. Contact with infected body of family members and health workers without protective equipment had led to the spreading of the EBOV. Sudan virus in Uganda asked for 224 deaths out of 425 infected patients. Zaire virus occurred in next years in Republic of Congo (Table 3.) where EBOV was spread over Gabon's border with refuges from infected regions with EVD. In this period EVD was for the first time diagnosed in Republic of Congo. Another extended wave of the reported EVD cases, country experienced in 2007 with 264 cases, where rate of deaths reached 71%. EBOV was also diagnosed in Uganda, Gabon, Philippines (six asymptomatic cases) and in Russia (CDC, 2016).

Table 3: Third EVD epidemic (2000 - 2009)

Year(s)	Country	Ebola subtype	Reported number of human cases	Reported number (%) of deaths among cases
2000 – 2001	Uganda	Sudan virus	425	224 (53%)
2001 – 2002	Gabon	Zaire virus	65	53 (82%)
2001 - 2002 (October - March)	Republic Congo	Zaire virus	57	43 (75%)
2002 - 2003 (December - April)	Republic Congo	Zaire virus	143	128 (89%)
2003 (November - December)	Republic Congo	Zaire virus	35	29 (83%)
2004	Sudan (South Sudan)	Sudan virus	17	7 (41%)
2004	Russia	Zaire virus	1	1 (100%)
2007	Democratic Republic of Congo	Zaire virus	264	187 (71%)
2007 - 2008 (December - January)	Uganda	Bundibugyo virus	149	37 (25%)
2008 (November)	Philippines	Reston virus	6	0
2008 - 2009(December - February)	Democratic Republic of Congo	Zaire virus	32	15 (47%)

Source: CDC (2016), own processing

3.4.4. The fourth Ebola virus disease (EVD) epidemic (2011 - 2013)

Fourth epidemic started in Uganda in 2011 with EBOV cases. However, the diagnosis of EBOV from the patient who died was quick and in Uganda was installed Uganda Viral Research Institute (UVRI), where consecutive cases were tested and confirmed. For this period of time 21 reported out of 54 infected patients from Uganda and Democratic Republic of Congo died (CDC, 2016)

Table 4: Fourth EVD epidemic (2011 - 2013)

Year(s)	Country	Ebola subtype	Reported number of human cases	Reported number (%) of deaths among cases
2011	Uganda	Sudan virus	1	1 (100%)
2012 (June - October)	Uganda	Sudan virus	11	4 (36,4%)
2012 (June - November)	DRC	Bundibugyo virus	36	13 (36,1%)
2012 - 2013 (November - January)	Uganda	Sudan virus	6	3 (50%)

Source: CDC (2016), own processing

3.4.5. The fifth Ebola virus disease (EVD) epidemic (2014 - 2016)

The latest and biggest epidemic started in the end of 2013 where the first suspicion case appeared. 2014 was the critical year when the epidemic somehow affected many countries in the world. There were also found some cases in Europe and USA. However, the most affected countries were: Guinea, Liberia and Sierra Leone (CDC, 2016). According to the Table 5 this epidemics caused more than 11,325 deaths.

Table 5: Fifth EVD epidemic (2014 - 2016)

Year(s)	Country	Ebola subtype	Reported number of human cases	Reported number (%) of deaths among cases
2014 – 2016	Many different countries	Ebola virus	28 652	11 325
2014 (November - August)	DRC	Ebola virus	66	49 (74%)

Source: CDC (2016), own processing

4. THE FIFTH EVD EPIDEMIC

The fifth epidemic of EVD between the years 2013 and 2016 required a massive response from the international partners from different spheres, where the risk countries had be prepared for EVD and other threats connected with the health. The last recent devastation in Liberia, Sierra Leone and Guinea could be quite well recognized, however what could be less recognizable is the fact that people in these countries according to Frieden (2016): “more probably died because of Ebola than from Ebola”. Ebola epidemic interfered to the derailed programs to prevent for example some vaccine-preventable diseases, i.e. tuberculosis, malaria, etc. and other health care systems. Moreover the fact is, if the EVD had not been recognized and contained in Nigeria or Lagos, the disease most probably would have spread to other parts of the Nigeria, and possibly to other continents. Nevertheless, the response in these countries was supported from local and international organizations, where CDC could be mentioned which supported infection controls, border protection measures, implementation of technical guidance and many others preventive measures carried out against EVD outbreak spreading. Some of the key activities which could be mentioned are:

- support to management system in Liberia, Sierra Leone and Guinea to permit action to stop EVD,
- improvement of case detection and contact tracing to stop transmission of EVD,
- improvement of infection controls,
- promotion of safe and dignified burial serviced to stop spreading the EBOV, and
- assisting to state health departments, modelling a predictions for the course of epidemic, etc. (Frieden, 2016).

4.1. Epidemic of EVD between the years 2013 and 2016 in comparison with previous four epidemics

By the March 2016, a total of 28,646 of EVD cases were reported, from which 11,323 deaths were documented. In the epidemics control international partners were involved, for example in seven agencies from US operated nine laboratories, in other international

agencies that operated 13 laboratories with a performance of diagnostic tests. For a support from CDC, WHO, International Rescue Committee and many others were thousands of personnel. Apart of the main affected countries, EVD had also impact in other neighbouring countries, i.e. in Mali, Nigeria, or Senegal. Because of the transport of treatment from USA and Europe, with EBOV were infected some foreign aid workers, thus the disease was also reported in several overseas countries like Spain, US and Italy (Spengler, et al., 2016).

In that critical time period there had been many speculations why in this particular region and why in that time period started new EVD epidemics. Currently known EBOV appeared from possible recent ancestor from 50 years back. This fact might be because of the actual genetic bottleneck. When the EBOV was detected for the first time (in 1976), during the period from 1976 crossed Congo to the West Africa, thus before the biggest outbreak was evident of one non-fatal human case. However, associated by Tai Forest EBOV, that impacted death of one zoologist in Côte d'Ivoire in 1994 of infected chimpanzee. There is unclear answer to the fact that non-human primates and animals played main role within the spreading of EBOV across the Congo. There has been a linkage between fruit bats or other animal and eating it as a source of EBOV spillover. These information still does not have a clear answer (Spengler, et al 2016).

Some comparable facts are shown in Table 6 where aspects that differ from period between 2013–2016 outbreak and previous outbreaks are described.

Table 6: Comparison of previous EVD outbreaks to the 2014 West African EVD epidemic

Aspect	Previous Outbreaks	West Africa 2014 - 2015
Number of cases	Typically 100-200	~ 25,000
Number of responding countries, per outbreak	Usually 1	3 (plus ~ 25 imported)
Duration	2 - 4 months	> 1 year
Exported cases outside area	Extremely rare	Frequent
Community cooperation	Occasional resistance	Frequent resistance
Organizations responding, per outbreak	5 – 10	>100
Urban areas	Spared	Heavily involved
Number of Ebola treatment units employed, per outbreak	Typically 1 – 2	> 50
Number of diagnostic labs involved in response, per outbreak	Typically 1 – 2	> 50
Cost of response, per outbreak	< \$5 million	Nearing \$1 billion

Source: National Academies of Sciences, Engineering, and Medicine, et. al, 2016, own processing

4.1.1. EVD epidemiology in Guinea

- Date of the first confirmed case = March 2014,
- Number of confirmed, probable and suspected cases = 3,811 and
- Number of deaths = 2,543.

The beginning of the EVD epidemic in Guinea most probably started as a small outbreak in Guéckédou prefecture in late 2013. Identified cases were spread to the Conakry (the capital city) by March 2014. CDC and WHO staff started to work with Guinean government. In the April, the situation of epidemic seemed to be waning. However, new cases occurred again in bigger amount. Teams of the workers daily fluctuated from 2 to 38, for example CDC made around 568 deployments to Guinea by March 2016. The support from government was primarily technical that provided technical assistance through the pillars consisted of five activities. Each of them was led

by Guinean experienced partner; care and treatment by Medecins Sans Frontieres (MSF), surveillance by WHO, sanitation by International Federation of Red Cross (IFRC), communication with UNICEF, and research by a Congolese professor. By the teams were provided activities that focused on various supporting acts such as contact tracing, supporting case findings, contact listing documentation of chains of transmission, investigating cross-border movements etc. The next operators in Guinea that played role with EVD treatment were IFRC, MSF, Alliance of International Medical Action (ALIMA), African Union (AU) in collaboration with the Cuban Brigade (Frieden, 2016).

Initial unreported epidemic of EVD seemed to be waning. There was induced distrust among Guinean residents. This distrust of misconceptions in the country about EVD and distrust of the government, foreigners and lack of reporting caused in some cases hostility toward responders. Misleading situation “took its place” in September 2014. Local residents from village killed eight responsible workers in which were also comprised WHO workers, journalists and doctors. This event highlighted the dangerous environment for working, distrust of authorities, and atmosphere filled with fear. The response was to maintain the peace by using of security forces and by several approaches by Incident Management System (IMS). This consisted of such as working with village elders, deployment of social members from anthropology sphere, and engaging residents with the families in the villages. At the next stage there was done a door-to-door monitoring where contacts of EVD patients had daily temperature checks. However, inhabitants were not socially or physically restricted from travelling or other actions. Nevertheless, with the new chains of transmission Guinean National EVD Response adopted an approach that should have limited movement of contacts of EVD patients. To assure participation of community with the restriction of movement, there were provided some supplemental food and hygiene materials as well as essential medical services (Frieden, 2016).

The last EBOV transmission was declared by WHO on December 2015. The new case of EVD was reported again in Guinea in March 2016. However, there had been expectation of sporadic cases of EVD after the end of epidemic (Frieden, 2016).

4.1.2. EVD epidemiology in Liberia

- Date of the first confirmed case = March 2014,
- Number of confirmed, probable and suspected cases = 10,675 and
- Number of deaths = 4,809.

After the request from Liberia's Ministry of Health and Social Welfare for assistance in Liberia, member staff from organizations arrived approximately in the middle of July in 2014. Investigations focused mainly on magnitude of the epidemic outbreak and determining the extent. Activities among the healthcare workers included such as strengthening data system and reporting the situation, coordinating enhancement of laboratory capacity and providing overall support for all Liberian responses (Frieden, 2016).

The seriousness of the situation was recognized in the early beginning of August 2014, where the Liberian president declared a state of emergency. Moreover WHO termed EVD epidemic "a public health emergency of international concern". With the formation of IMS there were established following priorities:

- early detection and isolation of person who has an EVD,
- safe transportation of EVD suspected patients,
- support of infection controls to prevent transmission within the health care system and
- safe burials.

Although the setting of the strategic goals was implemented, in the strategy was not included treatment of patients within existing health layout. However, instead there was supported home based care but without usage of involuntary quarantine for contacts of patients. In Monrovia in the middle of August in 2014, the involuntary quarantine by authorities of impoverished community resulted in violence, thus was not supported and repeated again. Teams involved focused on supporting contact tracing and investigations of epidemic in remote areas and in all countries within Liberia which had on-going EBOV transmission (Frieden, 2016).

Designation of low-level transmission of EBOV epidemic in the country could be characterized by November 2014, where sporadic cases occurred in rural and remote

areas. Although it looked that Liberia will have a status “Ebola-free”, one new case occurred in March 2015 in Monrovia. The investigation that had been done showed that the patient probably acquired EVD via sexual intercourse with a person who survived after EVD that had in six previous months. WHO could call Liberia as free of EVD in May 2015, plus two subsequent occasions in September 2015 and January 2016 to have clusters or subsequently detected cases. Currently CDC and other member concentrated on laboratory capacity, prevention and controls of infections, on strengthening epidemiology and restoration of routine health services (Frieden, 2016).

4.1.3. EVD epidemiology in Sierra Leone

- Date of the first confirmed case = May 2014,
- Number of confirmed, probable and suspected cases = 14,124 and
- Number of deaths = 3,956.

In Sierra Leone the first cases of EVD were reported in May 2014. Process of transmission of EBOV had started early in the two east districts (Kenema and Kailahun) with result of affection of all 14 districts. Equally as in other countries, international worker groups were as a technical assistance for EVD surveillance, supported health service with prevention, case investigations and many other kinds of help and epidemic control activities. There had been implemented concept of “Ring Infection Prevention and Control” which was a strategy of CDC. Action supported plenty of actions. For example isolating, improvement of screening, use of better hygiene, and also decontamination practises that were used for health care workers and facilities that were in the highest risk of EVD infection. Furthermore, these activities were collaborated together with nongovernmental organizations, WHO and United Kingdom’s Department for International Development (DFID). In comparison with Liberia and Guinea, in Sierra Leone was established and staffed special laboratory by CDC for testing of EBOV. The capacity of laboratory had peak of 180 samples per one day (Frieden, 2016).

During the epidemic, organizations and other institutions cooperated among themselves. There could be named such as cooperation of ministries of health (MOHs), CDC, Ebola Response Consortium, Infection Prevention and Control (IPC), WHO, etc. Activities provided asked for 1,188 government clinics with around 4,264 of health care workers

who were trained on infection-control procedures including hand washing, temporary and waste management, screening, using of protective materials and equipment, decontamination and much more. There had also been done surveys and studies on effective vaccine or recognizing and understanding EBOV, generally activities to improve community engagement. The end of the epidemic in Sierra Leone was declared by WHO on November 2015. Two cases appeared in January 2016. However, effective implementation of controls and measurements stopped sporadic clusters to occur (Frieden, 2016).

5. TRANSMISSION THROUGH THE BUSH MEAT

Bush meat is general meat of wild animals with different types of mammals and sometimes including reptiles, birds and insects. Bush meat is traded in several forms, such as raw, smoked or preserved form. It is an important item of consumption of population in poor areas or inhabitants in or near the forests (Davies, Brown, 2007). Bush meat could contain various germs, which might cause sickness or illness of people, including EVD. Processing of bush meat brings people into the contact with the blood and body fluids of potentially infected animal and EBOV could be spread through this straight contact (CDC, 2014).

There have been still speculations about the origin of the EVD epidemic outbreak. One of them is eating bush meat. The first case of the EVD epidemic between the years 2013 and 2016 started in village in Guinea. Family of the death child confirmed hunting and eating of two species of fruit bats. For African families is buying of bush meat typical, but some of them buy it cooked where smoked or cooked bush meat should not be usually infectious. On the other hand, hunting or preparing the raw meat represents the highest risk for infection. This could be also called “eating meat society” because their task of the day is to eat the meat, otherwise they feel like they did not eat properly. Mellissa Hogenboom from Health Check compares this situation to the Europeans who eat rabbits and deer (Hogenboom, 2014).

Figure 3: Bush meat in the informal market



Source: CBSnews, 2017

Experts for a health believe that the initial cases of EVD epidemics have its start from the people who handle or eat animals infected by EBOV. This could cause transmission to other people through the contact with body fluids. As it was already mentioned, fruit bats, chimpanzees and other primates are cited as potential reservoirs of EBOV. Many Africans hunt animals for the meat. However, there have been some cases of human infections linked to the butchering, hunting and processing meat from animal, although none was eaten (The Associated Press, 2015).

5.1. Animals as the carriers

There are number of factors that play a role in the EVD epidemic such as social customs like traditional funeral practises, reliance on healers, and practise of eating wild animal meat. Contact between the human and suspected animal reservoir increased and it led to the phenomenon of zoonotic spillover, which is also factor that contributes on the transmission. Fruit bats as the most important reservoir and carrier is fed from the fruit trees and climate changes affect the growth of those trees. When a dry season starts, trees produce less fruits and that causes migration of fruit bats to the areas where the fruit production is higher. This reduces contact between the fruit bats and humans. However, there is an opportunity for interaction through fruit bat's guano that may end up on the fruits that humans eat or fruit bats could be hunted for bush meat (Ealy and Dehlinger, 2015). According to scientists, assumption index cases contract the EBOV from animal that can be carriers or they are sick. However, infected animals that are vectors or carriers are able to carry an EBOV within itself though not getting sick. The key part appears when infected animal comes in contact with other animal, such as monkey or humans, who can get sick of EVD. One way of EBOV spread is exactly this way, when vector animals can infect other animals or humans (Draper, 2002).

There was done experimental research on number of animals as possible carriers. Researchers have examined spiders, ticks, rodents, fruit bats, and monkeys. Because of the human similarity when monkeys get the EVD, they die and they are not effective as long-term carriers. On the other hand, in parts of Africa, monkeys are hunted and ate, thus monkeys might be a “conjunctive” host. Once the monkey is infected and is consumed, the infection EBOV is passed to the human (Draper, 2002). In the upshot, animal population living in the African forests including fruit bats, these animals can be classified as the reservoir for the EBOV. There is a possibility for the humans that live

near the border of these forests to be infected by hunting some of these animals that are carriers of EBOV (Richards, 2016).

5.2. Methods of hunting

There have been different ways how to hunt animal starting with snares, that are usually tied to trees and are able to capture animal around neck or legs. These snares are mostly used to hunt or poach animal for bush meat (antelope, gorillas). (Thewildlifemuseum, 2017). These animals can be however infected by EBOV.

Among other methods are counted trap nets. When animal is caught in the net, hunters then kill an animal. Moreover next methods are followed by pitfall traps (hole dug in the ground covered with leaves) and traps; these traps could be used to catch small animals. To hunt an animal are also used guns or arrows and spears. (Thewildlifemuseum, 2017).

According to a survey that was done in West Africa, the study found that fruit bats are widely hunted with several different techniques of killing which include netting, scavenging, shooting and catapulting. Some of the hunters reported the handling with live fruit bats where a possibility of contagion is even higher, because they often come into a contact with a blood, sometimes they are scratched or bitten, or they are contaminated with different fruit bat's secrets (Kamins, et al, 2015).

5.3. Preparation of meat and its risks

There are many methods how to prepare bush meat. Bush meat could be eaten sometimes raw (in special occasions), usually smoked, salted or dried on the sun. Smoked bush meat is available in urban markets in the most countries in Africa (Ntiamoa-Baidu, 1997). For some people it is a special treat, for example a soup from a roasted fruit bat is highly sought (The Associated Press, 2015).

Potential infected animal, which is hunted unfortunately does not show any outward symptoms of EVD, thus make good candidate from it for the hunter. Moreover, local communities do not have clear notion how to act safely. When the potential infected animal is hunted, EBOV supposes to be killed within the high temperature by cooking, smoking should make meat safer. Furthermore, people handling with wild animal are at risk of contracting the EBOV (Chastain, 2014).

Concrete overview of types and preparation meat could bring questionnaire survey that had been done among African citizens in chapter 9.

5.4. Reasons for the consumption of bush meat

In African rural regions, the problem is malnutrition that inhabitants face every day. To way for finding food and nutrition are either cultivation crops, domestic animals and hunting of wild animals. Bush meat has been the main source of protein and source of food since pre-historic times. It is preferred meat with high protein supply and had higher retail value in the urban market than meat from domestic animals. Although bush meat is source of protein in rural areas, urban households find also this type of consumption (Baidu, et al., 1997).

Consumption of bush meat is also determined by its availability, cultural prohibitions and socio-economic status. Some people are dependent on bush meat for the protein and cannot afford alternative source. For other people bush meat remains kind of luxury or delicacy and meat is eaten for special occasions (Baidu, et al., 1997). Despite all risks, bush meat is found as a source of protein and vitamins for many West African people (The Associated Press, 2015).

Bush meat is consumed mainly by Africans from rural areas. This bush meat consumption in West Africa will continue as long as the families and individuals will rely on the wildlife meat for income or protein. Unfortunately, no awareness or threat will cut this trade and substitute it by realistic alternatives. However, wildlife conservations with agricultural development effort to create protected and strengthening areas to ensure reliable harvesting and others and that is addressed to the bush meat alternatives (Tobiason, 2009).

5.5. Bush meat trade as a possible reason for epidemic

Bush meat trade including commercial hunting and selling wilds for money and meat is illegal. There appears the clear difference from subsistence hunting, which includes killing animals for sustenance for a village or family. This trade is involved for money (UNchronicle, 2014).

Great apes in Africa are under renewed threat resulting from the explosion in the bush meat driven by practises of European companies. Ape Alliance reported large illegal trade with bush meat where included endangered species are and developed into a major activity threatening survival of monkeys (chimpanzees, gorillas, and bonobos). This Ape Alliance is coalition that includes ape specialists and thirty four international organizations which take actions to save great apes (orang-utans, bonobos, gorillas and chimpanzees). This trade is dangers for animal species but also for humans, because the EBOV could be transmitted via ape's meat (The Associated Press, 2015). All the great apes, as were mentioned in the paragraph above, are basically endangered by private zoos, habitat destruction, hunting, illegal trafficking of apes and by human population growth (UNchronicle, 2014).

Nevertheless, not only wild animals are threatened by bush meat trade, also the people who do not take in mind the risk of their own health. UNchronicle (2014) just certifies that the increasing evidence of the danger to humans who handle with the flesh of a certain wild animal is high. The result is EBOV which devastated many areas of West Africa, through the transmitting by fruit bats, initially to bonobos, gorillas and chimpanzees. Apes might become infected from handling fruits which is contaminated by bat faeces, or by hunting the infected bats. Through this cycle EVD can be passed to the human (UNchronicle, 2014).

5.6. Overview of the hunted animals

Over 9,000 primates In West Africa are killed for single bush meat market every year. In spite of the law and researches against illegal hunting animals, they are still killed. This issue is problem for the whole Africa and other continents. Part of the West African Forest biodiversity hotspot has a large conservation priority and it is a home of many endangered primate species including West African chimpanzee (*Pan troglodytes versus*), Western red colobus (*Procolobus badius*), and Diana monkey (*Cercopithecus diana*). Hunted wild animals are daily imported to Daobly market, which attracts customers from whole country including towns that are 570 km far away (Mark, 2014).

There was done a survey by researchers from American university where the amount of meat traded at Daobly market was documented. During the three hour surveys, they recorded different species of all primates' carcasses (fresh or smoked) which were

brought in to the market via canoe from Cavally River (river from North Guinea to Liberia). Total number of animals was 723 which included 264 primates that were traded for restaurants or household consumption. Finally researchers estimated approx. 9,464 primates sold at Daobly market every year (Mark 2014).

5.7. Organizations against wildlife trade

Although illegal trade with wildlife animals is big, there have been set many international organizations. Many of them have similar base of their goals and action against wildlife hunting, trafficking, etc. Few of these organizations will be briefly explained below.

CAWT (Coalition against Wildlife Trafficking)

Organization seeks to address of increasing threats to wildlife from illegal trade and poaching and it is involved in any enforcement activities. CAWT partners work individually to achieve Coalition's goals. The aim is focused on political and public attention on ending the illegal trade with wildlife. CAWT coalition was initiated in 2005. Among one of their goal is for example reducing consumer demand for illegal trade, improve Wildlife Law Enforcement, etc. Members of organization pursue to educating consumers about alternative choices, improve wildlife legislation, raise awareness of wildlife laws, support effective implementation of the CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora), and many others approaches (CAWT, 2017).

WCS (Stand for Wildlife)

The goal of WCS is to conserve the world's biggest wild places in fifteen priority regions. The mission is to save wild places and wildlife through the education, science, conservation action and inspire the people to value nature. An approach is to use science and apply practical solutions on the ground that will be a cause of wildlife trade and hunting (WCS, 2017).

ABCG (Africa Biodiversity Collaborative Group)

ABCG group consists of seven international NGOs conservations (World Wildlife Fund, World Resources Institute, The Nature Conservancy, Conservation International,

the Jane Goodall Institute, African Wildlife Foundation and Wildlife Conservation) with a goal to collaborate effectively to have efficient and sustainable future for the Africa. The mission is through the challenges to strengthen and catalyse collaboration and work effectively and efficiency toward the vision of Africa. Vision is to have natural resources and biodiversity in balance with sustained human livelihoods (ABCG, 2017).

Another example of organizations against wildlife trade is Wildlife Alliance, World Wildlife Fund (WWF), Environmental Investigation Agency (EIA), and United for Wildlife, International Fund for Animal Welfare (IFAW), and many others.

5.8. Economic approaches

Current projects borrow from business sector, considered as a development or conservation. Projects borrow as much as possible and they are designed to provide economic incentive for a wildlife protection. For example conservation payments are broadly used in developing countries as a reason for increasing conservations on private land, while this type of system could involve individuals or communities paying for not using areas of wildlife habitat (for other conversion or farming) to not hunt wild animals (Tobiason, 2009).

Another type, as we can call it is conservation-oriented business models, where many businesses donate part of the revenues to the charity, however only few of them are created for the giving purpose and may be one is created especially for conservation and economic development wildlife (Wildlife Works). Wildlife Works helped Africans in rural areas supply Western commodity (t-shirts), by offering them alternative to their living. By exchange from part of 80,000 acre failing cattle range to build an EcoFactory for production t-shirts, that are sold in Europe and US. Sales can finance 56 full-time jobs in the community and finance development projects. The 80,000 acre ranch now provide key migration corridor for endangered wildlife (Tobiason, 2009).

5.9. Bush meat as a cause of EVD

Within the time period from first appearance of EVD in 1976 until the last biggest epidemic from 2013, spreading across Congo involved movement of EBOV through

fruit bats, primates or other animals is not clear for 100%. Contact with fruit bats or eating bush meat (fruit bats, monkeys, chimpanzees) has been related to presumed source of EBOV spillover. But how big role play bats and initiation of human disease is not clear. Epidemic between years 2013 – 2016 recorded fruit bats in spillover, however is limited to reports between villagers in Guinea and fruit bats. Studies showed that: “no epidemiologic or genetic data associate a putative reservoir species with the current outbreak” (CDC, 2016). Unlike MBGV (Marburg virus) EBOV, according to CDC (2016): “has yet to be isolated from bats, and no direct evidence links bats to EBOV infection in humans. Regardless, epizootic spillover remains the most widely accepted theory for how the outbreak began” (CDC, 2016).

Studies that do experiments of infections indicated that the share of the EBOV in animal that died on EVD was high; however proportion of the EBOV in healthy reservoir in slaughter form was much lower. Moreover, to identify significance of model of EVD by traditional experiments does not have to be clear. Thus, viral spreading through the excreta or virus in body of reservoir might provide initiation of virus spillover. Most EBOV epidemic outbreaks appeared with a one initiating spillover which was followed by human-to-human transmission. On the other hand MBGV outbreaks had initiation in multiple spillovers, this difference may reflect different primary reservoirs of MBGV and EBOV (CDC, 2016).

6. IMPACT OF EBOLA VIRUS DISEASE (EVD) IN WEST AFRICA

The latest biggest epidemic of EVD was taking a place in years 2014 and 2015 where in West Africa the epidemic was the largest that was ever recorded. Specifically on December 2015 in Liberia there were recorded 10,675 cases with 4,809 deaths. However overall number through the world reached 28,637 cases and 11,315 cases were marked as deaths, mainly in Guinea, Liberia and Sierra Leone. Although other countries were affected either, for example UK and Italy with one case without deaths, USA with four cases and one death, Nigeria with 20 cases and eight deaths, etc., the following West African countries were affected the most (Perry and Debbey, 2016). On the Fig. 4 are shown the most affected areas. The darkest colour remain areas with 501–4 000 reported cases.

Figure 4: Number of cumulative confirmed EVD cases during the 2014–2016 Ebola epidemic, Guinea, Liberia, and Sierra Leone, in March, 2016



Source: CDC, 2016

6.1. Guinea

On March 25, 2014 were reported first cases of EVD in Guinea. The information came with approx. 86 suspected cases, where about 59 of them were resulted in death. The actual outbreak is attributed to two year-old girl who died in a village of Meliandua on December 2013. Some members of family and health care workers had contact with her or her family. However, one health care worker who was already affected activated the further spread of the virus to other districts of Guinea (Perry and Debbey, 2016).

Data up to 27 March 2016, according to WHO shows, that in Guinea were reported 3,811 cases and 2,543 deaths (WHO, 2016).

6.2. Liberia

Two waves of epidemic of EVD faced Liberia, where the earlier one occurred in the rural town Foya in March, 2014. In the following period of 21 days Liberia did not report any new EVD cases and international community just believed that the EVD stopped and they did not consider it as a problem anymore. Nevertheless, the second wave in Liberia came to the capital city of Liberia – Monrovia, where almost 30% of its inhabitants live. Stricken by the EBOV were health care workers, doctors, hospitals, health care centres and others. EVD was merciless (Perry and Debbey, 2016).

Data up to 27 March 2016, according to WHO shows, that in Liberia were reported 10, 675 cases and 4, 809 deaths (WHO, 2016).

6.3. Sierra Leone

In number of total cases, Sierra Leone counted the largest number but in contrast had the lowest mortality rate that was below 50-90% deaths cited for infecting with the species of Zaire EVD which was based on earlier epidemics. However, in the social international media there was publicized up to 90% of fatality in early days of epidemic (Richards, 2016).

Data up to 27 March, 2016, according to WHO shows, that in Sierra Leone were reported 14, 124 cases and 3, 956 deaths (WHO, 2016).

6.4. Impact of Ebola virus disease (EVD) in different spheres

6.4.1. Economic impact

The latest epidemics required for suffering many deaths, where impacts on affected countries are relevant. The prices of commodities were increasing, together with provender (food resources). Moreover, unemployment rate increased because of the epidemic, the number of free working places was very low, because of the free movement of people among some countries to prevent spreading of the EBOV. Prevention against spreading of EBOV was also suspending of flights. Slowing down of the consumption of goods forced the enterprises to decrease working schedule and time. To dismiss of employees to be able to keep business sustainable was also needed. Trade between the countries was stopped, which brought about decline of financial source for suppliers. Overall impact of changes in consumption structure had also impact for the international trade, where regular trading partners had to be deflected from the negotiation with the countries that were affected by EVD, because of the new rules asking for prevention and changes in logistic (UNECA, 2015).

When it comes to numbers, costs on Gross domestic product (GDP) are high. Findings that were revealed in earlier results in Guinea, Liberia and Sierra Leone were pronounced by EVD fatalities. In so-called medium term between 2014 and 2017 gains seemed to be reserved. Losses ranges (in average) in low scenario (4.9%) to high scenario (9.6%) for Guinea; 13.7% ranges to 18.7% for Liberia and 6% to 8% for Sierra Leone. However, according to UNDP (2015), remained Sierra Leone faced in highest scenario US\$219 mil., followed by Liberia with US\$188 mil. and Guinea US\$184 mil. The high scenario shows the range in US\$315 mil. in Guinea to US\$245 mil. in Liberia. Sierra Leone could lose as much as an annual average which counts around 7.1% between 2014 and 2017. These and other economic losses enable affected regions to catch up with other countries. These losses in GDP can also implicate to the jobs and have impact on households (UNDP, 2015). Update from the World Bank in 2016 brought following summary. An impact of EVD outbreak in 2014 and 2015 on economy in Guinea, Liberia and Sierra Leone was estimated at \$2,8 billion. When it comes to concrete division; \$300 million of finances came for Liberia, \$600 million for Guinea, and \$1.9 billion for Sierra Leone. In these sums are included projections for 2016 and crisis in 2014 and 2015. Moreover, the situation was worsened by decline on

world commodities, for example prices of iron, gold and bauxite have declined by 30% to 60%, also issues in mining for Sierra Leone and more others (Worldbank, 2016).

6.4.2. Socio impact

From the socio point of view, the primary impact caused by EVD epidemic, is high increase of infected people and higher mortality. With respect to seriousness of the virus the epidemic of the EBOV is highly death demanding. Treatment for patients requires a special and complex method that needs special training and special equipment. Victims of EVD during the last big epidemic caused somehow strain for sanitary budget and made a pressure on health care systems that affected regular providing of services. Moreover, the risks that EVD brought increased mortality on diseases that are not connected to the EBOV, but have similar or combined effect on treatment. Another problem was fear of citizens to ask for a help because of the fact that they could be exposed to EVD. Poor health care system can affect ability to treat other diseases that occur in the countries, such as dengue fever, malaria, yellow fever and other. However, the highest possibility to get infected was mainly for the doctors, health care workers and personal working with infected people. The extensive part of the deaths did belong to them (UNECA, 2015).

During the EVD epidemic approximately 16,600 children from Guinea, Liberia and Sierra Leone, lost one or both of parents, and around 3% of them had to be placed out of a family or community. This show strengthens of relative connections. On the other hand, in some communities the fear from EVD was stronger than family where some of the children were, because of the EVD, abandoned (UNICEF, 2016).

6.4.3. Socio-economic impact

Africa was facing up to now the most devastating epidemic in 2014 for all of its history. All medical services and cares in the most affected countries (Guinea, Liberia and Sierra Leone) were not prepared and equipped well for the dealing with EVD. Doctors and medical workers were informed about EVD, however because of the similarities which EVD brought was comparable to other virus's diseases. The treatment, prevention and statement of EVD was too slow. The general procedures that had been done including basic hygiene, cultural traditions of taking care on ill relatives

and handling with deaths related to funeral traditions, which can cause the transmission of the EBOV. The seriousness of the epidemic crisis and poor identification of the problem led to scarcity of medical staff together with hospital beds. Furthermore, EVD epidemic precluded identification of other different diseases. This latest EVD epidemic had impact on socio-economic sphere that stopped development of the named three West-African countries (UNECA, 2015).

EVD also took people to bigger poverty which makes them more vulnerable. The elasticity of poverty growth in 2016 in Guinea, Liberia and Sierra Leone should remained 49.8% in Guinea in comparison with 31.2% in Sierra Leone and 63.5% in Liberia. But EVD changed this trend and baseline got to worse values. Supposed values were for Guinea from 2.3% in 2014 increase to 7.9% in 2015, for Sierra Leone between 13.8% and 14.1% and between 5.5% and 17.6% during 2014-2015 (UNDP, 2015).

6.4.4. Impact on politics

Impact of EVD affected global political environment together with several countries. Inadequate response and poor organization of government created distrust, criticism and political sphere has changed. Guinea, Liberia and Sierra Leone's citizens were scared for their safety and could feel instability and threat. Moreover, country still has been struggling from the political instability and consequences from civil wars. Epidemic affected operational and political hierarchy in these countries (Qureshi, 2016).

Political infrastructure in Sierra Leone was affected quite seriously. Some parts of the damage infrastructure belong for example to restrictions of movement of individuals, limitations to travel and constraints on the people's rights of assembly. Government in Sierra Leone stopped with financing of services and facilities that were not directly connected to EVD, which the situation made worse. Consequence of this access caused big criticism of government. Citizens wanted to president Ernest Bai Koroma to handle the situation. Moreover, the Ministry of Health Sanitation (MOHS) faced also a lot of criticism. The situation from June 2014 was really weak and within the increase in mortality, minister of health Karbo was removed from the office. The situation of EVD was everywhere that the assistance had to be find from outside source to handle the crisis. However, improvement from governance came when President Koroma started to hand with Ministry of Defence. Some improving steps were done, such as increasing

presence at isolation units, treatment centres, support of development, tried to balance education balanced and other improvements (Qureshi, 2016).

Situation in Guinea and Liberia was similar. The lack of trust in government was visible. Because of slow response and uncertainties during the EVD epidemics, several aids workers, investors and skilled employees started to leave the country. Even the pleases from Liberian minister of finance to citizens asking for assistance did not stop them. According to Qureshi (2016): “Concerns regarding political and social unrest leading to coup and civil war still prevail” (Qureshi, 2016).

6.4.5. Impact on Education

Educational services were also restricted by the focal point of EVD. Economic losses from the education had to be covered from the state budget to provide salary for professors. Even worse impact could affect those, who were forced to leave the education (schools) and were not able to come back. This could affect productivity for them in the future. To bring students again to the schools will ask for high supplemental investment to ensure education system as it was before EVD epidemic. In Liberia, Sierra Leone and Guinea were all schools closed from June 2014. Opening the schools again passed off in January 2015 in Guinea, in February 2015 in Liberia and schools in Sierra Leone were opened again in March 2015 (UNDP, 2015).

6.4.6. Impact of health system deficiency

When it is started with governance, the slow response to the epidemic of EVD and implementation of plans has diminished trust from people and efforts were limited. Also the financing part was thoughtful because there was not enough financial resources and commodity shortage to pay local health personnel. However, not only shortage of health of personnel but also supporting staff, statisticians and other important workers who would know how to prevent and treat EVD had missed. With the problem is also connected insufficient supply of protective equipment and closed health facilities in Liberia and Sierra Leone. Lack and limitation of capacities ruled out the control of the EBOV (UNDP, 2015).

7. ROLE OF EXTERNAL ACTORS ON EBOLA VIRUS DISEASE (EVD) OUTBREAK

In spite of the facts that were found, the role of media could misrepresent the reality. Sometimes the style of coverage and broadcast of the epidemic brought unnecessary fear for people. Media has thrown the scenario of killing, spreading and no vaccination or drugs. The coverage about EVD by media was sometimes unbalanced during the outbreak in 2014 was mainly debated (Yusuf, et. al., 2015).

Unbalanced media coverage was filled with sources that brought panic in various parts of the world. However, coverage of local media provided piece of benefit for some regions that were experiencing EVD. Coverage by local radio, TV or social media raised some level of awareness of people, who do not have access to internet, electricity, etc. Locals were at least informed by this way about the danger and some preventive measures. On the other hand, while private and government media were broadcasting live, and programmes were running by professional health and medical experts, the real and true symptoms, causes, prevention, controlling measures and true information were given to public. By the other side, social media supported the message about spreading and situation as well as own media, but solutions and information were non-professional and sometimes unsupported by evidence (Yusuf, et. al., 2015).

The intensified fear of EVD had spread through the different social media (facebook, twitter, etc.). Because of the misinformation from non-professionals the hysteria resulted in protesting or attacks against health care workers. Threat did overrun also neighbouring African countries and subjected to fear from sitting beside Africans to travelling to any African country (Yusuf, Yahaya, et. al., 2015).

Today's world is surrounded by social media, which are widespread and use its own scenarios to benefit from it. This brings non-professional information and cause panic. Moreover the outbreak of any problem could increase even more.

8. METHODOLOGY

8.1. Organization of the thesis

The thesis is divided into several chapters, where the beginning part is introductory with the literature research in which basic information about the terms related to the topic – information about EVD, its symptoms, types and treatment are included. Third part describes transmission and prevention and show more about the EVD. In the same chapter West African countries that were the most affected (Guinea, Liberia and Sierra Leone) are introduced. The brief overview is also done on the five EVD epidemics.

The next part describes situation in West Africa during the biggest epidemic between 2013 and 2016. In selected countries epidemiology and some situations during the outbreak are shown.

Fifth chapter is mostly related to the bush meat and aspects connected. Furthermore in this chapter paragraph examining effect of bush meat on the epidemics, how the bush meat is traded and what is its value is included.

The next chapter deals with impacts in different spheres, that last EVD epidemic caused.

Lastly the final part belong to the discussion, conclusion of situation, to the research and possible implications for prevention.

8.2. Research design and data collection

Thesis focuses mainly on EVD transmission, its primary sources that could be from the bush meat or other sources and final impacts. The part of the study looked mostly on the latest biggest epidemic between 2013 and 2016. During the ascertaining there were studied other factors that can cause transmission out of the spreading through the bush meat. Source data used for the study were from the biggest part secondary data with sources such as books, articles, academic papers, journals, statistical data and other internet sources.

Furthermore, there was applied research quantitative method with particular focus related to the study, concretely to detect eating and hygiene habits of African

population. These information could be related to the transmission problems and possible infection through the bush meat. For this purpose of quantity data collection was set questionnaire for people with Africa as a country of origin. Total number of respondents collected is 53. Survey was conducted to students and people mainly from West African countries where there were included small village as well as big towns and cities. Research took place over four months. Questionnaire had several parts where the division was based on personal information, eating and hygiene habits, and small part did belong to EVD. Whole research was mainly done to get know the African style of dining and things connected, rather more than EVD causes. Questionnaire was not a key part for the thesis.

Respondents could provide basic information about their age, religion, country of origin, occupation of parents, where these answers could help to allocate the concrete family into a notional social group and thus able to assign other answers to the group. Respondents were also asked on questions related to eating habits, especially how do they prepare meat, what equipment do they use, what kind of meat they buy or where they buy the meat. These questions were important to find out the African habits that could be connected with bush meat and possibility of infecting. The last part did belong to knowledge about EVD. Structured questionnaire applied was distributed online on the social websites among African groups and individuals.

8.3. Data sampling and analysis procedure

Quantitative data were sampled from the data base of WHO, CDC, UNDP, and other statistical sources. The research looked mainly in time series specifically the years between 2013 and 2016.

8.4. Definition of Terms

In the paragraph below there are some basic terms presented that are connected to the key topic and progression of the disease (infection) and the individuals that could be characterized also as the host.

- **Epidemic disease:** it is a human disease that usually occurs in massive way and is spatially and locally limited on certain country or region.

- **Epizootic disease:** it is animal disease that usually occurs in massive way and is spatially and locally limited on certain country or region.
- **Epidemics:** rapid spread of infectious disease to a large number of people in a given population within a short period of time.
- **Bush meat:** meat originated from non-domesticated animals that are hunted in the nature.
- **Causative agent:** living organisms such as bacteria, viruses, algae or parasites and their products (toxins) able to cause the disease.
- **Reservoir animal:** animal that is highly dangerous transmitter of a disease that spreads the disease but also causative agent that reproduces the disease.
- **Spillover animal:** is an organism that gets infection after the contact with the causative agent of the disease, but does not break out the clinical signs of the disease. After some period of time the disease is deactivated and cannot be spread to other host organism.
- **Infection:** process in which causative agents enter organism of host (human or animal), develop parasites, reproduce algae, bacteria or viruses.
- **Infectious disease:** causative agents of disease are transmitted from infected individual to another which is susceptible.
- **Infected individuals:** can be animals and/or humans clinically ill with symptoms and progression of the disease, or can be in the process of reproduction without symptoms, or be carriers of the causative agent of the disease.
- **Incubation period:** time between the moment of infection of individual and appearance of first clinical symptom of the disease.
- **Source of disease (infection):** infected animals and/or humans representing reservoirs of causative agents or they are viral carriers (see below).
- **Viral carrier:** organism that is contracted with the infectious disease but displays with no symptoms, however EBOV to other sensitive host including humans and non-human primates can transmit.
- **Ebola virus disease (EVD):** infectious disease characterized by many symptoms: fever, vomiting, diarrhoea, internal bleeding and many others connected with damaged blood vessels.

9. RESULTS

In total, questionnaire was opened by 338 respondents but only 53 (17.7%) respondents finished questionnaire completely. Type of answers can differ from age and particular area and region.

General information about targeted group

The average age of all respondents was 26.1 and 45.3% of respondents were women and 57.7% men.

Focused group mainly come from Ghana with 55% of respondents, however there have been recorded answers also from Nigeria, Uganda, Tanzania, Benin, Zimbabwe or Eritrea. Respondents were from the smallest villages that counted around 600 inhabitants, to the capital city of Ghana, Acra.

Information about education of parents was important for classification of respondent to the social group. When it is come to basic education of mother, 19 responses (35.8%) stated that education of mother is basic education. The same amount (35.8%) has secondary cycle education and tertiary education have 15 (28.3%) mothers of respondents.

Education of father of respondents has slightly different aspects and it is higher. Basic education's rate counts eight responses which is 15.1%, secondary cycle is more than twice bigger and counts 35.8%. The most respondents (26, 49.1%) presented, that father's highest reached education is tertiary.

For the next type of questions had to be filled occupation of parents. The most frequented and repeated occupation of respondent's mother was housewife with rate of 40% responses, teacher (15%), and other different profession, such as cook, trader, receptionist, cleaning lady, business women, street market seller, accountant or shop owner. Occupation of fathers differed for a bit, which can be caused by higher level of education. Profession were different and sameness were found in farmers (9 respondents, 17%); however other types of occupation occurred, for example lawyer, salesman, director, engineer, police officer, diplomat, land owner, accountant manager in bank or IT expert.

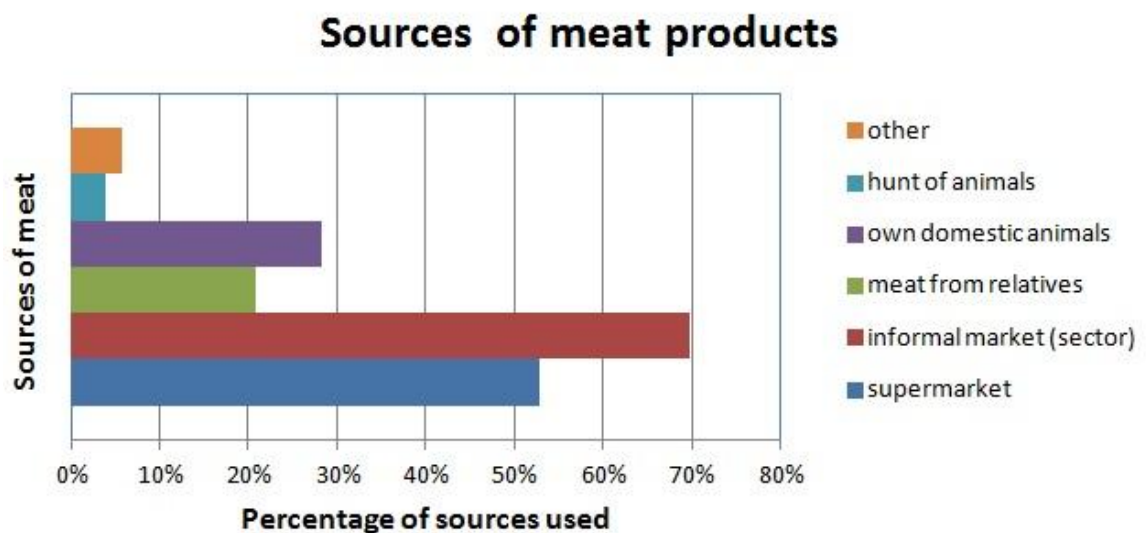
Religion part could have been connected to the rate of answers in consumption of meat. The biggest part of respondents (75.5%) stated Christian religion 13.2% Muslim religion and the rest which is 11.3% is atheist.

Consumption of meat and source of acquiring

In the next phase of a survey emphasis was put on consumption of meat, started with place of buying meat also with types of meat that are consumed. The Fig. 5 shows that the highest percentage of buyers (69.8%) buy meat products on informal market and in the supermarket (52.8%), however quite considerable share have meat from relatives and have own animal. It is needed to mentioned, that 3.8% of respondents indicated that they sometimes hunt animals. The rest of answers can be included into informal market.

In the following three types of questions it was possible to choose multiple choices.

Figure 5: Place of buying raw meat

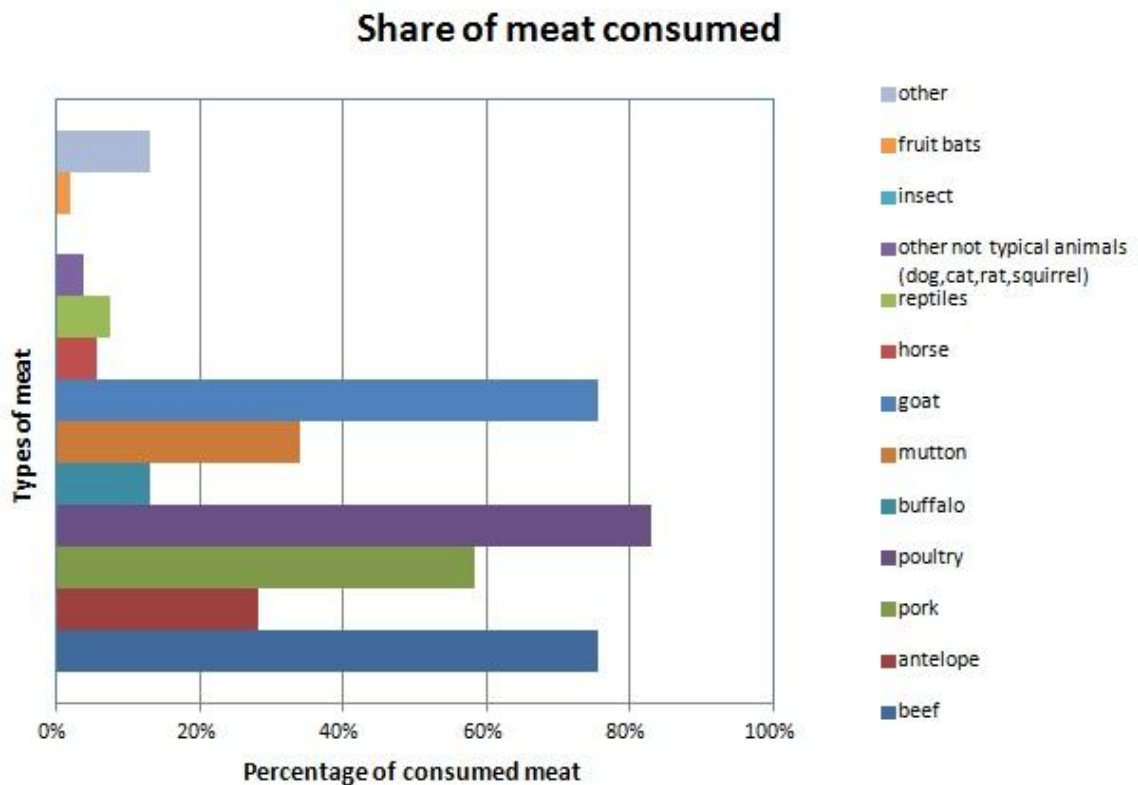


Source: own processing

Exact types of meat are described in the Fig. 6. Types of meat eaten, could be influenced by religion. However most of the people consume poultry meat (chicken turkey, goose and duck), beef (75.5%), pork (58.5%), and big percentage of respondents eat goat meat (75.5%). Survey also found some people who eat antelopes and counts 28.3% of respondents, buffalo 13.2%, 5.7% of people eat horse, and other such as

reptile meat or other not typical animal. Share of students with other answer reported eating of fish, snail or lamb. An interesting fact is that there was one from all respondents who eat or had eaten fruit bats.

Figure 6: Types of consumed meat



Source: own processing

Connected to the consumption is style of eating. 22.6% of respondents responded that prefer eating by fork and knife, 30.2% prefer eating by hands and the rest 47.2% most likely prefer eating by both options.

For preparing the meat special knife for row meat (67.9%) and cutting board for meat (67.9%) are usually used, special fork for meat 20.8% of respondents and special gloves for meat 5.7% of respondents used.

Preparation of meat could also affect structure of meat. The survey showed that from respondents 84.9% prepare meat by boiling, and 77.5% of respondents fry the meat.

There is also popular steaming (66%), smoking (52%), broiling (28.3%), 26% Africans prepare some kind of meat by drying on the sun, and 5.7% says that they sometimes steam with leaves under the ground and in some special occasion eat raw meat.

Storing of the meat is done most respondents by the freezer or fridge (81.0%), and the rest of respondents is meat let dry (3.8%), and the rest do not store the meat.

An interesting part of the questionnaire came when respondents had to answer if they have some special tradition related to raw meat of blood of animal. A total of 49 respondents (92.5%) stated that they do not have any; however four people from all respondents (7.5%) have some special occasion or habit of eating raw meat, concretely washed raw meat in salt water. One respondent from Ghana gave exact example: "We eat raw meat with hot spice and sometimes alcohol, specially wine".

Hygiene and medical care

The next part belongs to hygiene. A total of 44 of asked (83%) washed hands with water and soap and the rest only with water (17%). Drying of hands has been done by 71.7% with towel, 22.6% let dry hands by air and 5.7% of respondents dried hands just by t-shirt or jeans.

The last part is more about the healthcare service and knowledge about EVD. An average distance of respondents to the closest medical centre is 1,5 hour, where according to the respondents, 37.7% have good health care in their country, 26.4% think that they have very good medical care. On the other hand 24.5% of respondents see satisfying health care, and 5.7% think that care seems to be excellent, same as 5.7% of respondents feel that medical care is unsatisfying.

Situation on EVD

Because the questionnaire was not related directly to the EVD, there are only few information about how respondents see EVD.

A total of 56.6% of asked respondents, know only important general information about EVD, 20.8% presented, that they know almost everything about EVD and 12 respondents which is 22% have not many knowledge about the EVD.

There have been put a question to respondents if they know anyone from relatives or friends who had EVD. From all, 98.1% did not met anyone, however on respondent from Ghana cited, that her cousin had EVD.

The last question was related to the fact if “Ebola crisis” impacted somehow their village or town. Almost all respondents (94.3%) answered negatively. However 5.7% answered either that EVD killed many people where included response from Uganda was: “Just stigma and phobia in the city, as well as taking of precautionary measures as echoed by the government”.

10. DISCUSSION

The first case WHO reported was on March 2014 in West Africa in rural region in south-eastern Guinea with borders of Sierra Leone and Liberia. In these regions were many unrecognized chains of transmission that took its place for several months. Evolving outbreak could be assigned to lack of surveillance systems and other public health. The fast expansion of epidemic to rural areas affected treatment capacity and limited isolation, which led quickly to poor infection control. Transmission in health facilities was increasing and resulted into a collapse of health care systems. Poor surveillance and reporting the disease got out of the control what resulted in an outbreak, especially in areas difficult to reach (Frieden, 2016).

This could be signed as a fatal step that caused expansion in this big scale. West African countries have not experienced EVD before and this could be a reason of unpreparedness. When the EVD appeared, inhabitants connected EVD with other disease that have similar symptoms and are typical for the region (malaria).

By end of July 2014, EVD reached populated capital cities and urban areas of all three countries and case counts still had been increasing (Frieden, 2016). Moreover, various factors made containment of EVD difficult. As it was already mentioned, health systems in Guinea, Liberia and Sierra Leone were not prepared for EVD epidemics. The lack of required tools such as ambulances, drugs, trained personal etc. was key factor for the crisis. Also the beginning misdiagnose of EVD enabled continuous transmission. Moreover, according to UNDP (2015): “some people thought that the disease was being spread by the government resulting in underreporting and thus contributed to the silent spread of the virus, which remained hidden and eluded containment measure” (UNDP, 2015).

There have not been found any straight proofs, how the EBOV was spread and why came just that time period, the topic could be speculative. However this detecting was not a main aim for the thesis.

Speculations about the difference between previous EVD epidemics and epidemic between the years 2013-2016 were also appeared. Some theories observed that last epidemic was focused on rapid mutation of virulent EBOV strain. However, next analysis showed that overall EBOV substitution rate was identical with previous

outbreak's rates that were in Central Africa, thus changes of the EBOV are not related resulting to the epidemic. More likely the result could come from external factors. Even when the differences of EBOV strain of outbreaks do not explain magnitude of the epidemic, the conditions in West Africa were poor. Because of the decades of civil war extremely poor areas had been still recovering from the war. Consequences that war brought were bad infrastructure, civil instability, struggling of healthcare system and others, made Guinea, Liberia and Sierra Leone easily "unsafe". Moreover, these three mentioned countries had never experienced EVD before, in comparison to other African countries from previous outbreaks. Guinea, Liberia and Sierra Leone experienced similar epidemic diseases for example malaria, which had same or similar presentation as EVD. Delay of identifying the EVD led to quick and frequent human-to-human transmission and outbreak was transformed to epidemic (CDC, 2016).

The probability of taint was and still is even bigger in less developed countries, because the lack of education and prevention, which can lead to higher number of tainted people. In developing countries for example in Africa, the number of members in families is huge and the spreading of diseases is quite common. Although in hospitals where the care should be good, the hospital environment do not have to be without germs, and mentioned needles and lack of proper equipment has contributed for spreading disease.

Poor health care together with not-professionally skilled workers, working in unfriendly environment and others led to quicker spread of EVD. Countries did not know for the long time that the disease that appeared is EVD, thus the countries were not prepared well for the disease.

EVD is very dangerous because if the illness cannot be recognized and just keep spreading for the various reasons for example as it was already mentioned, doctors do not figure out the EBOV or the spreading is uncontrolled. There appears threat of spreading outside the localized area, and the risk become as the global problem. Pandemic and illness can affect whole region, continent or whole world (Stimola, 2011). There are different type of transmission including animals.

Animals are usually slaughtered and often infected with EBOV which is linked to consumption the meat. African countries, especially in West Africa bush meat is from primates considered as a delicacy. However, the main reason is the lower cost of meat.

(The Associated Press, 2015). This could be case of less developed countries as it was in case of Guinea, Liberia and Sierra Leone. Although the survey from questionnaire confirmed that raw meat is eaten in special occasions, the research through the thesis did not confirm bush meat as a 100% primary source of transmission. However, awareness about transmission and how to handle with raw meat would help to possible next epidemic. As well as other intervention to prevent any other expansion of epidemic in big scale which were confirmed by statistical data.

Although the statistical data used from WHO and CDC in Atlanta (USA) are not identical, there are some unreported cases of infection and deaths (underreported incidence of EVD). It is needed to say that numbers explained in this thesis reflect only laboratory confirmed cases. Moreover the survey questionnaire used was not a key part of the study. Some respondents could give unreliable information, because questionnaire was based mainly on hygiene and eating habits that could be sensitive topic for someone. Interviewees have been deployed in Ghana, Uganda, Nigeria and other African countries. Low rate of answers and respondents could be because of the specific target group and could be because of the sensitive questions for someone.

Nevertheless, EVD epidemic between 2013 and 2016 could be as a warning for the other possible outbreak of any disease and could increase preventive controls and measures.

Current situation was described by Dorothy H. Crawford in her book *Ebola: Profile of a Killer Virus* from 2016 describes her arrival to Freetown in Sierra Leone in April 2015 where the atmosphere was electric. It was hard to believe but she found there clear optimism everywhere around. EVD epidemic which had been raging for several months was coming under the control, which led to function of markets and schools again. However, no one forgot on that fact that country was held in deadly epidemic. She explains how the controls and washing hand in chlorine solution was provided even before the entering the airport and among other actions filling a long health questionnaires was also part of controls. The procedure of washing hands and measurement of temperature was taken many times during Crawford's stay. No one was allowed enter any building such as supermarket, offices, and hospitals before this ritual. Even the streets were filled with the reminders against the EBOV, for example ABC- Avoid Body Contact, NHS-No Hands Shakes. Town was full of response teams from

such as WHO, UNICEF, different centres for diseases, Oxfam and others NGO's. Furthermore, during the stay Crawford visited some politicians and people from different spheres and from all the corners came the fact that the country just wants to rid of the EVD (Crawford, 2016).

Today's world is surrounded by globalization and the world is connected in different spheres, either via social medias, trade or through the tourism, the importance of security and mainly health security is necessary. An epidemic between 2013 and 2016 with sporadic cases should have had response from the international capacities for the possible future origin of the EVD. Attention should be addressed to controls and prevention measures to prevent civilization from the outbreak in this scale.

11. PROPOSAL FOR THE PRACTISE

The recovery of infected countries will take a few years further and preventive measures have to take its importance. Necessary step is to build the trust between the society and the government. New recovery intervention from the government could help with the trust of citizens. Some preventive measures that could be done are following:

- promotion of safe burials of death patients,
- proper equipment for handling with infected patient (gloves and proper clothes),
- good hygiene including washing hands,
- monitoring of person with same or similar symptoms as EVD,
- early determination and treatment,
- avoiding of eating raw meat and reduction of eating bush meat,
- protected handling with raw meat,
- awareness about unsafe sex,
- maintaining of clean environment (hospitals, health care centres) and using, sterile syringes and needles and
- improvement of case detection system and controls.

12. CONCLUSION

In spite of sporadic cases and four bigger epidemics, the biggest EVD epidemic outbreak was in 2014 and 2015. This EVD epidemic affected mainly Guinea, Liberia and Sierra Leone, but was also spread to other continents with few cases.

Impact of EVD in West African countries was not only on mortality, but affected different spheres starting from political, economic, or social sphere. Social change was and still is recognizable. Many children lost their parent and families are now uncompleted. Impact on politic caused such as distrust and panic among the citizens. Moreover, economic impact affected either whole country as well as individuals. International trade decreased and EVD epidemic was also costly. Basically said, epidemics caused almost all sectors in all three the most affected countries.

However, the EVD in West Africa was significant event and all countries have edified experiences for the next possible EVD epidemic outbreak. Government's attitude was not thought-out well, in case of decision that was done. Government should prepare a plan for similar cases or epidemic. The same preparation applies for economical sphere, whereby decision about spending money was not effectively divided. In this case would be reasonable to prepare special fund for this type of occasion. Communication in social sphere failed which caused the panic among the citizen, thus the awareness about the EVD or other common diseases would help to solve the situation and reduce panic.

Although the impact in Guinea, Liberia and Sierra Leone was perceptible, each country had different development of EVD and final impact on the country. The noticeable difference was in number of deaths in each country, for example Sierra Leone had the highest number of deaths, in spite of the outbreak started in the country as the latest one.

There have not been found exact evidence of start of the latest biggest outbreak in 2014. However, the transmission types of EBOV are different. One of the possible way is through the bush meat. There could be found that there is also high bush meat trade, which is possible way of transmission of EBOV. Fortunately, some international organizations focus on decreasing this trade and fight against hunting of animals. Bush meat could be the primary source; however the highest possibility of spreading is human-to-human transmission. This type of transmission was the case of the epidemic in 2014. Although the possible infected animal (fruit bat, chimpanzee, etc.), is a primary

source, the possibility of spread from animal to human is low. The highest possibility of infection which can lead to epidemic is human-to-human transmission.

Questionnaire used, was as a supplement for the thesis to found out eating habits and hygiene connected with consumption conditions. Most of the respondents mentioned, that the mostly buy meat from informal sector and supermarket. They usually eat by hands and also with fork and knife. Beef, goat, poultry and pork prevailed in meat consumed and are often well prepared with higher temperature. However, 7.5% of respondents out from 53 in total specified, that they eat raw meat in special occasion.

It was found, that possibly infected animal have EBOV in raw meat and while the meat is prepared with high temperature, EBOV is killed, thus there is a confirmation about possibility of infection through the bush meat.

The reason for the latest epidemic in that big scale was the unpreparedness of countries: either from the medical side or from the late solving of problem from the government or late recognizing of the EVD which led to the fast expansion and brought impact for West Africa and even whole world.

The role of medias played a significant role while informing public about the situation. Presented information about the situation were exaggerated and cause panic among the people, not only in West Africa but also in other continents. On the other hand, influence of medias in area of epidemic, helped to clarify situation of local inhabitants about what was happening.

For the future research in this field it would be useful to create a detailed plan for government and institutions about how to react or deal with same or similar situation. The quick recognizing of EVD is necessary for the prevention of next possible EVD outbreak of epidemic.

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Table 1: First EVD epidemic (1976 - 1979)

Table 2: Second EVD epidemic (1994 - 1996)

Table 3: Third EVD epidemic (2000 - 2009)

Table 4: Fourth epidemic (2011 - 2013)

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Figure.1: Ebola virus (EBOV)

Figure 2: Ebolavirus ecology

Figure 3: Bush meat in the informal market

Figure 4: Number of cumulative confirmed EVD cases during the 2014–2016 Ebola epidemic, Guinea, Liberia, and Sierra Leone, in March, 2016

Figure 5: Place of buying raw meat

Figure 6: Types of consumed meat

16. LIST OF ANNEXES

Annexe 1: Questionnaire

Hello. I am an undergraduate student of International Territorial studies at the Faculty of Regional Development and International Studies, and I would like to kindly ask you to fill this questionnaire which will be part of my Bachelor thesis; *Spreading Ebola Virus from Primary Sources through the Bush Meat and its Impact in West Africa*. The questionnaire was created in order to find a typical routines and fact about African ‘‘food culture’’.

Questionnaire is anonymous and lasts around 10 minutes.

Please respond due to a fact according to your country of origin.

1, How old are you?

.....

2, Sex

-male

-female

3, Your country of origin?

.....

4, How many inhabitants your village/town has?

.....

5, Education of your mother?

-basic education

-secondary cycle

-tertiary education

6, Education of your father?

--basic education

-secondary cycle

-tertiary education

7, Occupation of your mother?

.....

8, Occupation of your father?

.....

9, Religion

-Christian

-Muslim

-Buddhist

-animistic

-atheist

-other

10, Where do you or your parents buy meat? (select all relevant answers)

-in the supermarket

-in the informal market (sector)

-we get meat from our relatives

-we have domestic animals

-we hunt animals

-other

11, How do you prefer to eat?

-fork and knife

-by hands

-both

12, What equipment do you use for preparing of raw meat? (select all relevant answers)

- special knife for row meat
- special fork
- cutting board for meat
- gloves
- other

13, What kind of meat do you eat? (select all relevant answers)

- beef
- pork
- poultry (chicken,turkey,goose, duck)
- buffalo
- mutton
- goat
- horse
- reptile meat (snake, lizards, iguana)
- fruit bats
- antelope
- other not typical animals (dog, cat, rat, squirrel)
- insect (locusts, scorpions, ants, grubs)
- others

14, How do you prepare meat and meat products? (select all relevant answers)

- boiling
- steaming
- steaming with leaves under the ground
- frying
- broiling
- smoking
- drying on the sun
- in special occasion row
- other

15, How do you store meat?

- in the freezer or in the fridge
- by letting the meat get dry
- fermentation
- no storing the meat

16, Do you have some special tradition related to raw meat or blood of animal? (if yes be more specific)

- yes
- no

17, How do you wash your hands?

- with water
- water and soap

18, How do you dry your hands?

- let dry by air
- dry by clothes (jeans, t-shirt)
- dry with the towel

19, How far is the closest medical treatment from your home?

.....

20, How good is medical care in your country?

- excellent
- very good
- good
- satisfying
- unsatisfying

21, Do you know some information about Ebola symptoms, transmitting and prevention?

- almost everything
- only important basic things
- not many knowledge about the disease

22, Do you know anyone from your friends or relatives, who had Ebola?

- yes
- no

23, Had an “Ebola crisis” in 2014/2015 some impact for your village/town? (if yes, be more specific)

- yes.....
- no

Thank you for your time

