



Ministry of Environment and Physical Planning
The Government of the Republic of Republic of Macedonia

Conducting Climate Change Health Vulnerability and Adaptation assessment in South East region of Republic of Macedonia

Third National Communication to the UNFCCC

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The recently adopted and published climate change strategy documents as well as investigations and projections in Republic of Macedonia have provided pretty clear indications of the future climate change health risks in the country over the coming decades mostly based on probabilistic outcomes and a range of future emissions scenarios. Where possible, and taking into account the wide range of uncertainties in both climate projections and health effects, quantitative analyses have been performed. This report follows on from the actual first National Climate Change Health Adaptation Program, and can be considered as an integrative part with regional approach perspective.

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Contents

Part I

Executive summary	5
Region and population exposed	6
Some data from the region of relevance for the risk and vulnerability assessment.....	7
Methodology applied.....	7
NATIONAL CIRCUMSTANCES RELATED TO CLIMATE CHANGE VULNERABILITY IN THE HEALTH SECTOR	9
National Circumstances related to climate change vulnerability in the Health Sector.....	10
Introduction – climate change and health.....	10
Climate change vulnerability in the health sector.....	11
Climate change adaptation in the health sector.....	13
Disaster preparedness and response.....	14
Overview of the Health sector	14
Review of recent research and other projects	16
International obligations (in regard to CC and health)	19
National Policy and Legislation	20
Conclusions	21
VULNERABILITY AND IMPACT ASSESSMENT	22
VULNERABILITY AND IMPACT ASSESSMENT	23
I. Sensitivity of the SE region	23
I.1.Current climate change conditions - extremes in the region of relevance for the vulnerability assessment.....	23
I.1.1.Rainfall	23
I.1.2 Floods and Draughts	23
I.1.3. Heat and cold waves	24
I.2. Other biophysical factors of importance for the sensitivity assessment	25
I.2.1.Water and drinking water supply status.....	25
I.2.2.Food production and food safety	26

I.3. Socioeconomic parameters of sensitivity	27
I.3.1. Marginalized communities and the impact of disasters.....	27
II. Sensitivity/Impact assessment - Analysis of possible relationship between current and past weather climate conditions and health outcomes (including trends in climate-change related exposures (Where possible, and taking into account the wide range of uncertainties in both climate projections and health effects, quantitative analyses have been performed).	29
II.1. Current morbidity profile of the population.....	29
II.1.1. Infectious diseases in the country and the region.....	29
II.2 Current burden of climate – sensitive diseases and conditions – Baseline scenario	30
II.2.1. Total Mortality dynamics and link with the climate	30
II.2.2. Emergency calls distributions in the different variations of temperature periods and different age groups of population	31
II.2.3. Food and water born communicable diseases (enterocillitis and salmonelosis) variations in different temperature periods.....	34
III. Assessing adaptive capacity	37
III.1. National and local policies and strategies.....	37
III.1.1. General adaptive capacity	37
III.1. 2. Planning capacities.....	38
III.2 Sector capacities	39
III.2.1. Surveillance of communicable diseases.....	39
III.2.2 Surveillance of non-communicable diseases	40
III.3 Specific adaptive capacity	40
III.3.1. Health sector characteristics with focus on the region	41
III.3.1.1. Human capacities.....	41
III.3.1.2. Hospital beds	42
IV. Instead of Conclusions	43
V. Literature:.....	45
CONDUCTING CLIMATE CHANGE HEALTH VULNERABILITY AND ADAPTATION ASSESSMENT IN SOUTH EAST REGION IN RM ACTION PLAN.....	46

Executive summary

The recently adopted and published climate change strategy documents as well as investigations and projections in Republic of Macedonia have provided pretty clear indications of the future climate change health risks in the country over the coming decades mostly based on probabilistic outcomes and a range of future emissions scenarios. Where possible, and taking into account the wide range of uncertainties in both climate projections and health effects, quantitative analyses have been performed. This report follows on from the actual first National Climate Change Health Adaptation Program, and can be considered as an integrative part with regional approach perspective.

In the period 2025-2100 it is expected to have continuous increase of the temperature in the country, especially in the warmer period of the year. The summers will be warmer with extremely high temperature peaks. It is also obvious that the SE region, together with the central region of the country, compared with the other parts of the country have the lowest sums of rainfalls and could be at higher risk given the current climate conditions. South East region is especially sensitive on climate extremes like floods and droughts. Especially, the floods are every year present in Strumica region. The effects of climate change on floods and droughts could be investigated in terms of health impact, although this is difficult to quantify. Understanding of the health implications of flooding, particularly impacts on mental health and impacts from disruption to critical supplies of utilities such as electricity and water has increased in recent years, but knowledge gaps still remain.

Heat waves periods are also very frequent in the region. Cold is still likely to contribute to the majority of temperature related health effects over the coming decades. The analysis of the frequency of the emergency calls confirmed that the elderly are more vulnerable to extreme heat and cold than younger people, so future health burdens are likely to be amplified by an ageing population.

Climate change can influence the incidence of certain water and food-borne diseases, which shows seasonal variation. It should be mentioned that climate change is also likely to affect the risk from water and food-borne disease through changes in human behavior associated, for example, with food hygiene. Increased temperature will allow pathogens such as Salmonella to grow more readily in food. However, interventions to prevent this are likely to have more of an effect in reducing numbers of cases than climate change will have on increasing them. Climate change may also lead to reductions in the availability of certain food groups, which may lead to reductions in the nutritional quality of dietary intake in some population groups.

Vector-borne diseases are influenced in complex ways by the climate, land use changes and human activities, and as such it is difficult to make quantitative predictions of future changes due to climate change. However, following the findings in the other places in the country and the predictions, maps of the EEA, it is likely that the range, activity and vector potential of many ticks and mosquitoes will increase in the SE region as well in the decades to come.

Public health recommendations and research needs have been identified for each of the specific health effects of climate change in the region covered in this report.

Hospitals, health centers and care homes may be adversely affected by high temperatures during heat waves and flooding. The potential health effects of climate change adaptation and mitigation options are discussed in this context.

Assessment of the adaptive capacities of the health sector in the region has a significant part in this report. The current CC and health sector adaptation policies, planning capacities and knowledge gaps have been assessed on national and regional level.

In the final part of document adaptation options have been outlined and discussed.

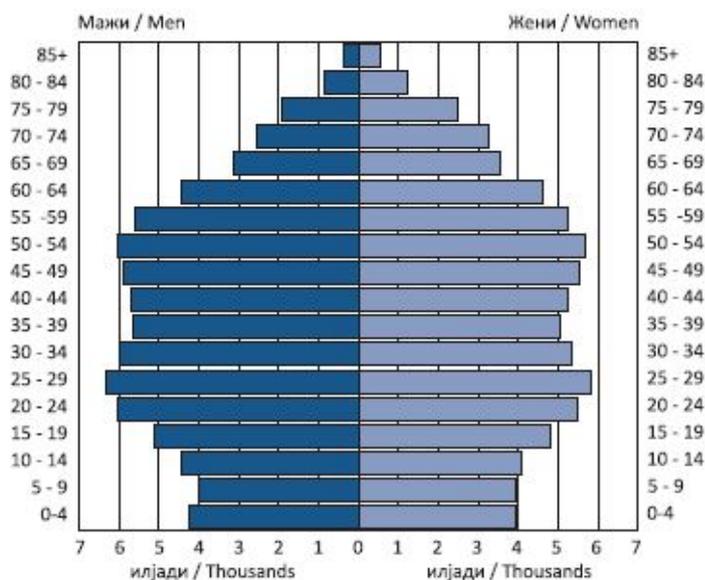
More accurate data are needed to assess the health and adaptation costs following the recently published WHO tool.

Region and population exposed

The Southeast Region is located in the extreme southeast part of the country. The region covers 10.9% of the total land area of the country, with a total population of 177 416 (2002 Census) and has a population density of 63.2 people per km².

The extensive hydrographic network, the great number of sunny days, the climate and the favorable soil conditions characterize the region as predominantly agricultural. The large-scale production of high-quality early vegetables, fruits and industrial crops enable the development of the canning and food processing industry, for which this region is renowned.

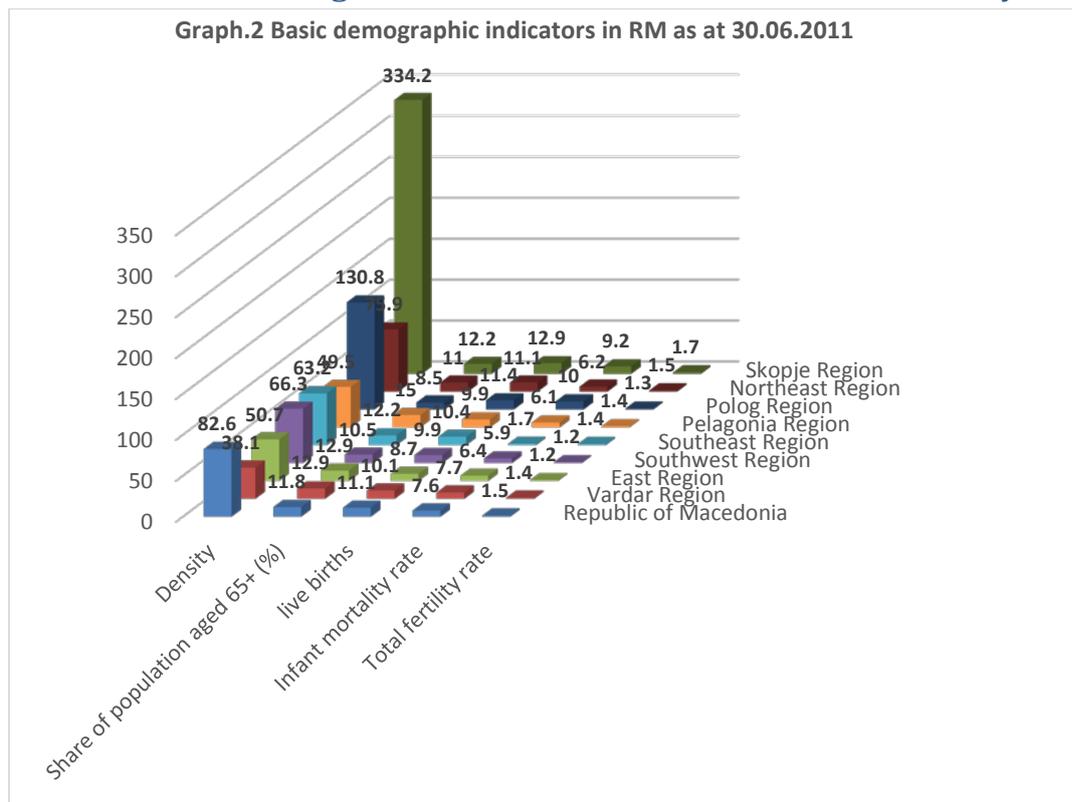
Graph. 1 Demographic characteristics of the SE region



Another specific feature of the region is that in 2011, compared to the other regions, it has high GDP, the highest activity and employment rates (71.0 and 64.4, respectively) and the lowest unemployment rate

Estimate of population in the Southeast Region as at 30.06.2011, according to gender and five-year age groups, NUTS 3.

Some data from the region of relevance for the risk and vulnerability assessment



Demographic and vital statistic data present a relatively well developed region with solid vital parameters with among the lowest density of the population in the country and low share of population over 65 (10.5 %) as one of the most vulnerable population groups on possible CC health impacts.

Methodology applied

Interactions between weather and climate and health are location-specific – using epidemiological evidence based on local data, if they are available, is therefore important. The first step was to specify the scope of the assessment in the country in relation to climate change and health, and community security issues of concern today and of potential risk in the future, both nationally (floods, droughts) and, where applicable, in the geographical region to be covered by the assessment. The main questions to be answered/explored are:

- What is the diseases burden of the region (epidemiologic profile)?
- What diseases of the epidemiologic profile are sensitive to climate (specifically to the conditions expected with climate change scenario for the region: increase or decrease temp, increase or decrease precipitation)?
- Who is exposed to the disease?
- Population groups?
- What are the risk factors/health determinants of those diseases?
- How important are risk factor/health determinants for the disease?

- How sensitive are the risk factors to climate (specifically the conditions expected with climate change)?
- What current health or other policies/strategies/programs are in place to attend the risk factors and/or the specific disease? (adaptive capacity)
- How effective are current health or other sector policies and programs in managing climate-sensitive health outcomes and its associated risk/determinants factors? (adaptive capacity)?
- How well is the current health or other sector policies and programs prepared for changes in demand due to changes in the geographical distribution, incidence or timing of climate-sensitive health outcomes?

A basic assessment was conducted using readily available information and data, especially the previous assessment made on national level, literature reviews by the IPCC, WHO, EEA and others and available region-specific health data. Limited analysis was conducted of regional health data, such as plotting the available data against weather variables over time. A more comprehensive assessment included a broader literature search focused on the goals of the assessment, some quantitative assessment using available data (such as the incidence or prevalence of weather-sensitive mortalities and diseases), expert judgment, and description and a formal peer review of results. A variety of statistical methods was used to analyze associations with exposure to weather or climate, taking into account modifying and/or interacting factors (mortality may be increased during periods with both temperature extremes). Epidemiology Change in physiological status or in disease occurrence that conforms to a regular seasonal pattern. For any given month in each year, the effect of seasonality is to raise or lower the observation by a constant proportionate amount (seasonal index) compared with what it would be have been in the absence of seasonal influences. Then we use the so-called seasonal index method to remove the seasonal component. A seasonal index is a way of measuring the seasonal variation -- that is, to measure the change that is due to seasonal changes in demand

NATIONAL CIRCUMSTANCES RELATED TO CLIMATE CHANGE VULNERABILITY IN THE HEALTH SECTOR

National Circumstances related to climate change vulnerability in the Health Sector

Introduction – climate change and health

All climate and weather variables have some influence on human health. The effect may be either direct on the human body or indirect through effects on disease-causing organisms or their vectors. Direct effects involve mostly physical impacts that act to cause physiologic stress (e.g., temperature) or bodily injury (e.g., storms, floods). Direct effects tend to be observed soon after the causative weather event, and are generally more easily modelled and understood than indirect effects.

On the other hand, indirect effects, such as climate impacts on food supplies and the outbreak of vector-borne diseases, may operate through diverse pathways involving multiple variables. People with chronic diseases, especially the elderly, are very susceptible to aggravation of the disease state from both excessively cold and excessively hot weather. Temperatures in warmer temperate zones are ideal for the survival and propagation of causative agents for some bacterial, viral, and parasitic diseases. Temperature also affects human health by affecting agriculture, fisheries, and water resources. The effects of high temperatures on human health are modified by the amount of moisture in the air. Climate change could affect human health through increases in heat-stress morbidity and mortality, tropical vector-borne diseases, urban air pollution problems and allergies, and cold-related illnesses.

Human health will continue to be affected directly and indirectly by climate change, and health systems will need to act to prevent and manage the impacts on populations. At the same time, health services will face various other complicating challenges such as rising costs of health care and an ageing society, making effective preventive strategies even more necessary.

Lots of influences of climate change including health effects, could be diminished or avoided with different adaptabilities. Primary goal of adaptation is to decrease burden of diseases, injuries, disabilities, suffer and mortality. Key determinant of health and the solutions also, lie primary out of direct control of health system. Important mechanisms for disease prevention originating from water and food are traceability, microbiological risk assessment, risk communication and risk management. Number of cases of salmonellas could be diminished by control and monitoring of entire food chain. High level of control measures should be reached along with the potential climate risk and potential storage information, and strengthening of measures of food processing.

Proposed alert and reporting system for possible health impacts from weather impacts aims to assess health risk and to diminish them. Instruments for that would contribute to promotion and on time alarming of population, particularly vulnerable groups, from

extreme weather events before its appearance. NGOs play important role in the system, particularly at the part of access to information of the population with social risk factors. Obtained data base will provide extrapolation to the future expected climate changes. Strengthening of capacities is essential step towards preparedness of sustainable adaptable strategies and palliative strategies. That includes education, raising awareness; creation of legal framework, as well as institutions which will inform people for decisions providing them higher long term benefits.

Both, by strengthening and implementation of Weather Early Warning System, as well as preparedness and response of health care system services from one hand and by adequate physical planning and housing from another hand, the reduction of mortality among the people is feasible. The system should include the implementation of preventive and action plans for heat waves and inclusion of strategies for vulnerable group's identification, as well as public health monitoring and citizens campaign promotion with financial estimation of reduction assurance with explanation that the inactivity is the most expensive. The instruments for risks reduction shall contribute in promotion and timely opportune warning forecasting from extreme weather events in the society and especially among the vulnerable groups.

Capacity building is an essential step in preparing sustainable adaptation and mitigation strategies. It includes education, awareness raising and the creation of legal frameworks, institutions and an environment that enables people to take well-informed decisions for the long-term benefit of their society.

Climate change vulnerability in the health sector

Climate change is expected to increase the burden of climate-sensitive diseases such as heat-related illness, vector-borne disease, diarrhoeal disease, injuries from extreme events, and respiratory diseases. The Republic of Macedonia was the country most affected by disasters in Europe in 2007, with a rate of 488 affected people per 1000 inhabitants, which means that almost half of the population was affected by wildfire. During July 2007, daily temperatures reached 43°C and caused more than 200 fires destroying over 2000 hectares of forests, and almost 1000 excess deaths. Under conditions of heat-wave, an increase of temperature of 1°C above the heat cut-point (30.8°C) leads to an increase in mortality of 4.8%.

About 10% of the population still lacks access to clean and safe water, be it for drinking or for meeting their basic needs. In addition, there are year-on-year growing trends for certain groups of communicable diseases, especially those associated with contaminated food and water (salmonellas, alimentary toxic infections, shigelloses). Recent studies on foodborne diseases show that disease episodes caused by Salmonella bacteria increase by 5-10% per each degree Celsius rise in temperature. During 1991-2008, 6969 cases of salmonellosis were reported, with total morbidity of 340.3 per 100 000, or an average of 387 cases a year,

with an increasing trend in recent years. The study on the climate change impact on pollen found out that the prevalence of sensitivity to standard pollen allergens in Skopje shows an increase from 16.9% in 1996 to 19.8% in 2009/2010.

Studies have shown that if the daily average temperature increases by 1°C in summertime, mortality increases by 3.2 % .The very high temperatures in hospitals and emergency care units were the major problem. There is growing evidence from EuroHEAT that the effects of heatwave days on mortality are larger when levels of ozone or PM10 are high, particularly among the elderly (75 years and more).

In 2010, the Institute of Public Health investigated the relationship between environmental temperature and reported salmonella infections among the population in five cities (Skopje, Kumanovo, Bitola, Strumica and Veles). Salmonella cases show a strong seasonal pattern, with the highest number of cases in summertime. For Skopje, it was estimated that the increase in the weekly temperature of 1°C above the detected threshold of 17.9°C is associated with a 2.8 per cent rise in the number of salmonellosis cases. The projection for 2030 of the seasonal index by month for food-borne diseases caused by salmonellosis, due to air temperature rise, shows two peaks in the summer months and one possible peak in winter months because of a decrease in the average monthly temperature in the future period.

The impacts of climate change on aeroallergens, and in particular pollen, include impacts on pollen production and atmospheric pollen concentration, pollen season, plant and pollen spatial distribution, pollen allergenicity, and similar impacts on mould spores. Since 1993, aeropallinologic research in the country has been performed at the National Institute of Occupational Health (NIOH) of Skopje. The Institute of Public Health and NIOH have assessed the impact of current burden of the weather maximum temperature of the 9 pollens distribution in Skopje (Betula, Cupressaceae, Quercus, Fraxinus, Platanus, Urticaceae, Plantago, Chenopodiaceae, Poaceae) for the 1996, 2003, 2007 and 2009. They have found statistically significant differentiates for the Cupressaceae pollens in this investigation and maximum temperature in Skopje during whole examined years with Beta Coefficient ($b = -0.23$) for $p = 0.02$, but not for other types. Pollen distribution and risk increases in three main periods: early spring, spring and summer, which are the main cause of allergies during those seasons. The impacts of climate change via the increase in the temperature in the next decades on aeroallergens, and in particular pollens, will include impacts on pollen production and the pollen season as detected in the airborne pollen spectrum, the weekly dynamics of the most important taxa, the influence of one meteorological variable as maximum temperature, and the changing distribution (onset of flowering, maximum and end of the seasons).

Climate change adaptation in the health sector

The possible risks for the sector and prediction for the main health risks of the population in the country are being mentioned in the Second National Climate Change Communication in 2008, emphasizing the need of special adaptation measures, protection of the food chain, weather early warning system, public awareness specially the messages and recommendations for the vulnerable groups etc.

On 17 June 2009 the Ministry of Health set up a National Committee for Climate Change and Health as responsible body for surveillance of activities and decision-making. The committee is composed by representatives from various sectors: the Ministry of Environment and Physical Planning, the National Public Health Institute, the Institute of Occupational Health, the Crisis Management Centre, the Directorate for Protection and Rescue, the Hydro meteorological Institute, the State Sanitary and Health Inspectorate, the Public Health Centre of the City of Skopje, Emergency Medical Services and the Republic of Macedonia n Red Cross.

To address and prevent potential health threats from climate change, the project in the Republic of Macedonia undertook an assessment of the health impact of and vulnerability and adaptation to climate change, as a basis for the development of a national health adaptation strategy.

The Committee developed (among others) a Climate Change Health Adaptation Strategy which arose from the relevance of this issue on a global, regional and national level, the necessity to prepare and respond to climate-change-associated health risks and the need for interdisciplinary cooperation and exchange of relevant data with other sectors that could contribute to improving the health status of the population in the former Yugoslav Republic of Republic of Macedonia .

The Strategy envisages objectives and activities that will be carried out by the health sector in cooperation with the other relevant sectors in the country. Its goal is to interlink with other strategies in this area developed by other sectors and to form part of the chain of activities aimed at reducing the impact of climate change on people's health in the Republic of Republic of Macedonia .

The general goal of the strategy is to plan climate change adaptation measures for the health system in order to prevent and/or overcome both existing and future risks and to respond promptly to the risks and problems for people's health and well-being that are expected as a result of climate change in the Republic of Republic of Macedonia .

The following specific goals are envisaged as part of the implementation of this Strategy:

1. Provide a coordinated approach and functional cooperation between the sectors and the relevant institutions in terms of effective and efficient use of the available resources;

2. Raise public awareness about climate change and its effect on health;
3. Establish an integrated, efficient and effective approach for prevention, early warning, management and overcoming of the effects of climate change due to heat-waves.
4. Overcome the climate change health consequences connected with air pollution and cold weather during winter, by establishing control and preventive measures.
5. Establish an integrated, efficient and effective approach for prevention, early warning, management and overcoming of the effects of climate change as a result of increased UV radiation.
6. Control and prevention of allergic diseases caused by pollen in the context of climate change.
7. Establish an integrated, efficient and effective approach for prevention, early warning, management and overcoming of the effects of climate change connected to floods and fires.
8. Protection from climate-change-related communicable diseases.

The strategy was developed and adopted by the Government in February 2011, and published in June 2011 in three languages: Republic of Macedonia n, English and Albanian.

In November 2012 a first annual evaluation on the implementation of the strategy as well as of the Heat action plan has been made. Lack of funds and human capacities are among the main problems. There is also a need of an improvement of the coordination of the activities, training and education

Disaster preparedness and response

During 2010-2011, WHO has supported the development of the Ministry of Health's National health crisis preparedness plan, and initiated the process of hospital crisis preparedness planning. Key health professionals and decision makers have received training in the area of disaster preparedness and response. Simulation exercises have been conducted in key health facilities to examine hospital's emergency planning. Strengthening the resilience and safety of the country's health facilities to ensure that continue to function in the event of a disaster included assessing the resilience of selected key facilities using the WHO Hospital Safety Index. (www.iph.mk)

Overview of the Health sector

Health care in Republic of Macedonia is delivered through a system of health care institutions, covering the country's territory relatively evenly .This makes it possible for around 90% of the population to get a health service in less than 30 minutes. The health facilities range from health care stations and centers at PHC level and specialty-consultative

and inpatient departments including three newly promoted clinical hospitals at secondary level, to university and institutes at tertiary level, with the latter also carrying out research and educational activities. In general, smaller rural settlements are served with general medicine services only. This includes the private clinics on each level (except the teaching level). The services of PHC centers at municipal level also includes emergency and home treatment, pharmacies, laboratories, X-ray and echo cabinets, preventive TB services, including "polyvalent patronage" nursing services, and dental care. In general, smaller rural settlements are served with general medicine services only.

WHO Health for All (HFA) data from 2009 report a population of 2.042.485 with a fertility rate which has declined from 1.9 births per woman in 1990 to 1.46 in 2008, i.e. lower than the European average of 1.6. The current trend is one of ageing. Life expectancy at birth was 73.54 years (76 for females and 71 for males) in 2007, while the disability-adjusted life expectancy was 63 years. The 2005 birth rate was 11.04 per 1,000 populations and the mortality rate was 9 per 1,000, resulting in a natural increase of 2 per 1,000 population. The distribution of deaths by age shows the highest proportion of total deaths for age 75 at 43.6 per cent.

In Republic of Republic of Macedonia, non-communicable diseases (NCD) present the biggest burden to public health analyzed by direct cost to society as well as to the government, based on the disability adjusted life years (DALY) indicator. The total burden of the most common diseases in the Republic of Macedonia (circulatory, cancer and respiratory) are estimated as 67% of DALY from all cause mortality. The most common diseases in the Republic of Macedonia – cardio vascular diseases, cancer, respiratory diseases, injuries and non-specific symptoms - have many causes which are often interconnected, including genetics, lifestyles (diet, exercise, etc.), and the environment.

The Republic of Republic of Macedonia, regardless of the perceived deterioration of core public health functions over the last few years, enjoys nearly complete institutional coverage by public health agencies across the country.

The Ministry of Health and the government are responsible for developing and implementing health policy and especially public health policy. The National Institute for Public Health is the central tertiary centre for public health activity and teaching activity at the medical faculty. It coordinates, supervises and oversees the activities of ten regional centres for public health, and provides technical services to the clinical centre and to the country as a whole. The ten regional centres have branch offices - a total of 21 - which provide local services. The main functions of the National Institute for Public Health are: collection of health data for all indicators; monitoring the health status of the population; reports and analysis of the health status and organization of the health-care system; epidemiological surveillance; immunization; environmental monitoring; drug control; and advising the Ministry of Health on matters related to health policy.

The Public Health Law (Official Gazette 22/2010) regulates also the implementation of the essential public health functions and tasks, the public health system, public health emergencies, and the funding of public health activities.

Issues in environmental health that have a high priority in the country are:

- access to safe drinking-water in rural areas
- access to sanitation almost in whole country
- Inadequate waste and waste water management on national level
- Uncontrolled use of chemicals and pesticides
- Inadequate air quality indoors and housing generally (in particular associated with poverty and children's exposure to environmental tobacco smoke
- Hotspots
- Climate change

Furthermore, the Ministry of Health and the Public Health Institute introduced an Early Warning System for communicable diseases surveillance (EWARN) based on a clinical description, with the potential for early warning, the main goal of which is detection of epidemics. General practitioners from all health care institutions on primary health care level take part in this system. Among others, this system enables timely detection of clusters of cases of communicable diseases, as well as analysis of the trend in a certain time period.(www.iph.mk)

Data sources and health statistics – there is still no integrated health information system . Currently, main sources of health related informations are : for the mortality data – State Bureau of statistics; for the morbidity data – Institute of Public Health, Health Insurance Fund , regional centers of public health and health care institutions

Review of recent research and other projects

There were a number of activities in this field in the country implemented mainly in cooperation with the World Health Organization, the Ministry of Health and other partners, such as the Ministry of the Environment and Physical Planning, National Institute of Public Health, Public Health Centres, Emergency Medical Services (Skopje), Hydro meteorological Institute, Crisis Management Centre, Directorate for Protection and Rescue, Red Cross, City of Skopje, NGO MACEF, etc. The results achieved include:

Strengthening the national capacity for assessing the health impacts of climate change:

- More than 600 health professionals, environment professionals, journalists and other professionals received training on the influence of climate change on health.

- An assessment was carried out of the health effects of climate change in the Republic of Macedonia and published in March 2012 in three languages: Republic of Macedonia n, English and Albanian.
- A study was undertaken to examine the impact of heat-waves on morbidity in the summer months in the Republic of Macedonia for the period 1994-2009.
- A study was carried out on the correlation between the occurrence of salmonella infection and average weekly temperature distribution for the period 1996-2009.
- A study was carried out on the presence of the vector *Aedes albopictus* in the Republic of Macedonia and published in November 2011 in two languages: Republic of Macedonia n and Albanian.
- A study on the impact of climate change on pollen microflora related to respiratory allergies among the adult population in the city of Skopje was published in November 2011 in two languages: Republic of Macedonia n and Albanian.
- A study was carried out on the health and economic damage and adaptation costs of climate change due to heat-waves.
- A publication entitled The effects on health of climate change in the Republic of Macedonia was developed and published in November 2011 in three languages: Republic of Macedonia n, English and Albanian.
- The Action Plan to prevent Cold weather and Cold waves harmful effects was introduced in December 2012

Developing the Action plan to protect the health of the population in the Republic of Macedonia from heat-waves (www.iph.mk):

- The Heat-wave Action Plan was adopted by the Government in February 2011 and published in 2011 in three languages: Republic of Macedonia n, English and Albanian. A National Committee for implementation of the Action Plan is also established.
 - A heat-health early warning system has been developed, for timely announcement of heat-waves, including design of software and donation of equipment for its functioning.
 - Information leaflets for protection against heat-waves, aimed at the general population, managers in health and social institutions, general practitioners and workers have been developed and printed in three languages: Republic of Macedonia n, English and Albanian.

- More than 300 health professionals, environment professionals, journalists and other professionals have received training on the influence of health on climate change, with to the emphasis on heat-waves.

Investment in energy efficiency and technology transfer in two pilot health institutions, the general hospital in Gostivar and clinical hospital in Shtip:

- Energy efficiency and hospital safety assessments were performed in the general hospital in Gostivar and clinical hospital in Shtip and reports developed.
- Solar heating systems and thermostatic valves were installed in the two pilot hospitals.
- Study of the economic and environmental impact of the interventions undertaken in the pilot hospitals was performed, including projection of reduction of CO₂ emissions at municipal level as well as the long-term economic benefit forecast.
- Five professionals from the Republic of Macedonia participated in a study tour on energy efficiency and renewable energy sources, which was organized to LVR-Klinik, Bonn.
- A publication entitled *Energy efficiency and renewable energy sources -A manual for managers in the health sector* was developed and published in December 2011 in three languages: Republic of Macedonia n, English and Albanian.
- Training was organized for health managers, as well as medical and non-medical personnel, on the importance of energy efficiency in the health sector.
- Activities were put in place to raise the awareness of health managers, as well as medical and non-medical personnel, on the importance of energy efficiency in the health sector.

Early information on climate-related infectious disease risks at municipal and national levels:

- *Guidelines on climate change and communicable diseases - A manual for health workers* was developed and published in three languages (Republic of Macedonia n, English and Albanian) to increase awareness of health professionals and the general population about the risks from infectious disease outbreaks (www.iph.mk).
- Over 300 epidemiologists, infectious diseases and hygiene specialists and other health professionals received training related to climate change and communicable diseases.

- Numerous expert missions and training workshops, seminars and conferences have been carried out.

Activities on building media capacities on issues related to climate change and health (workshops, field visits, production of videos, etc.) have been organized:

- A group of fifteen young journalists was created, who had expressed willingness to cooperate in a network of young journalists who focus on health and environment issues, with the emphasis on climate change.

Partnership between agencies and ministries has been built, and coordination has been improved. Information sharing and training, capacity building and improved public awareness are essential.

International obligations (in regard to CC and health)

UNFCCC

UNFCCC, Article 1, paragraph (1) states need to minimize adverse effects on "*natural and managed ecosystems or on the operation of socio-economic systems or on **human health and welfare***".

EU

COM(2005)35 Winning the Battle Against Global Climate Change - The recommendations for the EU climate policies are listed including increased public awareness, more and better focused research to further improve the knowledge, enhanced innovation etc.. In the Annexes some climate change health effects are emphasized such are thermal stress and infectious disease(<http://eur-lex.europa.eu>)

COM(2009)147 White Paper – Adapting to climate change: Towards a European framework for action – sets out a framework to reduce the EU’s vulnerability to the impact of climate change. It complements the actions by the MS and supported wider international efforts to adapt to climate change. The CC adaptation is about to be integrated into all EU policies (<http://eur-lex.europa.eu>)

SEC(2009)416, Human, Animal and Plant Health Impacts of Climate Change , Commission staff working document-accompanying document to the White Paper - Adapting to climate change: towards a European framework for action – in the conclusions the need for development of guidance on surveillance was stressed out which will have to be matched by support for implementation and capacity development, as well as reinforcing capacities to develop modeling of health effects as a function of extreme weather and obtaining data to define needs for improved forecasting, reinforcement of public health policies and training, assessment of CC effects on vulnerable social groups , international collaboration including collaboration with WHO etc. (<http://eur-lex.europa.eu>)

World Health Assembly Resolution WHA/61.R19, and Executive Board Resolution EB124.R5, request WHO to ***develop capacity to assess the risks from climate change for human health and to implement effective response measures***, and support countries through ***Awareness raising, Partnerships, Evidence, and health system strengthening***.

Other relevant documents

WHO (2005): Health and Climate Change : the “now and how” – A Policy action guide – presents a brief summary of the results of the research project “Climate change and adaptation strategies for human health in Europe” (2001-2004). The project identified a range of options that have been taken or could be taken by European policy-makers to prevent, prepare and respond to the effects of weather and climate variability on people’s health (www.euro.who.int)

WHO, Climate Change – Quantifying the health impact at national and local levels, EBD, series, No.14, 2007 – this guidance presented outlines a general approach and describe the methods that were applied in the WHO global risk assessment project in identifying the range of health outcomes that are both climate-sensitive and important in public health terms, and also quantifying the relationship between climate change and each health outcome etc. (www.euro.who.int)

WHO/PAHO: Protecting Health from Climate Change – Vulnerability and Adaptation Assessment (2009), describes the steps in conducting a vulnerability and adaptation assessment of CC health effects with special emphasis on the categories of populations vulnerable to the health impacts of climate change (www.euro.who.int)

ECDC (2010) Climate Change and communicable diseases in the EU Member States – Handbook for national vulnerability, impact and adaptation assessments – stresses a methodology that involves as many different stakeholders as is feasible, to identify potential vulnerabilities. Among others it describes the current situation including demographic and socio-economic factors, health systems, epidemiologic factors, and information from non-health sectors. The findings can then inform public health adaptation programs that strategically leverage existing strengths and mitigate the future weaknesses of health systems. (www.ecdc.europa.eu)

National Policy and Legislation

National Climate Change Health Adaptation Strategy (www.iph.mk)

2009 Republic of Macedonia adopted a **National Strategy for Prevention and Control of Non communicable Diseases** (www.moh.gov.mk)

The new **Laws for Public Health and for Health Evidence** were passed in 2010 and 2009 with the aim of strengthening the basic public health function and the network of public health facilities within the country

On the basis of Article 13 paragraph (2) of the Law on Public Health ("Official Gazette of Republic of Macedonia No. 22/2010 and 136/2011), the Government of Republic of Macedonia at the session held on 9.01.2012, adopted the last - 2012 NATIONAL ANNUAL PROGRAM ON PUBLIC HEALTH IN REPUBLIC OF MACEDONIA

The health status of the population is monitored and analyzed through the public health system, that is, through the impact of health risk factors, such as environmental factors, disease agents, life style and socio-economic factors.

The National Annual Public Health Program is a standard set of measures and activities implemented by the Public Health Institute of Republic of Macedonia and the 10 Centers for Public Health.

The Program includes measures, tasks and activities to monitor and evaluate the health and wellbeing of the population; identification, forecasting, examination and alleviation of health problems and hazards in the community.

Law for Health Evidence (Official Gazette 20/2009)

Conclusions

Despite the numerous activities implemented in the health sector in Republic of Macedonia concerning the Climate Change health effects mitigation, there is still much to be done. As long as climate change is not too rapid or strong, many of the health effects can be controlled by further strengthening of the health system. This can include strengthening preparedness, public health services and health security, advocating action in other sectors to benefit health, better informing citizens. Health systems need to strengthen their capacity to assess potential climate-related health effects, to review their capacities to cope, and develop and implement adaptation and mitigation strategies, and to strengthen a range of key areas of work – from disease surveillance and control to disaster risk reduction – that are essential for rapid detection of and action against climate-related risks. The most elementary form of adaptation is to launch or improve health monitoring and surveillance systems which will summarize the mechanisms for a comprehensive monitoring scheme for the types of potential health impact of climate change. As most important the monitoring and adaptation in the country will concern: heat stress vector-borne diseases and other communicable diseases, natural disasters freshwater supply, food chain and supply etc.

Primary and secondary adaptive measures, intersectoral and cross-sectoral adaptation strategies are needed to reduce the potential health impacts arisen from climate change.

VULNERABILITY AND IMPACT ASSESSMENT

VULNERABILITY AND IMPACT ASSESSMENT

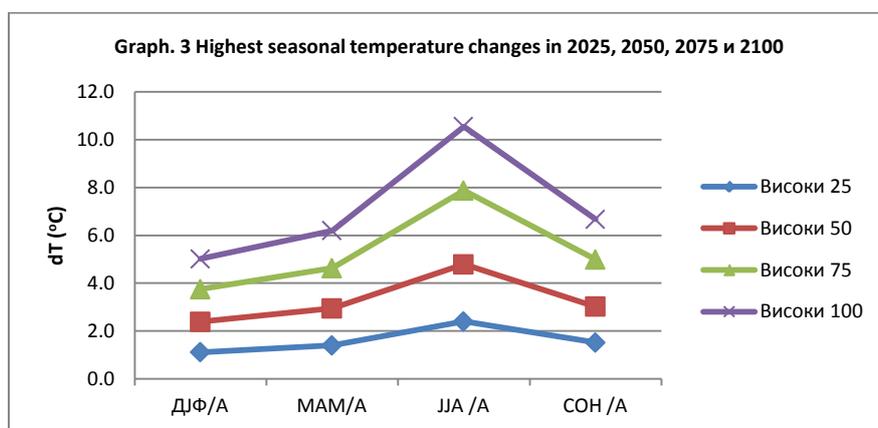
Vulnerability is a function of exposure, adaptive capacity and sensitivity.

I. Sensitivity of the SE region

Baseline conditions – **description of human health risks of current variability and recent climate change**

I.1. Current climate change conditions - extremes in the region of relevance for the vulnerability assessment

Climate scenarios - Predicted Seasonal temperature changes in the region



In the period 2025-2100 it is expected to have continuous increase of the temperature, especially in the warmer period of the year. The summers will be warmer with extremely high temperature peaks.

I.1.1. Rainfall

From the presented GIS maps in other parts of this document it can be noticed that the SE region, together with the central region of the country, compared with the other parts of the country have the lowest sums of rainfalls which could generate a greater risk to the impacts of climate change, given the current climate condition. Beside this spatial distribution of yearly rainfall sums the GIS maps gives us a good overview of the temporal trends of yearly rainfall sums. From the maps presented it can be confirmed that the SE region will remain one of the most vulnerable regions of the country in terms of decreasing of rainfalls over time due to the negative impact of CC.

I.1.2 Floods and Draughts

South East region is especially sensitive on climate extremes like floods and draughts. Especially, the floods are every year present in Strumica region. This is certainly a treat among others (as drinking water quality and water supply and sanitation infrastructure, food production and food safety) to human health though so far there is no specific evidence. In such circumstances there are vulnerable groups of population sensitive to floods effects. People with lower socio economic status, homeless, elderly, children, pregnant women and people with physical impairments are among the most endangered.

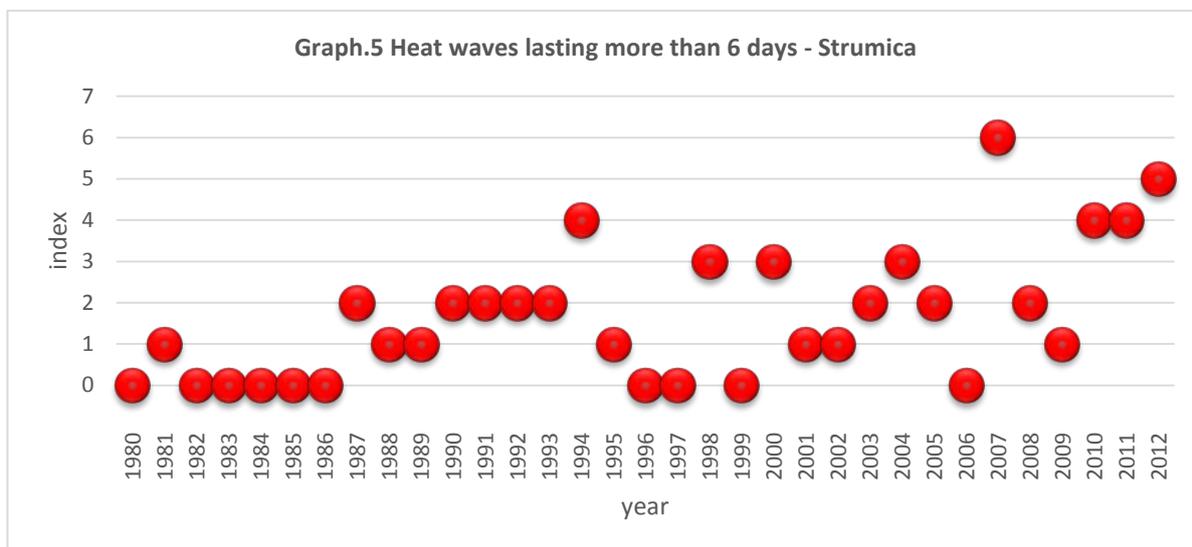
Such groups are present in Strumica region. Unfortunately there is lack of specific evidence for this.

Graph. 4 Floods and droughts events in SE region 1990-2012

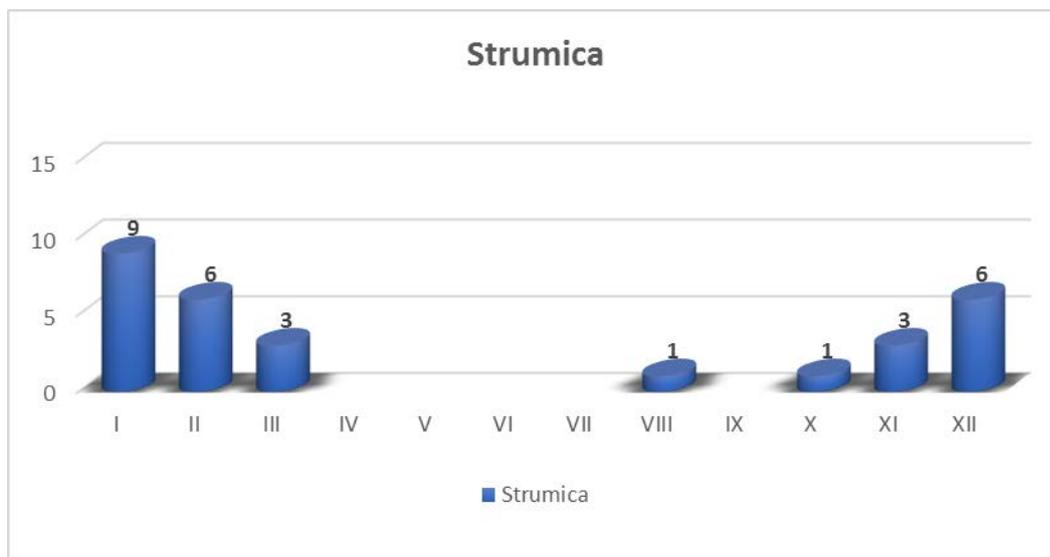


I.1.3. Heat and cold waves

The region also has very frequently period of extremely warm and rarely cold weather, which is also a confirmed risk to human health



Graph. 6 Monthly distribution of Cold waves periods in Strumica (1961-2012)



I.2. Other biophysical factors of importance for the sensitivity assessment

I.2.1. Water and drinking water supply status

Climate change has the potential to affect both water supply and water demand in Macedonia. Climate change will reduce water supply. According to the recent Green Growth study of the World Bank, there are increases in water supply in a few basins through 2020, but by 2050 all basins see a decline in mean annual runoff. Supply is impacted through changes in temperature and rainfall amounts as well as temporal and spatial patterns. Higher temperatures cause higher levels of evaporation in natural lakes and man-made reservoirs thus reducing water availability.

In the Water report of this study it is concluded that Strumica watershed is vulnerable region in both cases/scenarios, current condition and projected condition up to 2025. During the year the risk is dependent of the season. Out of the irrigation season, January to May, there is no water shortage in the watershed.

In the region of Strumica, Vasilevo, Novo selo, Valandovo the population living in the urban areas has an access to drinking water systems with proper purification and disinfection. In Strumica, the city drinking water is coming from the two artificial accumulations (Vodocha and Turija) with a proper treatment with purification and disinfection. Some of the villages have a regional water supply system with regular disinfection of the water (Bosilovo).

Generally the water quality is affected by floods and draughts. Floods could contaminate or damage the infrastructure of water supply systems. The SE region is already experiencing such difficulties with water supply systems in most of the rural parts of the region. Out of the cities, the % of the water samples with in proper quality is rising with variation between 40-100 % samples (especially in the rural water supply objects which are not regularly checked and treated). Most frequently among the chemically in proper samples, the absence of residual chlorine is present, while in the structure of the microbiologically contaminated samples, the presence of coli form bacteria is most frequent which is a treat

for the health of the population and potential cause for diarrheal diseases. This situation could be exacerbating given a climate change scenarios with increasing floods. Draught affect the water supply and currently water shortage is present during irrigation season (January to May). In a climate change scenario with increasing temperature or extreme weather events, the current vulnerability conditions could increase climate change risk. The same status has the drinking water profile of the Gevgelija region (Gevgelija, Negorci Bogdanci, Dojran, Miravci) with the emphasis of frequent presence of Arsenic in the city of Gevgelija drinking water system.

Conclusion: the drinking water system in the region has a satisfactory status so far, especially in the urban areas. The potential health treat could be the unsafe surveillance and absence of treatment of the water supply systems in most of the villages. Failures in the domestic water supply are especially possible in the periods of floods which are very frequent in this area, due to damage in the water supply infrastructure.

Table 1. The most common effects during specific occurrences of the health ecology for the water-supply and the disposition of waste water.

Most common effects	Floods	
Damaging of building constructions	1	1 <i>serious possible effects</i> 2 <i>less serious possible effects</i> 3 <i>the least or no possible effects</i>
Main intakes damaged	2	
Damaging of the water sources	2	
Lack of energy	2	
Pollution (biological or chemical)	1	
Transport damages	1	
Lack of personnel	2	
System overload (due to people displacement)	1	
Lack of equipment, spare parts and supply	1	

I.2.2. Food production and food safety

Local food production

From the data presented in the Agricultural part of the document it can be noticed that the Growing season length in the South Eastern part of Republic of Macedonia will be shortened in some sub regions up to 33 days. This is significant reduction of the growing season and significant influence in agricultural production can be expected which means reduction in the basic agricultural products so characteristic for this region. In this report it is also clearly stated that the SE region is highly vulnerable to the negative impact of CC in terms of increasing air temperature on a yearly base and during the growing period, and this changes will have serious (negative) impact on the agricultural production.

Food safety

Despite the reorganization made in the food control system there is still no proper monitoring of the food safety in the country especially for the domestically produced food. The situation is the same in the SE region. The number of food producers establishing

HACCP food safety control system is increasing but there is still room for improvement. Among the tested samples 3% are microbiologically in proper caused mostly by contamination of the animal food (especially fast street food) with Salmonella species and E. coli.

Conclusion: in order to have much better food safety control system, there must be improvements in the monitoring of domestically produced food and increasing number of the producers and other subjects in the food supply system introducing proper HACCP systems.

Nutritional status

The nutritional status of the children is the most representative indicator for the status of nutrition. This is the task of the National Public Health Program or sometime is done through special surveys. The table below presents the children nutritional status (up to 5 years old) in the country in 2011, including the South East region.

Table2: Nutritional status of the children under 5 years in the regions of RM

	Weight for age			Number of children under age 5	Height for age			Number of children under age 5	Weight for height			Mean Z-Score (SD)	Number of children under age 5
	Underweight		Mean Z-Score (SD)		Stunted		Mean Z-Score (SD)		Wasted		Mean Z-Score (SD)		
	percent below				percent below				percent below				
	- 2 SD ¹	- 3 SD ²			- 2 SD ³	- 3 SD ⁴			- 2 SD ⁵	- 3 SD ⁶			
Sex													
Male	1.5	.2	.5	669	5.6	2.4	.1	667	2.2	.3	13.4	.6	653
Female	1.1	.2	.4	663	4.3	1.7	.0	652	1.4	.1	11.4	.6	646
Region													
Vardar	1.3	.0	.3	99	5.1	2.3	.1	98	3.8	.8	6.5	.3	98
East	3.3	.0	.1	110	6.3	2.7	-.3	110	2.8	.6	7.3	.4	109
Southwest	2.8	.7	.6	117	13.3	8.4	-.2	111	3.8	1.5	22.5	.8	103
Southeast	.4	.0	.6	81	1.3	.0	.3	81	1.0	.0	12.8	.7	79
Pelagonia	1.8	1.3	.4	152	4.1	1.4	.0	152	2.3	.0	13.1	.6	152
Polog	.5	.0	.2	251	5.0	1.7	.0	250	3.4	.0	6.0	.3	244
Northeast	1.5	.0	.9	135	5.0	3.1	.0	135	.4	.0	28.5	1.2	130
Skopje	.6	.0	.5	388	3.1	.5	.1	382	.0	.0	10.9	.7	382
Area													
Urban	.8	.3	.6	671	4.1	1.5	.1	666	1.2	.2	15.8	.7	657
Rural	1.8	.1	.3	661	5.8	2.6	.0	653	2.4	.2	9.0	.4	642

The under nutrition in the SE region is the lowest in the country which confirms that this is not a risk/sensitive factor in the region. From other side, in recent food consumption studies, it is found out that the most present locally produced food on the tables is bread (above 45%). Most of the other products (except some vegetables) are mainly bought on the market.

1.3. Socioeconomic parameters of sensitivity

1.3.1. Marginalized communities and the impact of disasters

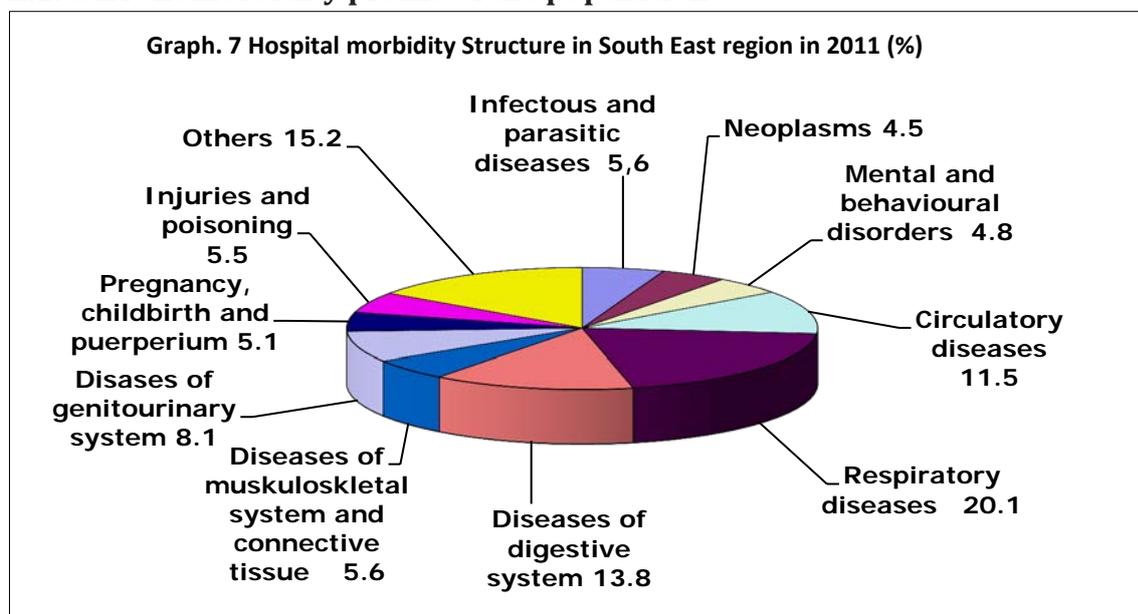
The poorest communities often suffer the most when disasters occur. Marginalized communities have poorer access to information on risks, therefore when disasters occurs they often have less information on issues such as possible evacuation, special humanitarian distributions etc.

These communities are therefore unlikely to have proper infrastructure, water supply and sewerage, paved roads, and electricity. Their houses are often of low quality and are easily destroyed by fire, flooding, landslide and earthquake. Such communities in the region are located mostly in of the rural areas especially in the frequently flooded areas.

The informal settlement “Tursko maalo” of Strumica affected by the wildfire in 2012 fits completely in to this model of vulnerable community. It is located in the suburb area near the city forest where approximately 3,000 mixed Turkish and Roma people live. The community lives in high poverty, often in illegally build houses with poor quality easy destroyed by fire or floods, with no proper infrastructure, neither proper water supply nor sewage system.

II. Sensitivity/Impact assessment - Analysis of possible relationship between current and past weather climate conditions and health outcomes (including trends in climate-change related exposures (Where possible, and taking into account the wide range of uncertainties in both climate projections and health effects, quantitative analyses have been performed).

II.1. Current morbidity profile of the population



Source: Institute of Public Health, 2012

The structure of the hospital morbidity in the region as a parameter of the health profile of the population is similar with the national one with the predominance of the respiratory, circulatory and digestive systems diseases.

II.1.1. Infectious diseases in the country and the region

Almost every year, the enteric (diarrheal) infectious disease most frequently from food or water born origin are the most present infectious diseases in the country and the region as well.

Table 3. Ten leading infectious diseases in RM, 2011

Enterocolitis (diarrheal diseases)	14,733.0	716.9
Chickenpox	6,999.0	340.6
Alimentary infections and intoxications	1,427.0	69.4
Measles	701.0	34.1
Scarlatina	357.0	17.4
Scabies	332.0	16.2
Viral hepatitis A	303.0	14.7
Chlamydia infections	289.0	14.1
Salmonellosis	281.0	13.7
Mononucleosis	218.0	10.6
Total	25,640.0	1,247.7

Source: Institute of Public Health of RM

It should be also noted that the compulsory immunization coverage in the region is similar to the country level, above 95 %.

II.2 Current burden of climate – sensitive diseases and conditions – Baseline scenario

The broad categories of health impacts which are associated with climatic conditions:

- Impacts that are directly related to weather/climate;
- Impacts that result from environmental changes that occur in response to climatic change;

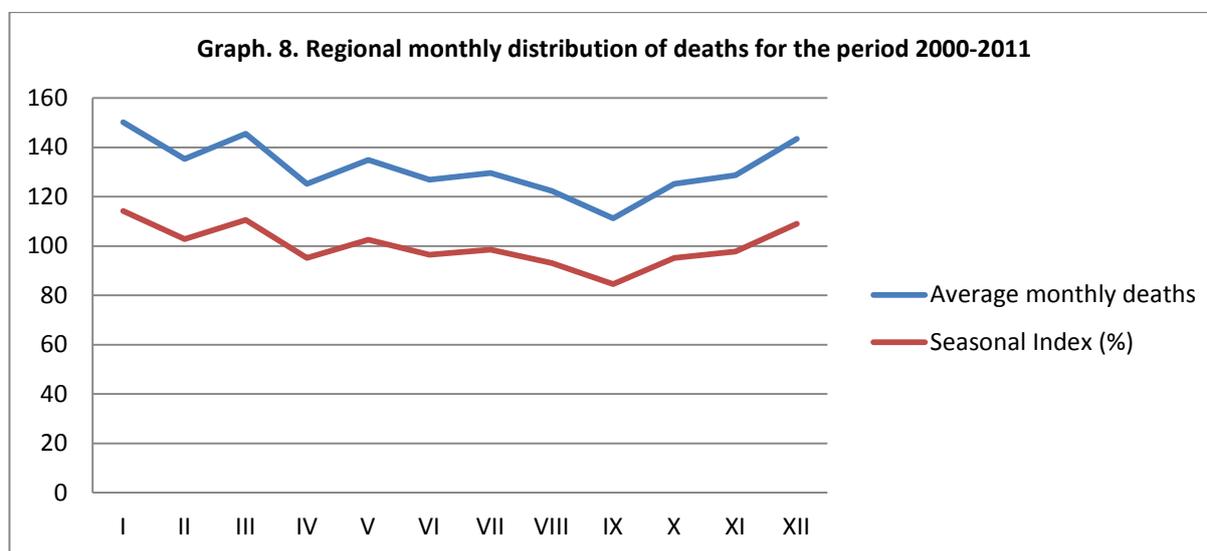
Health events to be part of this report are:

- Crude mortality link with temperature variations
- Emergency calls variations and link with temperature variations
- Food and water born diseases variations in different temperature periods (enterocilitis and salmonelosis)

Other kind of diseases which were reported as climatic sensitive in the country (especially in Skopje) like pollenosis, specific vector transmitted infectious diseases or UV related problems are still not actual (not reported) for the region.

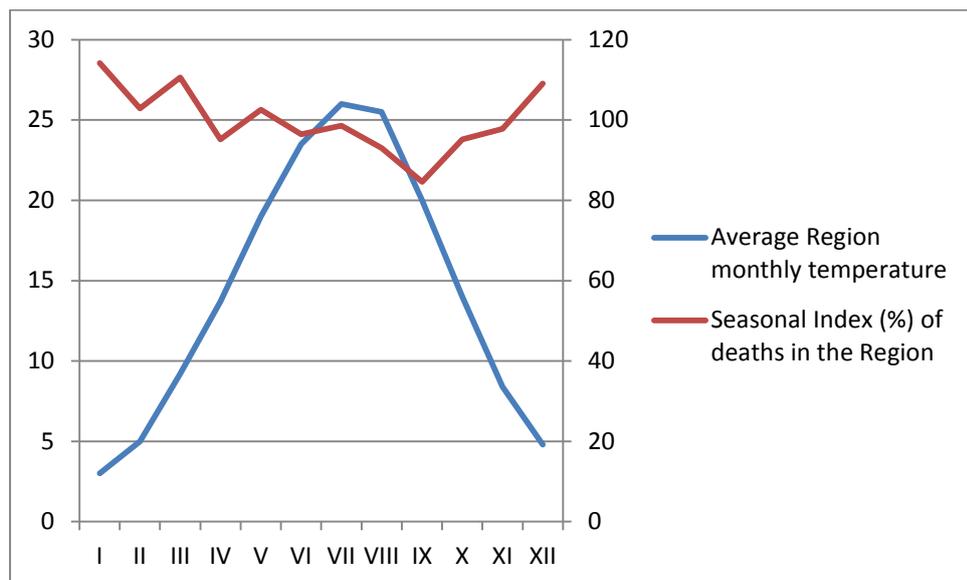
II.2.1.Total Mortality dynamics and link with the climate

The seasonal mortality index and correlation between the mortality trend and temperature variations were analyzed in Strumica (the biggest town in the region), based upon available data



January is a month with the highest number of deaths (14.4 % above the annual average of 131.5). Similar is with the other cold months (December – 109%, March 110% ...)

Graph. 9 Seasonal index of deaths in relation with average monthly temperature

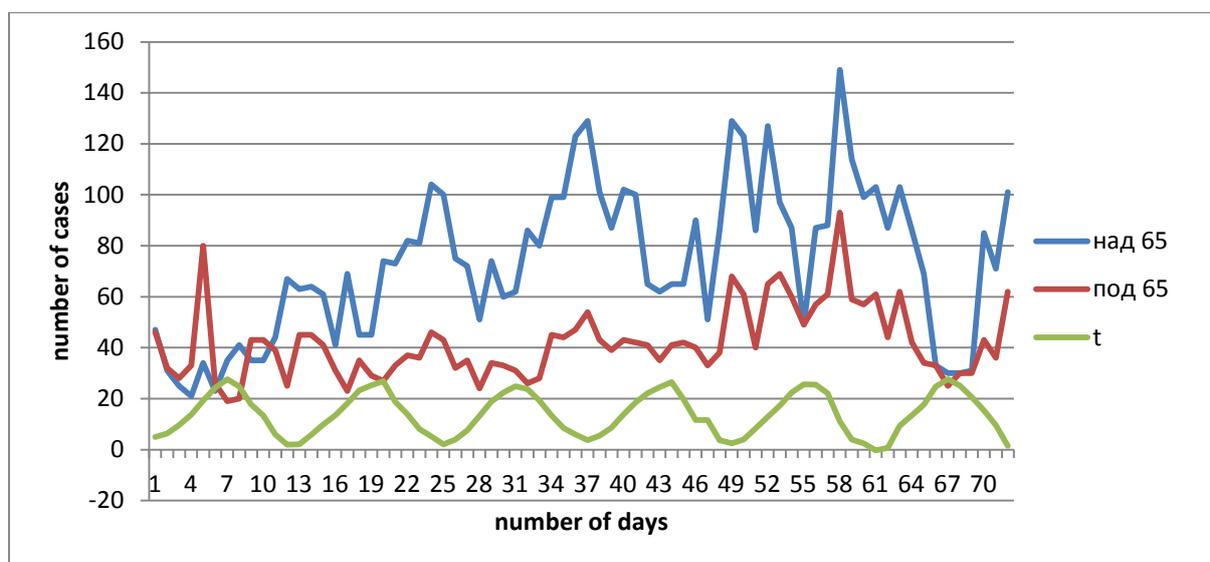


In multiple regressions testing, the correlation between the number of deaths and temperature variations in the period 2002 – 2011, Beta coefficient of -0.38 confirms the fact that the number of deaths are increasing with the decreasing of the temperature.

But, the testing in the warm period (June – September) of the year confirms another fact, the number of deaths are significantly increasing with the increase of the temperature in this period, **which confirms the sensitivity of the periods with high temperature and heat waves**

II.2.2. Emergency calls distributions in the different variations of temperature periods and different age groups of population

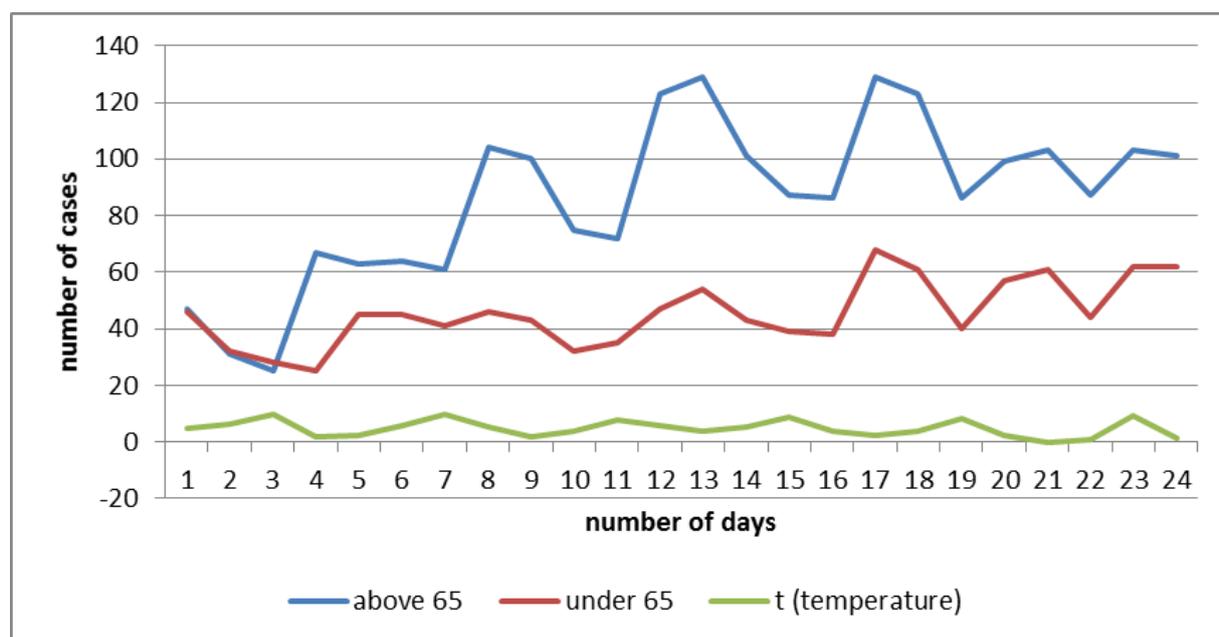
Graph. 10. Monthly distribution of Emergency calls for respiratory disease in Strumica in 2007-2012 by age-link with the temperature variations



It is visible the highest pick of the emergency calls due to respiratory diseases or symptoms is during the lowest temperatures (statistically negative correlation)

Multiple regression Coefficient is statistically significant Beta Coefficient (-,33) is highly statistically significant, which means with decreasing of the daily temperature there is significant increasing of the number of emergency calls due to respiratory diseases, even among the population under 65 but especially among the elderly which as well confirms the vulnerability of this age group as well as dependence on temperature variations.

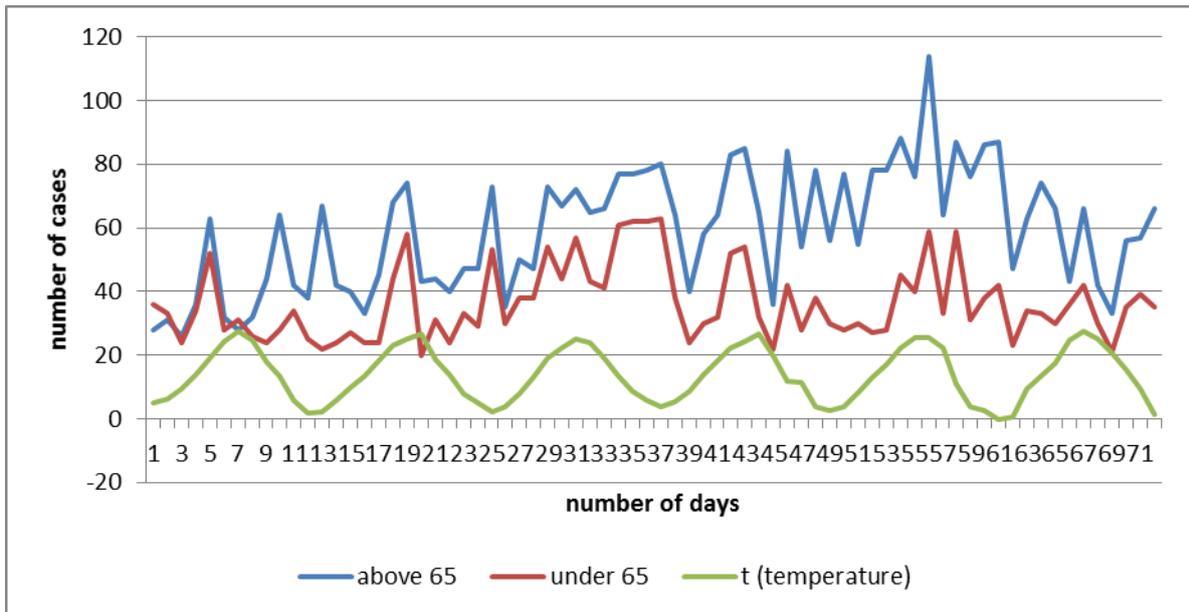
Graph. 11. Emergency calls from respiratory and CV diseases in the cold period of the year(December, January, February, March) in Strumica, 2007-2012, under and above 65 age



It is visible that in the period of lowest temperature the emergency calls due to respiratory diseases (or symptoms) are with highest pick, which means the statistical correlation is negativ.

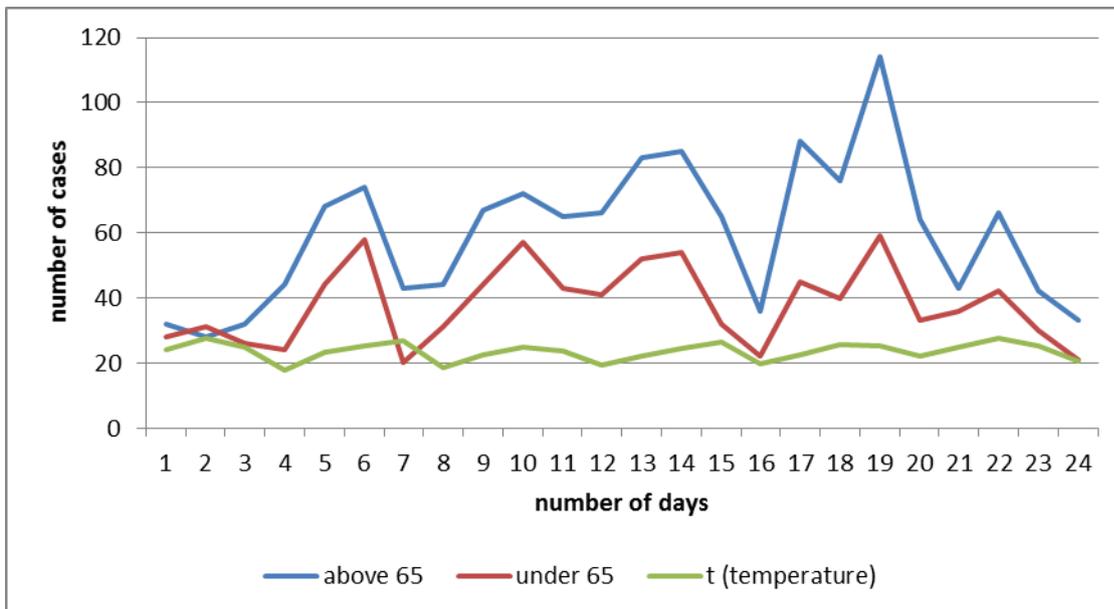
Beta coefficient (-,36) is statistically significant with negative tendency, meaning that with the decrease of the temperature in the cold period the number of emergency calls due to respiratory diseases significantly grows up among both groups of population.

Graph. 12. Age distribution of emergency calls due to respiratory and cardiovascular diseases in Strumica in 2007-2012



In regard to emergency calls due to cardiovascular diseases (or symptoms) the number is highest when the temperature is extremely high (statistically positive correlation), which could be a sign a health treat during the heat waves which are frequent in the region.

Graph.13. Age distribution of cardiovascular emergency calls in Strumica, in the warm period of the year (June, July, August 2007-2012)



It is visualized that the highest pick of emergency calls for cardiovascular reasons is in the hottest period (positive correlation)

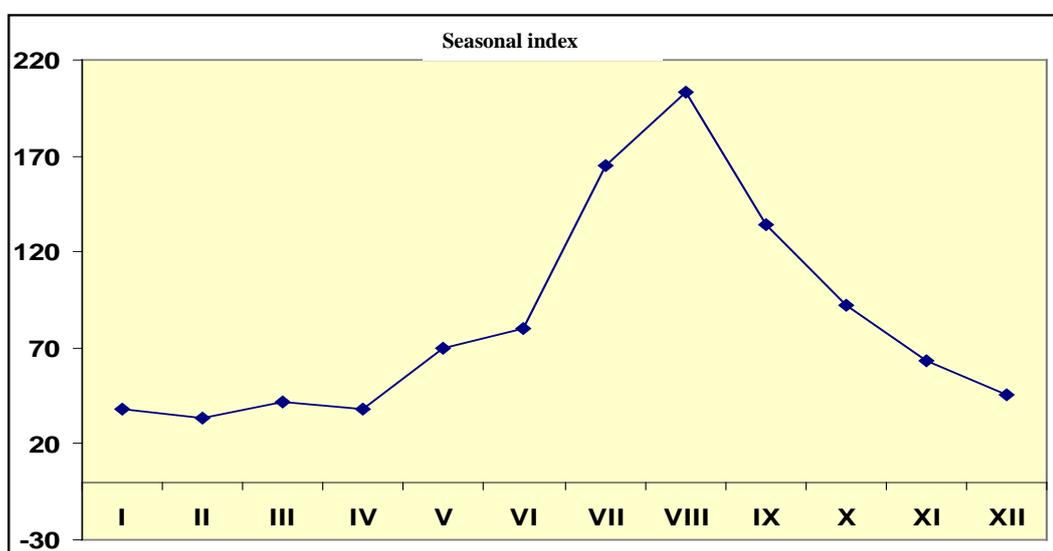
Number of emergency calls among the patients above 65 is **significantly increasing with the increase of the average temperature in the warm period of the year**, which confirms the special vulnerability of the elderly during the hot period of the year, (Positive beta coefficient (**0.227**)).

II.2.3. Food and water born communicable diseases (enterocolitis and salmonellosis) variations in different temperature periods

Infectious diseases in SE region

The structure of the infectious diseases in the SE region is similar to the structure in the country in which the diarrheal diseases (enterocolitis is most frequently on the first place). Among the first 10 diseases, there are others which can be linked with un favor climatic conditions and low level of hygiene and sanitation as well as food safety as are alimentary toxo-infections, salmonellosis and hepatitis.

Graph. 14. Seasonal index of Enterocolitis (diarrheal diseases) in Strumica in the period 1994-2008

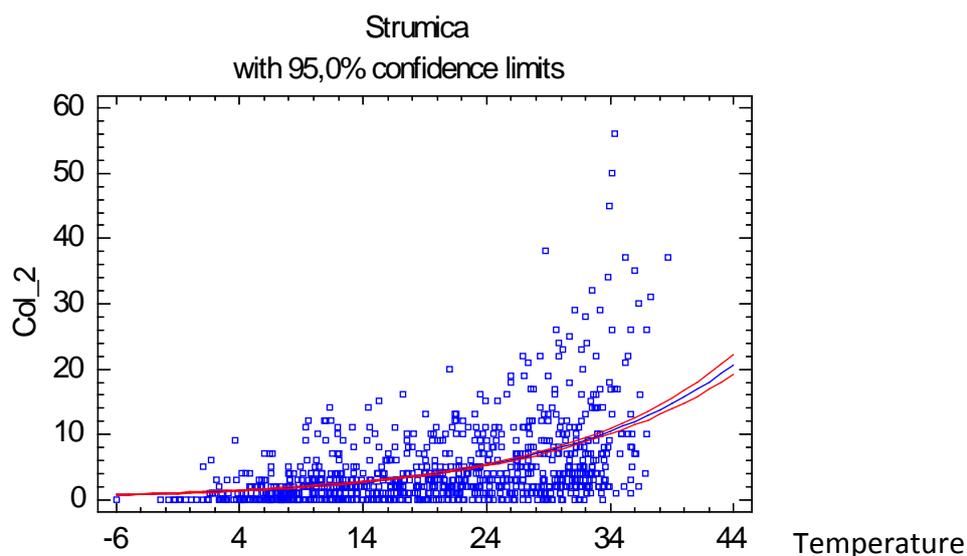


Average monthly = 24 / 1994-2008 год.

The highest value of the seasonal index of diarrheal cases was registered in the warm period (August 203 %, July 165%, September 133% and the lowest in the cold period February 33%)

The highest morbidity is registered in 2008 (1803/100.000)

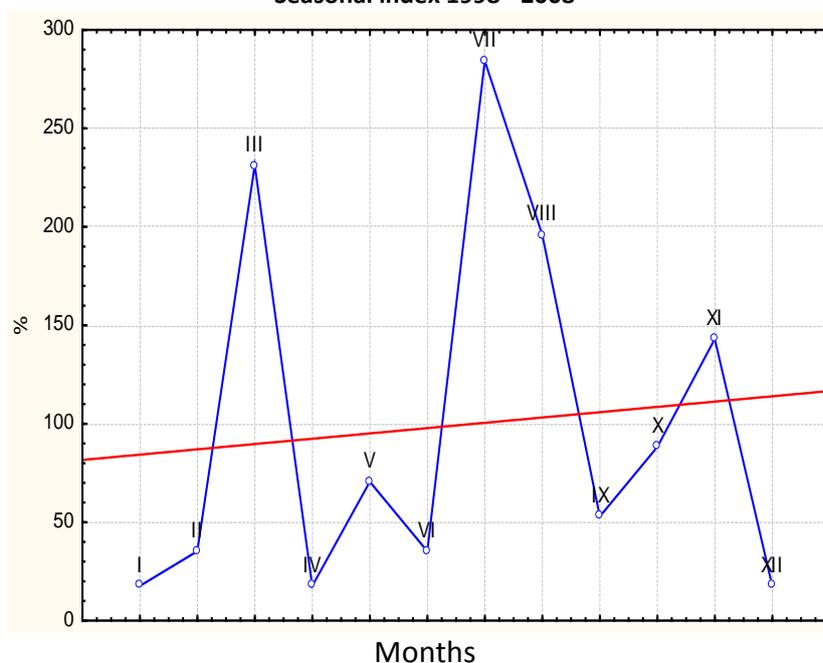
With polynomial regression test the correlation between the weekly diarrheal cases and average weekly temperature was analyzed for the period 1994-2008.



The results confirms the significantly positive correlation meaning the increase of the temperature is followed by an increase of the diarrheal cases

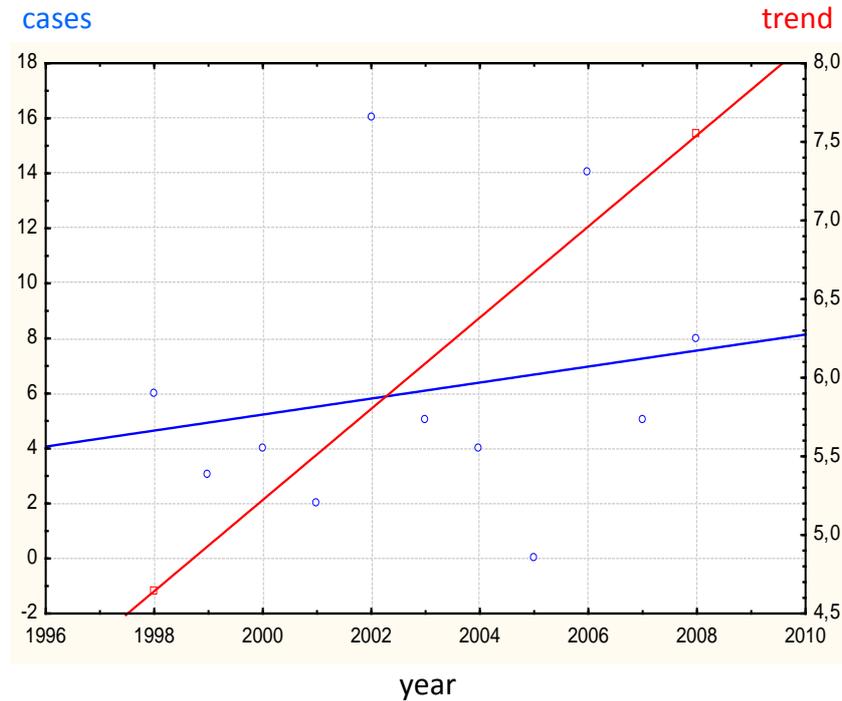
Trend of Salmonellosis cases in Strumica region- Recently a study was done to assess the relation between the dynamic and seasonal index of the salmonellosis cases and the average weekly temperatures in different cities in the country including the city of Strumica, for the period 1998-2008. The highest level of seasonal index of salmonellosis was mostly in the warm period in July, March and August and lowest in December and January.

Graph. 15. Municipality of Strumica/Salmonellosis Seasonal index 1998 - 2008



The total trend of the cases in the whole period was increasing

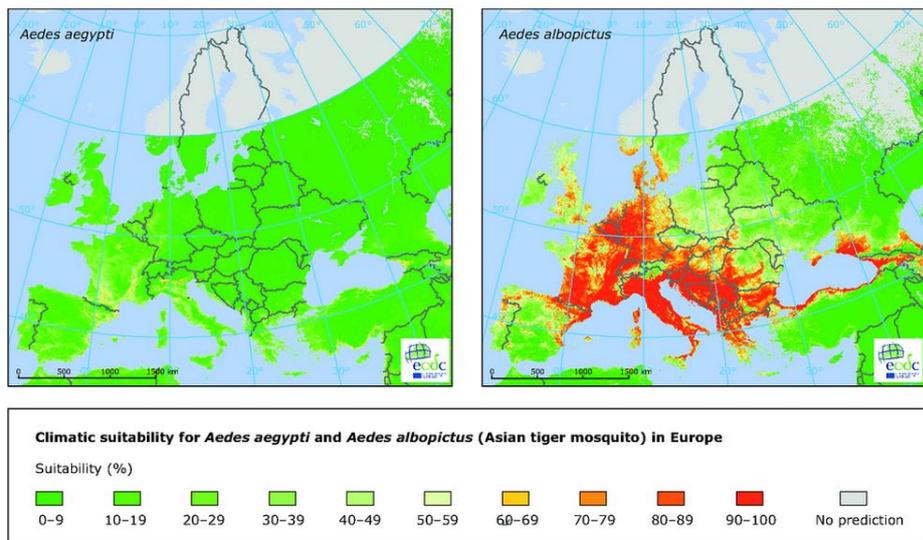
Strumica/Salmonellosis
Trend/1998 – 2008



Also, in biggest part of this period (1998-2008), the correlation between the salmonellosis cases and average temperature level, was statistically significant, meaning the cases were more frequent during the warm period.

Vector born communicable diseases - In accordance to the prediction maps from the European Environmental Agency, the region could be attacked by some vector transmitters of infectious diseases like the Asian Tiger mosquito. Though some isolated cases of West Nile virus fever and Malaria (imported) are reported last year in the country, so far there is

Fig. 3: Climatic suitability for the mosquitos *Aedes aegypti* and *Aedes albopictus* in Europe



no reported case of those diseases in the SE region. However, following the expert judgments it is likely, that based upon climate change predictions, the treat of an appearance of cases of Boreliosis, Leishmaniasis, Tick Borne Encephalitis and increasing of the rate of food

born or even water born diseases in the country and the region and could be possible.

III. Assessing adaptive capacity

What exactly is adaptation? The Intergovernmental Panel on Climate Change (IPCC) define adaptation as “an adjustment in natural or human systems in response to actual or expected climatic stimuli (variability, extremes, and changes) or their effects, which moderates harm or exploits beneficial opportunities” (IPCC TAR, 2001). It is this evidence base, along with the projected changes in climate, that have given rise to concerns that the continued viability and sustainability of many systems will be dependent on their abilities to successfully adapt to future changes in the climate (mean, variability and extremes).

III.1. National and local policies and strategies

III.1.1. General adaptive capacity

Policy and legal framework exists in the country through the already adopted National CC Health Adaptation Strategy which has an intersectoral and multilevel (national-local) approach.

National CC Health Adaptation Strategy – it was estimated that most of the goals in the strategy paper are achieved, though there are still rooms to be improved. **Intersectoral engagement** (including the coordination) should be improved, especially the involvement of the local government which so far is not the case in the SE region as well. The **knowledge of the climate health risks** (among the health workers) has been initially introduced, but not proper follow up and evaluation. There is no data about activities/campaigns for **raising public awareness about CC and health** as well as for the number and structure of flyers and brochures about CC risk distributed publicly. The Heat waves action plan is in function all over the country including the SE region as an example of an **integrated (weather and health) early warning system** dedicated to the prevention/adaptation to climate change events. Special role in it has the Regional Public Health center. Recently a **Cold weather action plan** is also adopted on national level. In the area of **the infectious diseases there is also operating Early warning system** which could be useful for the CC health risks observed in the region. Early warning system for monitoring and management of food born and water born disease is operating on a regular basis including the public campaigns and health public promotional activities of the Centers for public health. And, while the monitoring of the drinking water supply systems and drinking water samples is under the control of the public health system and seems to be manageable even in more extreme conditions, the food safety control and implementation of the HACCP system is uncertain since there is no proper and transparent information.

Vector born communicable diseases monitoring system in the country should be additionally improved and include the SE region since there are predictions from the international agencies (European Environmental Agency) for the enlargement of the vector populations and higher transmission risks of some vectors in the region. Namely the climate in the region will be suitable for spreading of mosquitoes like *Aedes aegypti* and Asian Tiger mosquito and appearance of diseases like Lyme borreliosis (already registered in the country). Chikungunya and West Nile fever.

However, the region also needs some **more précised meteorological observations (including extremely hot or cold periods), data and predictions** in order of taking some precautionary measures in the risky periods. The existing national air pollution alert system should include this region as well. Currently there is **no any air quality data in the region.**

The UV radiation risks morbidity and mortality data and UV radiation protection measures and monitoring system though emphasized in the National CC health adaptation strategy is still not introduced, and will be of considerable importance for the region endangered of UV radiation and potential increase of skin cancer incidence. This includes the need of special assessment of the UV health risk to population of exposed agricultural and other workers. Unfortunately, though there is evidence that the extended seasons of pollenosis in the country will become serious treats due to climate change conditions, the monitoring is still not introduced out of Skopje. SE region should be among the first to be observed, having in mind the results of a study made 7 years ago in the region of Dojran. There is a statement that the **floods early warning system** managed by many sectors (Hydro meteorological Health, Crisis management structures on central and local level) which includes the regional structures is operating on a satisfactory level, including regular checkups and exercises of simulated crisis. Still there is much more to be done especially in the health sector in order to prevent the possible health impacts and especially in the rural/agricultural settlements. The activities planned in the National Crisis Preparedness Program are also of great importance for the role of the health (especially hospital) sector in such circumstances. Such a system should be established for other **extreme climate events** actual for the region.

III.1. 2. Planning capacities

In **The National Crisis Preparedness Program**, it is emphasized that **The extreme events** cause a stress in the human system and structure because they are much greater forces than those that the body possesses and which are normally overcome.

Presenting the floods treat as one of the possible risks in the country, the most common critical regions in the Republic of Macedonia are shown during conditions of fast snow melting with intensive rainfalls. From the above shown it can be ascertained that there is a potential threat of flooding the heath facilities and a possible obstruction of the regular work of the same in the Skopje region, the Gevgelija region (where there is a General Hospital and a Special Hospital), the Strumica region (where there is a General Hospital, a Health House, and Center of Public Health for Health Care and etc.), etc.

According to this plan

- The health system response to specific and sudden crisis as well as the effectiveness and capacity in terms of supplying adequate health services and medical help to the affected population depend on ***the level of hospital preparedness*** and the other heath facilities.
- It is ***expected that they continue to function during crisis***, but experience has shown that they tend to be very fragile during crisis (for example during natural disasters and especially earthquakes) from the point of view of infrastructure, and consequently unable to satisfy the pressing needs.
- ***The hospitals must be designed so that they satisfy the security standards and the standards in terms of effect***, which will provide security for the patients and the medical staff in the hospital during crisis.
- ***The emergency department and hospitals*** need to have the necessary capacity and infrastructure to respond to the urgent medical needs of the population and to the prompt changes that occur in every crisis.
- ***It is necessary to maintain a high level of preparedness with all the emergency***

units in the country, especially with those located in the hospitals, and in case of a crisis “the hospital plan for crisis preparedness” needs to be activated. The resources and the staff are included in both the plans for the PHI Health Houses and the PHI Centers for Public Health on the level of individual regions, as well as all the relevant factors.

- In Republic of Macedonia there are 18 organized services for providing off-hospital emergency help in the sense of selected working units with an individual personnel, rooms and vehicles, including **Strumica with 12 teams on field and a clinic and 4 dispatcher nurses, three teams per shift and 1 dispatcher. And Gevgelija with 4 teams.**

III.2 Sector capacities

III.2.1. Surveillance of communicable diseases

The country has a well organized system for monitoring and reporting of the communicable diseases. If clusters of infectious diseases cases are reported the responsibilities, actions and coordination are taken by the Institute of public health, Clinic of infection diseases and febrile conditions, Regional public health centers and State Health Inspectorate. On the top of this system there is a National Committee for communicable diseases. When there is an outbreak of infectious diseases, surveillance and responses or in some cases international laboratories are made on a very effective way. Though existed, the collaboration with the veterinary sector should be improved with regard to both, surveillance and responses to outbreak. However, the National Climate Change Health Committee explicitly included consideration of the infectious diseases health risks of climate change, and made (and published) initial assessment of potential health impacts of climate change in regard to the infectious diseases potentially related to climate change.

Early warning system

There is a surveillance and response system which has been designed to detect the health threats outlined in the risk assessment, as soon as possible.

- Early warning system on behalf of the hospitals/clinics and institutions on a national and local level, with a special accent on Epidemic outbreaks.

At the moment of the conducted examination (in regular working hours or when working on call), when the doctor - infectious diseases specialist will determine a communicable disease, or in certain cases (in accordance with regulations from the Communicable Diseases Law) a suspicion of a communicable disease, he/she fills a registry form which is delivered to the Public Health Institute-Skopje. The procedure is conducted continually, during 24 hours, 7 days a week. The delivery of the registry forms is done during 24 hours via the person in charge (medical technician or an epidemiologist) from the PHI-Skopje that collects the filled and registered (outlines in the Communicable Diseases Book of Evidence) forms every day (except on Sundays, but in cases of epidemic outbreaks, even on Sundays) in the period between 08-12 am – with a deposited signature that he has collected a stated number of forms. Each of the registry forms is previously registered in the Communicable Diseases Book of Evidence, in which the following data are listed: ordinal number, diagnose, how the disease proved-clinically or via laboratory, name and surname of the diseased person, year of birth, profession, place of work/study/kindergarten, address, if the disease is subject to compulsory

immunization, if the person has been immunized, date of illness, source of the disease, date of examination/admittance, which doctor registered the person, bacillus carrier (yes-no), death registry (when was the person admitted and date of death).

The second notification system – ALERT, is consisted of notifications to an authorized electronic-computer connection of the PHI UCIDFS- Skopje for a syndrome (according to strictly defined criteria-upper respiratory tract infections, lower respiratory tract infections, rashes- without chicken pox, meningoencephalitis, water diarrhea, hepatitis, hemorrhagic fever) register of patients according to age (0-6 years, 7- 19 years, 20-59 years, above 60 years) every week (from Monday to Wednesday) for the previous week (from Monday at 00.01 till Sunday at 24.00), for which the Clinic receives a return information about the epidemiological state in the country. In agreement with the responsible epidemiologist the access to the system in an early phase of pandemic influenza will be maintained at every 24 hours (from 08 till 09 for the previous 24 hours), and in the developed pandemic phase – at every 12 hours (from 08 till 09 and from 20 till 21 for the past 12 hours).

For handling the consequences from extreme weather conditions in 2007, there was a National Committee established to monitor the effects on the people's health from the high/low temperatures with members coming of all the relevant sectors, with a mandate to suggest professional prevention measures on the basis of received data from the Hydro Meteorological Department-Skopje. There is a guide translated into Republic of Macedonia – "Health Action Plans for Heat Waves" (WHO, 2008) and the same has been distributed to all the relevant factors.

Due to the potential threat, in the future planning of building new public health facilities, it is necessary to take into consideration the assessment of the flood vulnerability, as well as to plan a procedure for reducing the damages of the already build capacities.

III.2.2 Surveillance of non-communicable diseases

The system is operating in accordance to Law for health evidence, and is based on monthly or annually reported cases of non communicable diseases through the network of the public health centers and the National Public Health Institute. Unfortunately the daily and weekly data (including data on emergency calls) are missing which is extremely important in the process of quantification of the health impacts from different the CC events and extremes. The mortality data should have similar dynamic of reporting.

III.3 Specific adaptive capacity

Hospital Safety Index – is another program for assessment of the preparedness of the health sector (hospitals) for operating in cases of emergencies and crisis which includes whether and climate extremes. The assessment was done through the special PAHO/WHO methodology and the results are presented for the Strumica Hospital which covers the whole region of almost 200 000 inhabitants. The findings confirms that there are many activities present on the ground (committees, operational plans, informed and trained staff) but still there are activities to be done (starting from the special budget, than proper investments in the stability and safety of the construction, medical equipment, air conditioners and other necessary supplies, many activities during crisis periods etc.)

Table 4. Preparedness for operation during crisis and emergencies - Strumica Hospital Safety Index (PAHO/WHO)

Function/activity	Level of preparedness
Hospital emergency committee established	
- Internet and communication	
- Special Budget for the committee	
Operational plans and procedures, trained staff on place for operation in different type of catastrophes (incl. floods and epidemics)	
Active surveillance of epidemics in the region	
Plans for risk communication	
Plans for Systems maintains in crisis	
Reserves of drugs, medicines and instruments in case of emergencies	
Ventilation/air conditioning	
Safety construction, Building, equipment, electricity and heating system	

III.3.1. Health sector characteristics with focus on the region

There are no big differences in the basic attributes of the health sector in the region compared to the situation in the country.

III.3.1.1. Human capacities

The average number of physicians in the cities (Strumica and Gevgelija) is in line with the national average, but there is missing doctors in the rural areas. The same is with the nurses. This could be a treat in case of climate extreme periods or events as floods and epidemics.

Table.5. Doctors and nurses (per 1000 inhabitants) in 2011

	Number		per 1000	
	Doctors	Nurses	Doctors	Nurses
Republic of Republic of Macedonia	5649	7488	2,74	3,64
South East region	331	453	1,91	2,62
Bogdanci	10	8	1,18	0,95
Bosilevo	5	5	0,35	0,35
Valandovo	17	24	1,42	2,01
Vasilevo	4	4	0,32	0,32
Gevgelija	74	118	3,23	5,15
Dojran	3	4	0,90	1,20
Konce	1	1	0,28	0,28
Novo Selo	8	7	0,72	0,63
Radovis	45	62	1,57	2,16
Strumica	164	220	2,91	3,91

III.3.1.2. Hospital beds

The number of hospital beds (per 1000 inhabitants) is 3,75 for the region which is slightly worse than national average and some international data (WB data..more than 4/1000 in most of the countries with similar level of development). This should be considered as important during the CC adaptation planning process.

Table 6. Hospital beds in the country and regions in 2011 (1000 inhabitants)

	BEDS	
	TOTAL	per 1000 inhabitants
REPUBLIC OF REPUBLIC OF MACEDONIA	9279	4,51
Pelagonija region	1432	6,13
Vardar region	503	3,27
North east	354	0,58
South west	825	4,71
Skopje region	4207	18,99
South east region	673	0,375
Polog region	646	3,73
East region	639	2,02

IV. Instead of Conclusions

Table 7. Overview of the CC consolidated impacts and predicted pressure to the Health sector in SE region

Climate effect	Impact	Confirmed the study	in	Consequence (pressures to the health system)	Probability to happen	
Increased summer temperature, included heat waves	Increased summer mortality especially among elderly	+		Increased demands on health and adult care services	high	
Warm periods/heat waves	Increased emergency calls	+		Increased demands on health and adult care services	high	
Increased average temperatures	Increased frequency and intensity of Summer air pollution (ozone)	To be confirmed (no appropriate data)		Increase in cases of mortality and morbidity linked to respiratory diseases and associated hospital admission	moderate	
Summer temperature	Temperature morbidity	+		Increased demands on health and adult care services (including workers)	high	
Increase in average temperature	Extended pollen season and more days with high pollen counts	Assumption to be checked and confirmed (need investigations)		More people suffering with hay fever and pollen asthma	moderate	
UVB radiation	Sunlight/UV exposure	To be confirmed after introducing proper monitoring and warning system		Increased demands on health and adult care services especially vulnerable population of workers	moderate	
Winter temperature	Temperature mortality (winter)	+		Reduced demands on health and adult care services	high	
Winter temperature/cold waves	Low temperature morbidity	+		Increased demands on health and adult care services	high	
Extreme weather events	Increase in demand for emergency medicine	+		Overwhelming of public services	high	

Conducting Climate Change Health Vulnerability and Adaptation assessment in South East region in RM

Extreme weather events	Health facilities infrastructure	Hospital safety index	Potential impacts on safety of hospital facility and operation	Low-to moderate 
Extreme weather events	Transport network failure, destruction of homes, water shortages, displacements, disruption of access to health services	Assumption	Increased demands on health and adult care services in the risky areas	moderate 
Temperature and rainfall	Increased prevalence and survival of certain arthropods such as ticks and mosquitoes	To be monitored and confirmed	Vector born diseases	Low-moderate 
Increased average temperatures	Increase in certain water born diseases, deterioration of drinking and surface water qualities, especially rural settlements	Potential treat, to be monitored permanently	Health impacts such as diarrhea and nausea	Low-moderate 
Summer temperature	Multiplication of pathogenic microorganisms	Partially confirmed	Increase in food born diseases	moderate 
Summer temperature	Exposure of medicines to high temperature	Hospital safety index	Reduction in medicine efficacy	Low-moderate 
Extreme weather events	Patient recovery rates in hospitals may be compromised	Hospital safety index	Increased demands on health and adult care services	moderate 
Extreme weather events	Impact on health workers and working conditions	Hospital safety index	Reduction in health workers performances	moderate 

V. Literature:

MoH, PHI - The Effects on Health of Climate Change in the Republic of Republic of Macedonia , 2011

MoH – National Climate Change and Health Adaptation Strategy, 2011

MoH - Crisis Preparedness Planning for the health system in the Republic of Republic of Macedonia , 2009

WHO - Climate Change and Human health- 1996,

WHO - Climate Change and Human Health impact and adaptation 2000,

WHO - Climate Change risk response 2003,

WHO - Methods for assessing Human Health Vulnerability 2003,

WHO - PAHO Assessment Guides (Hospital Safety Index), 2008

WHO – Guidance to support the implementation of the Health National Adaptation Process, 2012

WHO – Protecting Health from Climate Change – Vulnerability and Adaptation Assessment, 2008

WHO Climate Change and Health : A Tool to Estimate Health and Adaptation Costs , 2013

ECDC – Climate change and communicable diseases in the EU Member States (Technical document) 2010

EEA – Climate adapt portal - <http://www.eea.europa.eu/climate-adapt>

HPA - Health Effects of Climate Change in the UK 2012 -Current evidence, recommendations and research gaps, 2012

State Statistical Office – Regions of the Republic of Republic of Macedonia , 2012

Brief /WB - Republic of Macedonia n Green Growth and Climate Change Analytic and Advisory Support, Program, November 2012

Institute of Public Health annual reports

**CONDUCTING CLIMATE CHANGE HEALTH
VULNERABILITY AND ADAPTATION
ASSESSMENT IN SOUTH EAST REGION IN RM
ACTION PLAN**

Conducting Climate Change Health Vulnerability and Adaptation assessment in South East region in RM

Dragan Gjorgjev -CC Adaptation actions in health sector in SE region (as an addition to the existing – regular public health activities)

Action (adaptation measures that will maximize the economic benefit and minimize the climate change impact per sector)	Type Policy Legislation Capacity building	Stakeholders (Clear distinction of responsibilities among the relevant stakeholders)	Timeframe Short term/long term	Financing (Financial means for implementation of the measures)	Constraints (Identification of possible barriers and risks, including legal arrangements, institutional management, financial and technological aspects)	Comments	Cross sectors connection
<p>Preparation and establishment of Regional CC Adaptation Strategy (Health sector included) or other policy document as an executive document (operational plan) or to be in line with the III-rd National Communication or other national policy documents in this field or the field of disaster management + heat and cold waves Action plans (operationalization/implementation of existing National action plans)</p>	<p>policy document (win-win action)</p>	<p>Representatives of Centers of public health, local and regional municipality, Ministry of health, university, experts/consultation with red cross, hydro meteorological and center of crisis</p>	<p>to be prepared in short term for long term use</p>	<p>approx. 20.000 USD (for the strategy preparation and communication)</p>	<p>Lack of supportive policies, standards, regulations, and design guidance – deficiencies, encouraging status quo and/or presenting impediments; Prohibitive costs of identified adaptation options when budgets are limited;</p>	<p>To be consistent with the national, regional and local legislation and development policy documents. To have a clear conceptual framework which is necessary in order to define basic concepts like risk, impact, vulnerability, hazard, exposure, adaptive capacity and sensitivity and to define how to measure them and possible indicators. Focus on actions to manage priority climate risks – focus on actions to manage the identified risks and opportunities in this study. Recognize the value of no/low regrets and win-win adaptation options in terms of cost-effectiveness and multiple benefits. Make the cost benefit assessments. Monitor and evaluate (asses) systematically</p>	<p>All other sectors should (could) be included in the integral Policy paper</p>

Conducting Climate Change Health Vulnerability and Adaptation assessment in South East region in RM

Action (adaptation measures that will maximize the economic benefit and minimize the climate change impact per sector)	Type Policy Legislation Capacity building	Stakeholders (Clear distinction of responsibilities among the relevant stakeholders)	Timeframe Short term/long term	Financing (Financial means for implementation of the measures)	Constraints (Identification of possible barriers and risks, including legal arrangements, institutional management, financial and technological aspects)	Comments	Cross sectors connection
<p>Flood action plan (including the health sector chapter and introducing Flood early warning system) – to be separate or an amendment to the existing disaster preparedness plan</p>	<p>policy document/enhancing the adaptive capacities</p>	<p>National and local government, Ministry of health, center of crisis, Red Cross, National public health institute and centers for public health</p>	<p>long term</p>	<p>50.000 USD (only for the plan)</p>	<p>Limited interest and understanding of nature and extent of risks and vulnerabilities – current and projected; Not seen as a big problem and the temptation is to wait for the impact then react</p>	<p>Multisectoral approach an imperative. The region is especially vulnerable on floods (more than on droughts) with possible health, social and economical consequences. Primary prevention can be either structural (physically engineered interventions) or non structural (policy and organization). There should be Work in partnership – to engage the communities and ensure they are well informed. Make the cost-benefit analysis. Monitor and evaluate systematically</p>	<p>All other sectors should be included in the flood action plan</p>
<p>Establishment of SE Regional intersectorial Committee for Climate Change and health monitoring and adaptation process</p>	<p>Establishment/enhancing of local/regional adaptive capacity (low regret action)</p>	<p>(composition: representatives of regional and local structures and municipalities – mayors, Public health institutes , Center of crisis branches</p>	<p>short and long term</p>	<p>5.000 USD (annually for the work of the committee)</p>	<p>Limited interest and understanding of nature and extent of risks and vulnerabilities – current and projected; Not seen as a big problem and the temptation is to wait for the impact then react;</p>	<p>Work in partnership – to engage the communities and ensure they are well informed</p>	<p>All other sectors present in the regional /local community structures</p>

Conducting Climate Change Health Vulnerability and Adaptation assessment in South East region in RM

Action (adaptation measures that will maximize the economic benefit and minimize the climate change impact per sector)	Type Policy Legislation Capacity building	Stakeholders (Clear distinction of responsibilities among the relevant stakeholders)	Timeframe Short term/long term	Financing (Financial means for implementation of the measures)	Constraints (Identification of possible barriers and risks, including legal arrangements, institutional management, financial and technological aspects)	Comments	Cross sectors connection
<p>Enhancing of the ongoing public health activities in the region such (in the scope of the National Public Health Program) + enhancing the human capacities in the public health and health care institutions in the region</p>	<p>Enhancing of local/regional adaptive capacity in the public health sector (no regret action) disease surveillance (communicable, non-communicable diseases, including, early warning systems, Immunization, food hygiene, (food born diseases), nutritional status and supplementation</p>	<p>(National Government , Ministry of Health + The network of National public health institute and Public Health centers, + regional and local structures and municipalities)</p>	<p>short and long term</p>	<p>50.000 USD (to add on the present public health budget + new employments)</p>	<p>Public health budget constrains, Luck of human capacities</p>	<p>Many of the projected impacts of climate change on health are avoidable or controllable through application of well-known and well-tested public health and health service interventions</p>	
<p>Education and training of the health professionals for dealing/management with the CC impacts and adaptation measures on health sector level/+promotion and communication of the CC activities</p>	<p>Enhancing of local/regional adaptive capacity in the health sector + public awareness (no regret action)</p>	<p>(National public health institute and Medical Faculty to lead Training of different health professionals: representatives of regional and local structures and municipalities – mayors, Public health institutes , Center of crisis branches</p>	<p>short and long term</p>	<p>20.000 USD</p>	<p>lack of human capacities, lack (limited) of interest and prioritization</p>	<p>Work in partnership – to engage the communities and ensure they are well informed</p>	<p>Could be a part of integral (cross sectors) training and communication Program</p>

Conducting Climate Change Health Vulnerability and Adaptation assessment in South East region in RM

Action (adaptation measures that will maximize the economic benefit and minimize the climate change impact per sector)	Type Policy Legislation Capacity building	Stakeholders (Clear distinction of responsibilities among the relevant stakeholders)	Timeframe Short term/long term	Financing (Financial means for implementation of the measures)	Constraints (Identification of possible barriers and risks, including legal arrangements, institutional management, financial and technological aspects)	Comments	Cross sectors connection
<p>Creation information and data collection + research of CC health effects in the region emphasized in this study including those with limited or no data (UV risks, food and water born diseases, vector born communicable diseases especially Lyme borreliosis, Tick born encephalitis, Chikungunya fever as well as, pollenosis) – research studies about cost of damages and health effects as well cost benefit of the adaptation measures; Establishment of integrated CC early warning and monitoring health information system (as a part of the National one) including establishment of air pollution monitoring + creation and maintance of CC health database</p>	<p>Enhancing of national local/regional adaptive capacity in the health sector for proper/relevant monitoring of CC health impacts (no regret actions)</p>	<p>(National public health institute and Medical Faculty to develop and pilot CC early warning information system, + international assistance)</p>	<p>short term with and long term benefit</p>	<p>150.000 USD</p>	<p>Lack of supportive policies, standards, regulations, and design guidance – deficiencies, budget limitation</p>	<p>Fund raising activities and partnership with international agencies needed</p>	<p>Research projects for some diseases/impacts with interdisciplinary (cross sectors) participation – like water, agriculture, biodiversity</p> <p>Information (data base) and Early warning system could be cross sectors</p>

Conducting Climate Change Health Vulnerability and Adaptation assessment in South East region in RM

Action (adaptation measures that will maximize the economic benefit and minimize the climate change impact per sector)	Type Policy Legislation Capacity building	Stakeholders (Clear distinction of responsibilities among the relevant stakeholders)	Timeframe Short term/long term	Financing (Financial means for implementation of the measures)	Constraints (Identification of possible barriers and risks, including legal arrangements, institutional management, financial and technological aspects)	Comments	Cross sectors connection
Preventing effects or reducing risks – establishment of adaptation and resilience plans in the health care institutions + building resilience	Enhancing local (human and technical) adaptive capacity in the health sector to be prepared to operate in extreme weather conditions , especially floods and heat waves frequently present in the region with increase demands in services as a pressure (no regret action)	National and Local governments + Ministry of Health – to make proper plan and prioritization, secure a special budget or/and arrange fund raising	long term with in accordance with proper prioritization and operational plans	150.000 USD	Limited interest and understanding of nature and extent of risks and vulnerabilities + national and local budget constraints	To be an upgrade of the existing Hospital safety index and disaster preparedness plans; Potential impacts on safety of hospital facility and operation; special focus on adult health care services and demands of vulnerable groups of population, especially elderly, workers and socially deprived groups	
Improving the drinking water quality (and quantity) especially in rural areas	Investment in infrastructure - Enhancing local adaptive capacity (no/low regret)	National + Ministry of Health + Ministry of environment and Local governments – to make special operational plan and secure a special budget or/and arrange fund raising for improvement of the drinking water treatment and monitoring in rural areas	long term with in accordance with proper prioritization and operational plans	150.000 USD	Limited interest and understanding of nature and extent of risks and vulnerabilities + national and local budget constraints; Lack of availability or restricted access to appropriate technologies; Prohibitive costs of identified adaptation options when budgets are limited;	Work in partnership is an imperative	Water management sector
Establishment of an efficient system (or substantial enhancing of the present one) for food safety control and implementation of the HACCP in all levels of food production, transport and marketing including a transparent and regularly updated regional food safety date base	Enhancing local adaptive capacity (no regret action)	National + Ministry of Health + Ministry of agriculture , Food agency , Institute and centers for public health and Local governments	long term with in accordance with proper prioritization and operational plans	150.000 USD	Limited interest and understanding of nature and extent of risks and vulnerabilities + national and local budget constraints	Work in partnership is an imperative	Agriculture sector (food agency, veterinary sector)