

The importance of the climate, environmental and health profile of Kosovo in the assessment the health risks from climate change

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ABSTRACT

Assessment of health vulnerability to climate change in Kosovo is of most importance for adaptation and coping with climate change. The health information system is under review and is unable to provide the data needed to sufficiently determine and compare the burden of disease with countries with higher economies. Infectious diseases that are transmitted through food and water have a high incidence rate and can be exacerbated by climate events such as heat waves, floods (mainly urban) and droughts.

Determining the health, climate, and environmental profile of Kosovo is a basis for assessing health risks from the impact of climate change. Materials for conducting the assessment, data, information, and publications in the health and other relevant sectors as well as relevant international publications were used.

A methodological approach was to assess the vulnerability through a survey of the current disease burden of the population in Kosovo and analyse the climatic and health-environmental profile of Kosovo.

In the results and discussion, the demographic profile of the country, the technical and personnel capacities of the health system, morbidity, and mortality profile, as well as climatic and environmental extremes and hazards of importance are presented and commented. As conclusions and recommendations although Kosovo is not currently threatened by major climate extremes, future projections show the need to strengthen the public health and information system which will allow access to a sufficient amount of data that will define the process of adapting the health system to climate change.

Keywords: *Climate profile, Kosovo, environmental and health profile, climate extremes*

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I. INTRODUCTION

Climate change affects human life and health in different ways. They threaten the basic ingredients of good health - clean air, safe drinking water, a nutritious food supply and safe shelter - and have the potential to undermine decades of progress in global health. Between 2030 and 2050 climate change is expected to cause approximately 250,000 additional deaths per year from malnutrition, malaria, diarrhea and heat stress. Direct health costs are estimated to be between USD 2-4 billion per year by 2030. Regions with weak health infrastructure - mainly in developing countries will be least able to cope without adequate preparation and response. (1) Assessment of health vulnerability to climate change in Kosovo is of greatest importance for adaptation and coping with climate change. The main concerns are urban air pollution, lack of water, uncontrolled waste disposal and waste disposal in Prishtina and other large cities, which can play a role in serious health outcomes resulting from the emission of atmospheric pollutants. PM 2.5 particles can reach up to 130 µg/mg monthly average in urban monitoring. The health information system is in the revision phase and is not able to provide the necessary data to compare disease burdens with countries with a higher economy. Contagious diseases that are transmitted through food and water have a high incidence rate and can be worsened by climatic events such as heat waves, floods - and droughts. Vector diseases are so far less worrying. (2)

RESEARCH SUBJECT

The purpose of this paper is to determine the basic, health and public health, climate and environmental profile of Kosovo as a basis for the assessment of health risks from the impact of climate change, the vulnerable population groups it includes, and the assessment of the capacities of the health system for adaptation towards climatic extremes.

II. MATERIALS AND METHODS

As basic materials for conducting the assessment, monthly and annual data, information, reports and publications for the health sector, other relevant sectors such as the hydrometeorological institute as well as relevant international publications were used. The main methodological approach for assessing the vulnerability

of the health sector in Kosovo to climate change is made through: research of the current burden of diseases of the population in Kosovo (basic health-epidemiological profile), analysis of vulnerable groups of the population, research of other risk factors/health determinants of those diseases (in addition to climate change and determining the status of the health sector in the country and how vulnerable it may be in relation to climate change. Statistical methods were used for the analysis of the data obtained, for tabular and graphic distribution of continuous variables.

III. RESULTS AND DISCUSSION

Regional context

According to the 2018 Regional Cooperation Council (RCC) Study on Climate Change in the South East Europe (SEE) region, the priority recommendation for the SEE region is to ensure human health, safety, and quality of life, including the development of warning systems, dissemination of information and preparedness of the general public for disaster risk management. In the presented climate period, the temperature in the region has increased by 1.2°C compared to the past climate period. The annual accumulation of precipitation on average in the region has not changed; the current climate value is 807 mm with a 0.2% change compared to the climate in the past period. (3)

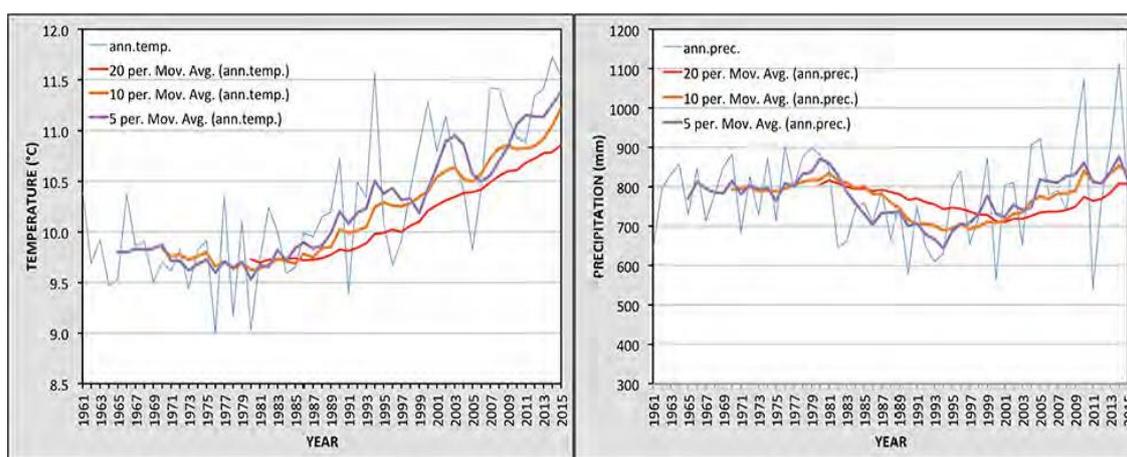
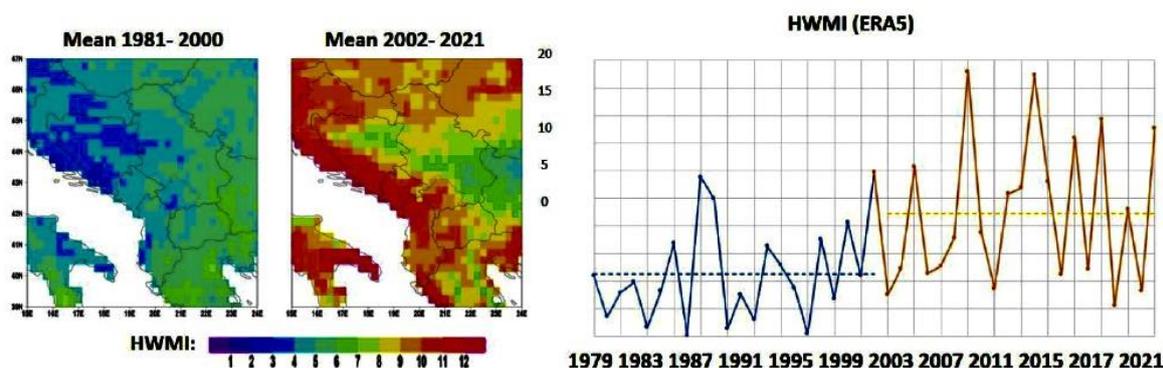


Fig. 1 Climate trends relevant to health in SEE countries

Source: Study on climate change in WB, RCC 2018

The figure shows the mean annual values for the Western Balkan (WB) area average values together with the moving averages for different averaging intervals (5, 10 and 20 years) with the values assigned to the last year of the averaging period. This approach allows a better understanding of climatological and sub-climatological changes in temperature and precipitation. The results show that a significant increase in temperature began during the 1980s. Precipitation decreased during the 1980s and 1990s and then began to increase and return, in the current climate to the values of the period defined as the past climate. The strength of extreme heat waves described by the Heat Wave Intensity Index (HWMI) has increased in the entire Western Balkans region, especially along the coasts of the eastern Adriatic Sea (Russo et al., 2014, 2015). The biggest increases were observed in southern Bosnia and Herzegovina, Montenegro and northern Albania. Other pronounced increases were observed in northern Serbia, Kosovo and the Republic of North Macedonia. On average, the size of extreme heat waves over the Western Balkans has doubled in the last two decades compared to the period 1981-2000. The worst heat wave before 2000 occurred in 1987 with a magnitude index of about 12. After 2000, this value was exceeded seven times already with record heat waves with an intensity 50% greater than the 1987 record. (Figure 2)

Figure 14. Heat Wave Magnitude Index (HWMI) over WB region 1979-2021



Source: ERA5 atmospheric reanalysis from the ECMWF

Figure 2. Heatwave index in the Western Balkans region 1979-2021

Source: ERAS atmospheric reanalysis from the ECMWF

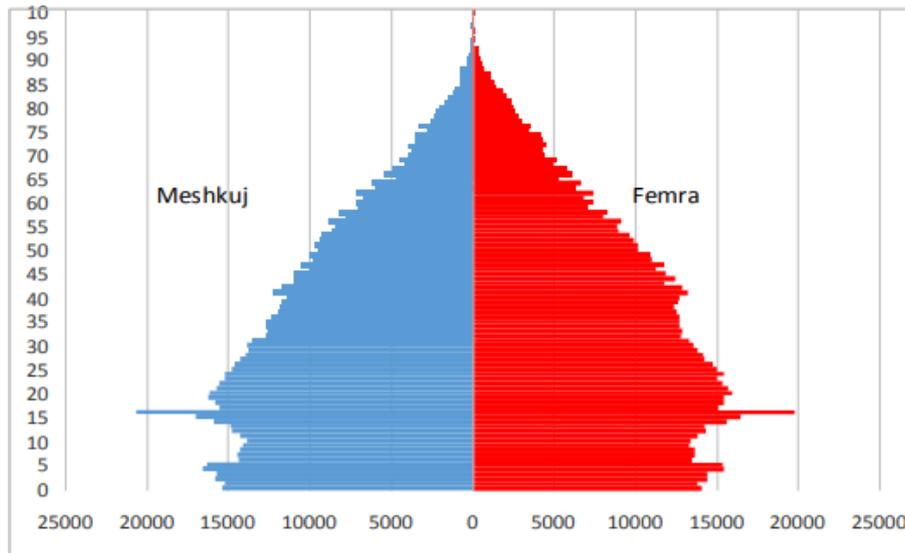
Considering the large impact of global warming, the SEE region, which is highly vulnerable to climate change, has seen a temperature increase of 1.2°C and is destined to further warm by 1.7 - 4.0 °. According to the same RCC study, climate change shows in the Western Balkans a subtropical climate encroaching further north, leaving the coastal and southern areas very hot and dry during the summer season which is expected to have an extended duration from the near future until the end of the century. The overall results of the analysis are consistent with the observed climate change impacts outlined in the WB's National Economies Communications and provide regionally integrated data for risk assessment and prioritization of regionally relevant adaptation options. Based on climate change projections, especially scenarios without ambitious mitigation, climate change can be expected to continue in the Western Balkans region in the future. Even if the International Paris Agreement achieves its goals and the average global temperature increase remains well below 2 °C, we will face at least one more degree of warming and corresponding changes in other climate variables. Climate change projections show that for the Western Balkans region, possible changes in mean annual temperature, relative to the period 1971–2000, range from 2 to 5.5 °C, depending on the chosen scenario and the part of the region being analysed. The results of the projections show that the average annual decrease in precipitation could be up to -40%, compared to the reference period 1917-2000, and that most of the territory has a negative anomaly. On the other hand, many studies identify possible increases in the intensity and frequency of extreme precipitation in warmer climates. In the future, a change in multi-day episodes with extreme precipitation accumulations is expected.

The most important risks to people's health in the region and related to the climate are: an increase in the frequency and intensity of heat waves, a very likely decrease in the quality of drinking water, a very likely wider spread and invasion of new vector-borne diseases (3)

Health profile of Kosovo

Social and demographic determinants of health

According to estimations of the Agency of Statistics of Kosovo (ASK), Kosovo has a population of 1,773,971 inhabitants (ASK, Estimate, Population of Kosovo 2021). The percentage of the population by age group is as follows: age group 0-14 years 24%, 15-64 years 67% and over 65 years 9%, which means that Kosovo has a higher percentage of the productive population (Graph.1). The average age of the population of Kosovo is 30.2 years. The average life expectancy in Kosovo for 2020 is estimated at 76.7 years, for men 74.1 years and for women 79.4 years (4).



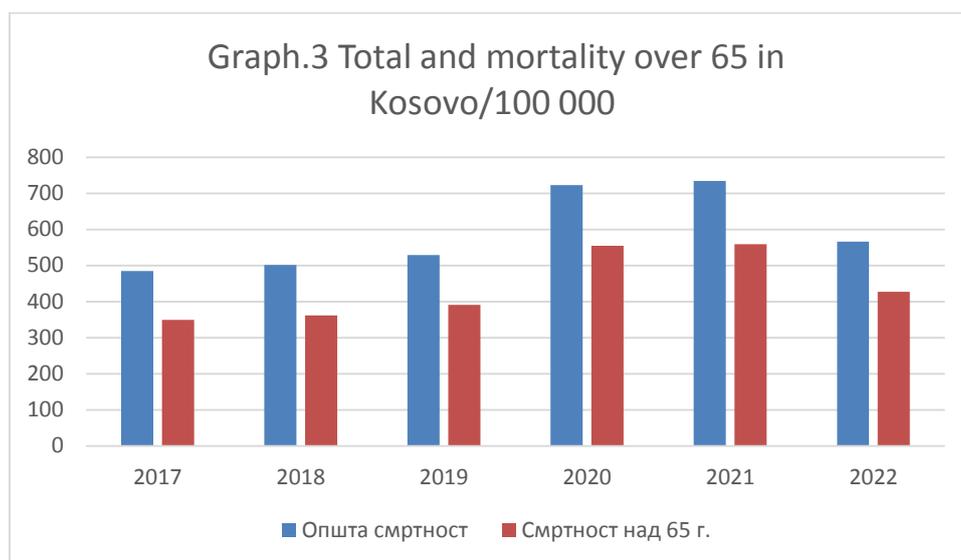
Graph. 1 Population pyramid of Kosovo, 2017
Source: ASK, Forecast of the population of Kosovo, 2017 – 2061

The birth rate during the years 2000-2021 shows a downward trend with variable movement with an average of 0.8‰. The birth rate per 1,000 inhabitants or the birth rate in 2000 was 19.3‰, while in 2021 it was 12.9‰. The mortality rate for 2021 is 8.4‰. In the period 2011-2021, this coefficient had a slight trend of average annual growth of 0.7‰ (Graph. 2). The latest data shows that the total number of deaths in 2021 in Kosovo is 14,900, while the death rate is 8.4 deaths per 1,000 inhabitants (ASK, Death Statistics, 2021). This figure is the lowest compared to the countries of the region - where Serbia has the highest mortality rate of 17‰ - and the countries of the European Union with an average of 12‰ (World Bank). Circulation diseases and tumours are among the most common causes of death in Kosovo for the period 2016-2020 (5)



Graph.2 Mortality trends (per 1000) in Kosovo 2011-2020
Source: ASK, 2021

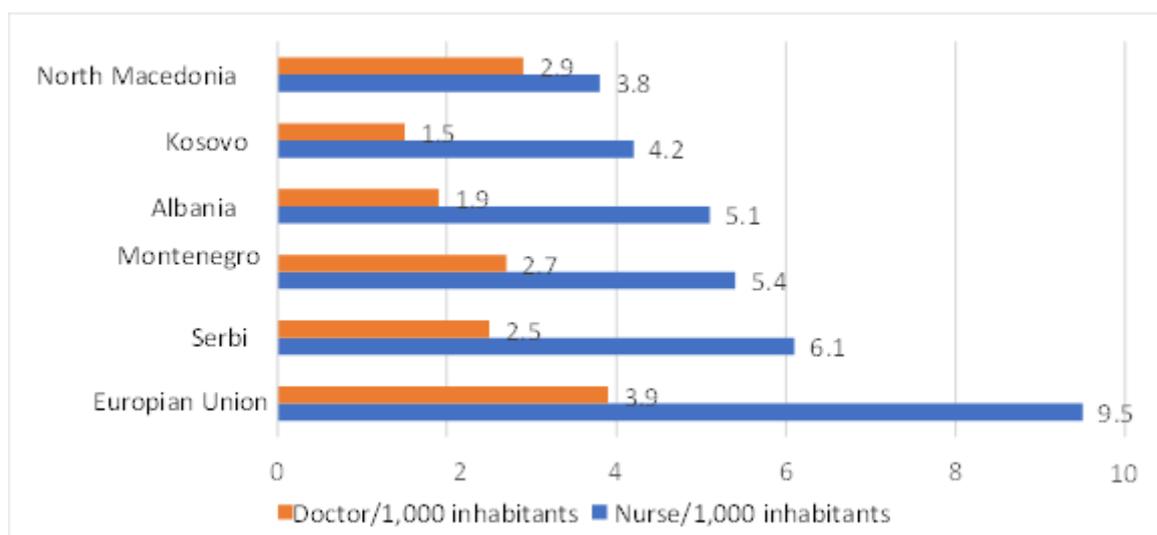
The mortality of the most vulnerable population group (65+) represents over 70 % of the total mortality (Graph.3)



Source: ASK, 2022

Organization of the Health Care System of Kosovo

The public health system of Kosovo is organized on three levels: primary, secondary and tertiary health care. In the network of health facilities from the public sector, 458 belong to the primary, 17 to the secondary and 19 to the tertiary level. In Kosovo, there are 2.6 Primary Healthcare Institutions (PHI) per 10,000 inhabitants and 0.5 public hospital facilities (secondary and tertiary) per 100,000 inhabitants. According to the data on the website of the Ministry of Health of Kosovo, at the end of 2021, a total of 1586 private health facilities were licensed. Of these, 1,566 are non-hospital private health facilities, while 20 private health facilities are of the hospital type (4). The largest percentage of them is in the municipalities of Pristina (28.6%) and Prizren (9.6%), and the smallest is in Shterpce (0.1%), followed by Junik, Dragash Hani and Elezit (0.2%). In 9 municipalities it seems that there is no licensed non-hospital health facility: Zvecan, Zubin Potok, Leposavic, North Mitrovica, Ranilug, Partesh, Klokot, Shterpce, Mamushe and Novoberd. (6) Based on these data, there are 8.7 non-hospital health facilities per 10,000 inhabitants in Kosovo. As for hospital facilities, in 2021 they were distributed in 9 municipalities of Kosovo, of which the most, 7 or 35%, in the municipality of Pristina. Based on these data, there are 1.1 hospitals per 100,000 inhabitants in Kosovo. Most of the employees in the public health sector in Kosovo belong to the primary level of health care (5,485 or 42.3%); followed by the tertiary-clinical level with 3,712 or 28.6% of them; while the secondary level of health care has a smaller number of employees in the public sector, 3,618 or 27.9% of them. (7) Based on public health system data, there are 1.5 doctors per 1,000 inhabitants and 4.2 nurses per 1,000 inhabitants in Kosovo, where the nurse/physician ratio is 2.8. There are also 0.2 dentists/1,000 inhabitants and 0.03 pharmacists/1,000 inhabitants. The number of doctors in Kosovo is lower than in European Union (EU) countries (3.9 doctors per 1,000 inhabitants) and all countries in the region. The number of nurses in Kosovo is also lower than in EU countries (9.5 nurses per 1,000 inhabitants) and all countries of the region except North Macedonia (3.8 nurses per 1,000 inhabitants) (World Bank Database).



Graph.4 Number of doctors and nurses (per 1000 inhabitants) in Kosovo, the region and the European Union
Source: World Bank database

The indicators of workload and quality in general hospitals are as follows: the average treatment is 4.5 days, the utilization of the hospital's capacity is 48.2%, the ratio of hospital admissions/doctor (daily workload) is 9.9, admissions/ nurses is 5.5, operations/physician is 29.7, while hospital mortality is 30.0%. (7) According to the structure of morbidity, at the primary level during 2015-2021, in all years, diseases of the respiratory system prevail, followed by factors that affect the state of health and contact with the health service and diseases of the digestive system, with exception of 2020 when the diseases of the circulatory system were dominant.

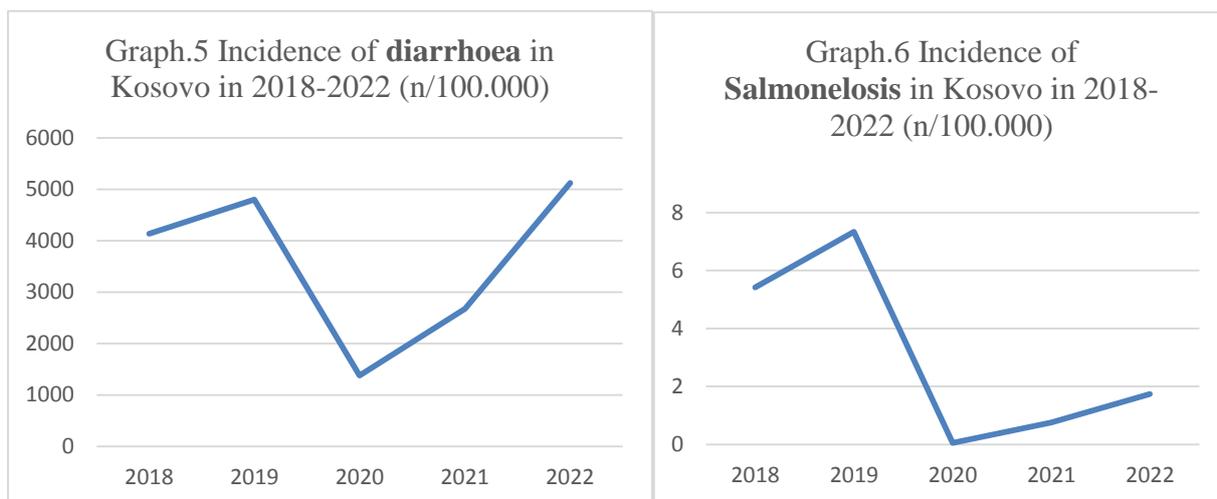
During 2015-2021, there was a change in the three dominant diseases in secondary health care. Diseases of the circulatory system were in the group of dominant diseases from 2015-2020, but not in 2021, and conditions in childbirth and motherhood prevailed in the years 2017-2021 except in 2019 (8) Regarding chronic non-communicable diseases in Kosovo in the period 2015-2021, among the ten non-communicable chronic diseases, the largest number of cases dominates Primary arterial hypertension with 46.5%, followed by non-insulin-dependent diabetes with 36.9%. , insulin-dependent diabetes 6.35%, and Schizophrenia with 2.95%. (Table 1)

Diagnosis	Gender					
	Male		Female		Total	
	N	%	N	%	N	%
Primary arterial hypertension(I10)	4,041	35.1	7,459	64.9	11,500	46.5
Non-insulin dependent diabetes (E11)	3,521	38.5	5,617	61.5	9,138	36.9
Insulin dependent diabetes (E10)	683	43.5	888	56.5	1,571	6.4
Schizophrenia (F20)	488	66.8	242	33.2	730	3.0
Chronic renal failure (N18)	259	51.0	249	49.0	508	2.1
Chronic bronchitis (J42)	222	47.7	243	52.3	465	1.9
Angina pectoris (I20)	198	63.7	113	36.3	311	1.3
Ischemic heart disease (I25)	153	63.0	90	37.0	243	1.0
Bronchial asthma (J45)	72	46.2	84	53.8	156	0.6
Symptoms of depressive illness	62	48.1	67	51.9	129	0.5

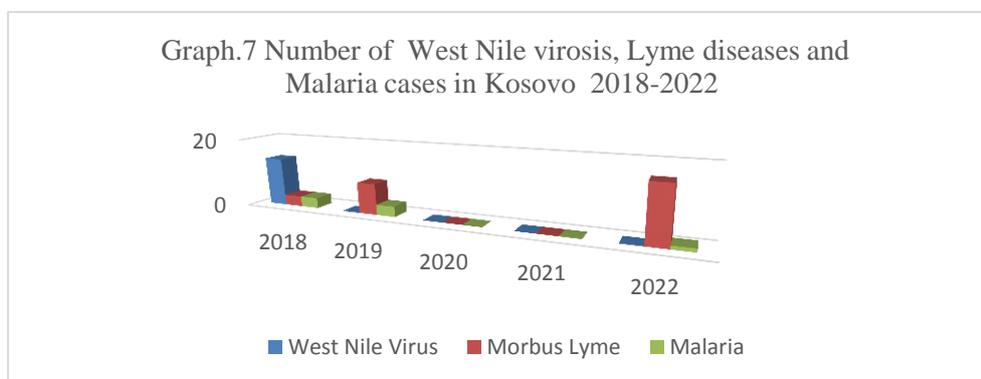
Tab. 1 Ten most common chronic non-communicable diseases in Kosovo, according to gender 2021
Source: NIPHK, Report on Hospital Morbidity in Kosovo, 2021

In terms of the infectious disease situation in Kosovo, acute diarrhea and seasonal influenza/influenza-like illness are the most reported in the period 2014-2020, while COVID-19 dominates in 2021 due to the COVID-19 pandemic. Cases of acute diarrhea and salmonellosis can be linked to poorly regulated infrastructure such as drinking water supplies from uncontrolled sources, long water supply interruptions, lack of basic

sanitation, irregular waste disposal, unsafe food, and poor economic and hygienic conditions which are evident in Kosovo. (Graph.5,6)



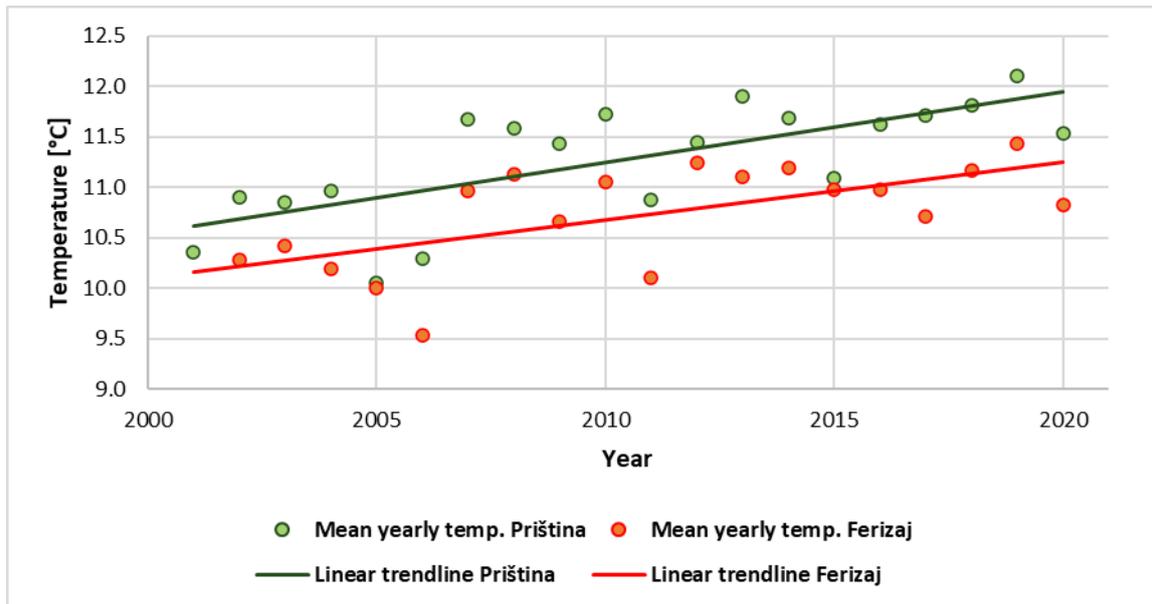
Regarding vector-borne diseases, in this period (2018-2022) Lyme disease, West Nile virus and malaria occurred occasionally. Their connection to climate change needs to be further investigated. (Graph. 7)



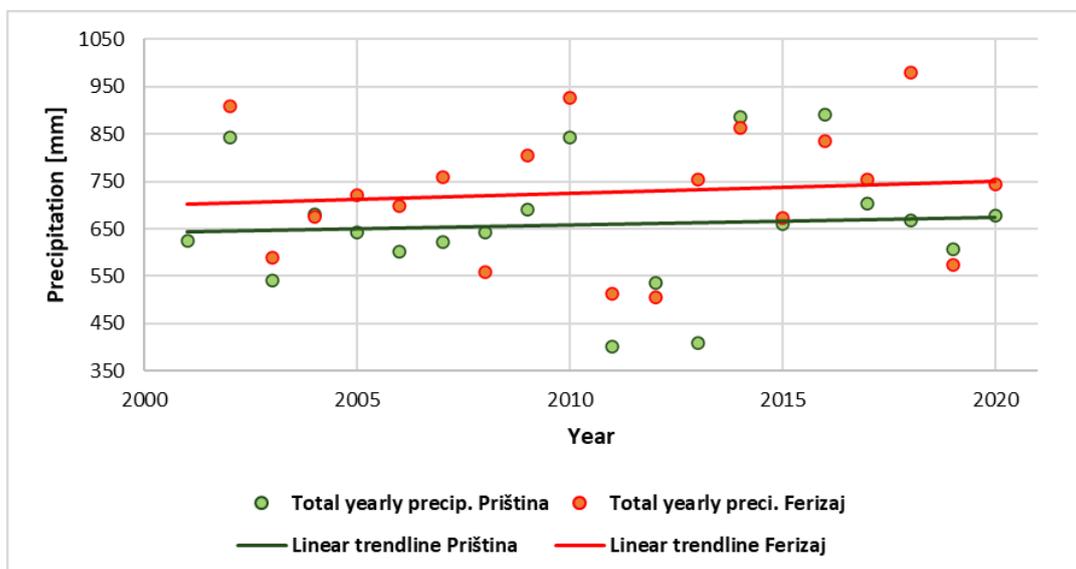
Source: National Institute for Public Health of Kosovo (NIPHK)

Climate profile of Kosovo

Kosovo has a predominantly continental climate, with hot summers and cold winters. Average temperatures range from -27°C in winter to 39°C in summer. The Hydrometeorological Service of Kosovo registered an increase in temperature observed at Pristina and Ferizaj stations in the range of 1.3 and 1.0 °C in the period from 2001 to 2020 (8) (Graph. 8)



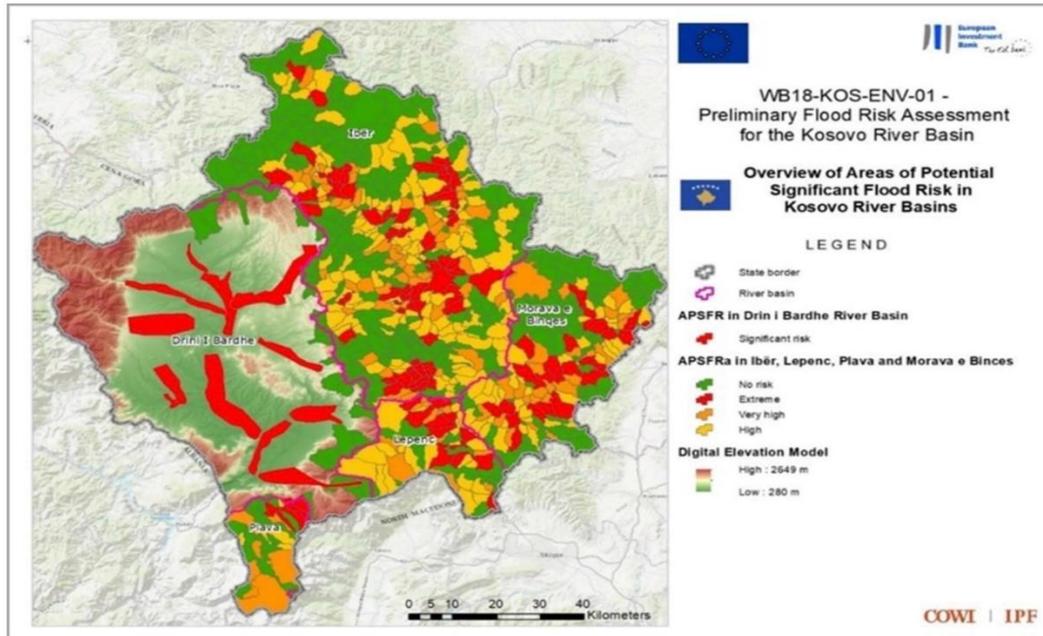
Graph 8 – Mean yearly air temperature in Prishtina and Ferizaj meteorological stations 2001 - 2020 with linear trendlines



Graph. 9. Amount of annual precipitation and linear trendlines in the meteorological stations Prishtina and Ferizaj in the period 2001-2020

Source: Meteorological data, monthly average, 2001-2020; Hydrometeorological Institute of Kosovo 2020

Forecasts for climate change in Kosovo speak of a further increase in the average air temperature and a decrease in precipitation. The increase in temperature is expected to significantly affect the climate of Kosovo, where by the end of this century most of the territory will be classified as a subtropical climate. The decrease in rainfall is expected to cause more droughts, with only the north-eastern and northern parts of the country still experiencing a dry season. (9) Compared to other climatic extremes from the 1980s onwards, the frequency of extreme precipitation like heavy rains but also droughts, including the droughts in Kosovo in 1993, 2000, 2007, 2008 and 2013, has increased (Graph.9).



The areas with various predicted risks from flooding in Kosovo are presented on the map above. Since 2000, there has been also an increase in the number of forest fires in Kosovo. (10) In the future scenarios, the entire region of Southeast Europe (including Kosovo) is projected to have warming higher than the global average, especially for mountainous areas, with a decrease in total annual precipitation, with the largest decrease in summer, and an increase in winter precipitation, especially in the mountains, which will result in more frequent spring floods.

Health and environmental profile of Kosovo

Of the environmental factors that can act in synergy with climate change on the health of the population, the quality of the air and the safety of drinking water are worth highlighting. Despite the existence of serious air pollutants, primarily in thermal power plants, heating and traffic, in recent years there has been a decrease in particulate matters (PM) pollution. Thus, in the period 2013-2022, the air quality trend for the PM2.5 parameter has improved starting from 2019 so that in 2022 we had a significant trend of decreasing the concentration of this parameter and the air quality was better compared to the previous years (11)(Graph. 10)



Graph.10 Average annual concentrations of PM2.5 particles in Kosovo in the period 2013-2022
Source: Hydrometeorological Institute of Kosovo, Report 2022

Regarding the safety of drinking water, the analyses of the Institute of Public Health show a high level of quality and only in 1-1.5% of the examined samples from water supply systems in urban areas, findings of coliform bacteria and E. coli were registered. These findings are more common in rural areas (8%) (7) .

According to the existing strategic documents, vulnerability challenges related to climate change in Kosovo can be summarized in six key issues: air pollution, water scarcity, water quality, land degradation (soil contamination due to heavy metals, soot diversion, irregular dumping of waste, dumping of hazardous material and chemicals), endangering the environment and essential services (eg food quality, forest maintenance, waste management, meteorological forecasts), forest depletion (improper logging, soil erosion)). (12)

Historic and current climate extremes in Kosovo

Although there are areas that are constantly exposed to adverse events, flooding in Kosovo is not a major cause for concern, unlike drought which is one of the most severe environmental threats. The exposed population can be assumed to be urban residents, with approximately 1 million people exposed to heat waves for example. From the report published by the Kosovo Red Cross, there is a worrying exposure of the Kosovo population to this extreme weather event. In 2012, 24 hours of strong winds followed by heavy snowfall necessitated the rescue of around 700 families (4000 people) with food, fuel and home repair equipment. Ambient air quality is particularly bad in Pristina, the Obiliq district, the Drenas/Glogovac district and the Mitrovica district. The two coal-fired power plants Kosovo A and B can be considered the main source of the PM in the Pristina region. The Kosovo A power plant, which is 3 times more polluting than the new Kosovo B in terms of particulates, will still be scrapped. In 2014, a mild winter and record-dry February was followed by a record-wet April; exceptionally heavy rainfall caused flash floods and caused serious damage to infrastructure, especially in northern Kosovo. (10) Regarding the future climate scenarios, a prolonged hot season, as well as a large number of continuous hot days, are expected to increase the risk of forest fires and their intensity. Exposure to hazards such as droughts, floods and forest fires will become greater with the climate changes that are already happening in Kosovo; higher temperatures will make heat waves and wildfires more likely. Since 2000, there has been an increase in the number of forest fires in Kosovo; increased temperatures, more uncertain rainfall and reduced runoff in combination will increase socio-economic pressures and will lead to increased use of water resources and exposure to drought; and finally, there will be an increase in new forms of water-related pollutions and diseases. (12)

IV. CONCLUSIONS AND RECOMMENDATIONS

- In the period 2011-2022, the average temperature in the South East Europe region has increased by 1.2°C compared to the past climate period. The annual accumulation of precipitation on average in the region has not changed; the current climate value is 807 mm with a 0.2% change compared to the climate in the past period
- The most important risks to people's health in the region and related to the climate are: an increase in the frequency and intensity of heat waves, a very likely decrease in the quality of drinking water, a very likely wider spread and invasion of new vector-borne diseases
- Kosovo has a higher percentage of the productive population. The average age of the population of Kosovo is 30.2 years. The average life expectancy in Kosovo for 2020 is estimated at 76.7 years, for men 74.1 years and for women 79.4 years
- The mortality rate for 2021 is 8.4‰. In the period 2011-2021, this coefficient had a slight trend of average annual growth of 0.7‰ .
- In Kosovo, there are 2.6 PHI per 10,000 inhabitants and 0.5 public hospital facilities (secondary and tertiary) per 100,000 inhabitants. The largest percentage of them is in the municipality of Pristina (28.6%) and Prizren (9.6%), and the smallest is in Shterpce (0.1%), Based on public health system data, there are 1.5 doctors per 1,000 inhabitants and 4.2 nurses per 1,000 inhabitants in Kosovo, where the nurse/physician ratio is 2.8
- Regarding chronic non-communicable diseases in Kosovo in the period 2015-2021, among the ten non-communicable chronic diseases, the largest number of cases are with Primary arterial hypertension (46.5%), followed by non-insulin-dependent diabetes (36.9%) , insulin-dependent diabetes (6.35%), and Schizophrenia (2.95%).
- In terms of the infectious diseases, acute diarrhea and seasonal influenza/influenza-like illness are the most reported in the period 2014-2020, while COVID-19 dominates in 2021 due to the COVID-19 pandemic
- From the vector-borne diseases, in the observation period (2018-2022) Lyme disease, West Nile virus and malaria occasionally occur. Their connection to climate change needs to be further investigated
- The Hydrometeorological Service of Kosovo registered an increase in temperature observed at Pristina and Ferizaj stations in the range of 1.3 and 1.0 °C in the period from 2001 to 2020
- Forecasts for climate change in Kosovo predict further increase in the average air temperature and a decrease in precipitation
- Regarding the safety of drinking water, it can be seen from the analysis of the Institute of Public Health that it is at a high level and only in 1-1.5% of the examined samples from water supply systems in urban areas, findings of coliform bacteria and E. coli.

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