Gradus Vol 3, No 1 (2016) 284-289.
ISSN 2064-8014

EFFECTS OF CLIMATE CHANGE ON HEALTH – A CASE STUDY IN HUNGARY

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Keywords:
Climate change
Health vulnerability
Heat waves
Hungary

Article history:
Received 31 Jan 2016
Revised 28 Febr 2016
Accepted 31 March 2016

Abstract
The aim of this study is describing health impacts of the climate change through projected trends in climate-change-related health. The paper consists of three major structural parts. The priority of introduction part is to define direct and indirect impacts of climate change on human health, and to present the relevant relationship between global climate change and health. The second major part is an empirical chapter contains the most important results and experiences of different research projects to describe health vulnerability in Hungary. The final part contains some policy recommendations aiming to improve local adaptation to climate-change-related health.

1 Introduction

The phenomenon of global climate change is linked to human health and influence the increases the prevalence of non-communicable and infectious diseases. The climatic factors (e.g. air temperature, humidity, precipitation, extreme weather events etc.) can directly or indirectly affect the social and environmental determinants of health with the result of health vulnerability. Human health vulnerability to climate change is assessed based on a range of scientific evidence, including the current burdens of climate-sensitive health determinants and outcomes, projected climate-change-related exposures, and trends in adaptive capacity [5]. World population will be affected by climate change in complex ways in the future, but some communities will be more vulnerable than others. People living in developing countries, or in megacities, or in other rural regions (e.g. small island, coastal, mountainous, polar area). On the other hand, some social groups (e.g. children, elderly, unemployed) are also particularly vulnerable due to their low-income, ethnicity or minority participation, poor housing conditions, unfavourable socio-cultural position, disadvantaged quality of life etc.

Health impacts of climate change and its territorial consequences have become important research topic in the past decades. Firstly, Intergovernmental Panel of Climate Change (IPCC) started to examine this problem-field from 1991 and in each report it could become more detailed topic. Secondly, this research topic has appeared in Hungary at the end of the 1990s according to the planning document called National Environment and Health Action Program (1999).

Nowadays, health impact assessment related to climate change with climate change vulnerability assessment is becoming more important research method at regional and local level, because it is explaining how adaptation is needed now in order to reduce current vulnerability to the climate change that has already occurred and additional adaptation is needed in order to address the health risks projected to occur over the coming decades.

2 Method

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The aim of this paper is describing health impacts of global climate change through projected trends in climate-change-related health with a Hungarian case study. The most important findings and experiences of this study are part of a national research project which is supported by EEA Grants.

Methodically, the paper is mainly based on qualitative research tools such as reviewing scientific literature, content-analysis and discourse-analysis. These qualitative analyses are focusing on international and domestic literature e.g. research reports, IPCC Reports, development-oriented planning documents such as health development strategies, special planning documents on environmental protection etc. The focus of the document analysis is on the explanation that e.g. health impact assessments how can define the connection between climate change and health at regional and local level through those determinant factors which are influencing daily life. The discourse-analysis is examining the adaption approaches at different scales because pro-active adaptation strategies, policies and measures need to be implemented by regional and national governments, by international organizations and by individuals. The synthesis of the study is based on the conclusive target to summarize research results and to give proposals for decision makers.

The territorial range of the paper includes global context with specific focus on Hungary with its national and local level. The examined period covered by the years between 2011 and 2050.

2.1 Definition – Health vulnerability

Apart from sustainable development, vulnerability is perhaps the other most popular definition, used in a large number of scientific research studies. Model of health vulnerability is focusing primarily on the vulnerability of society to the impacts of climate change, and is dedicated to the possible measuring of the impacts of climate change on social and economic processes [10] [8]. Climate change can affect population health through climate-induced economic dislocation and environmental decline, and through development setbacks incurred by damage to critical public health infrastructure and to livelihoods by extreme weather events [19]. The effects of climate change on natural and physical systems, which in turn alter the number of people at risk of malnutrition, the geographical range and incidence of vector-borne, zoonotic and food- and waterborne diseases, and the prevalence of diseases associated with air pollutants and aeroallergens. Additional climate change in coming decades is projected to significantly increase the number of people at risk of these major causes of ill health [3].

Climate is not the only factor affecting the geographical range and incidence of climate-sensitive health outcomes. Non-climatic factors can have a strong or even dominant effect, either independently or by modifying climate effects [5]. Social and economic processes exist also independently from the climate change and are affected by other determinant factors. It is practically impossible to conclude whether or not a change in society is attributable to the climate change or another process, independent from it.

In complex way, vulnerability can be defined in the context of exposure, sensitivity and adaptation. However there are some sectors which are highly sensitive to the adverse impacts of climate change and global warming, e.g. energy sector, critical infrastructure as water resources, tourism, agriculture, forestry, fisheries etc. Among them one of is health care system.

2.2 Potential impacts of global climate change on human health

Scientific studies indicate that extreme weather events such as heat waves and large storms are likely to become more frequent or more intense with human-induced climate change. Changes are also observed in temperature, precipitation, or sea level (*Figure 1*).

Long-term changes in climate can directly or indirectly affect many aspects of society in potentially disruptive ways [20]. For example, warmer average temperatures could increase air conditioning costs. More extreme variations in weather are also a threat to society. More frequent and intense extreme heat events can increase illnesses and deaths, especially among vulnerable populations, and damage some crops. Intense storms can damage property, cause loss of life and population displacement, and temporarily disrupt essential services such as transportation, telecommunications, energy, and water supplies.

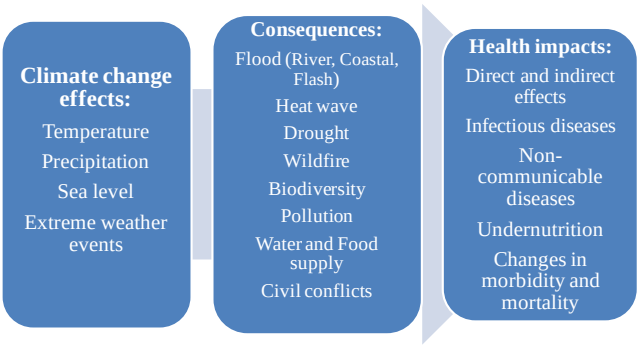

Figure 1. Potential impacts of global climate change on human health
Source: own made based on www.who.int and http://tn.gov/health

3 Results

3.1 Basic types of climate-change-related health

The causal links between global climate change and human health are complex because they are often indirect or displaced in space and time, and dependent on a number of modifying forces [22]. There are three basic pathways by which climate change affects human health [6]:

- Direct impacts: which relate primarily to changes in the frequency of extreme weather events through weather variables including heat, drought, and storms. These impacts are short-terms.
- Indirect impacts: these effects mediated through natural systems, for example, disease vectors, water-borne diseases, and air pollution. These impacts are medium- and long-terms.
- The third pathway: these effects heavily mediated by human systems, for example, occupational, impacts, undernutrition, and mental stress.

Environmental conditions as moderating influences of local environment (e.g. vegetation, geography etc.) indicate on how climate change exposure pathways are manifest in a particular population (*Figure 2*). There are feedback mechanisms, positive or negative, among societal infrastructure, public health, and adaptation measures and climate change itself [9]. Public health has experiences in coping with climate-sensitive health outcomes. The current state of population health and health inequalities reflects (among many other factors) the degree of success or failure of the policies and measures designed to reduce climate-related risks [19]. Climate change will make it more difficult to control a wide range of climate-sensitive health outcomes.

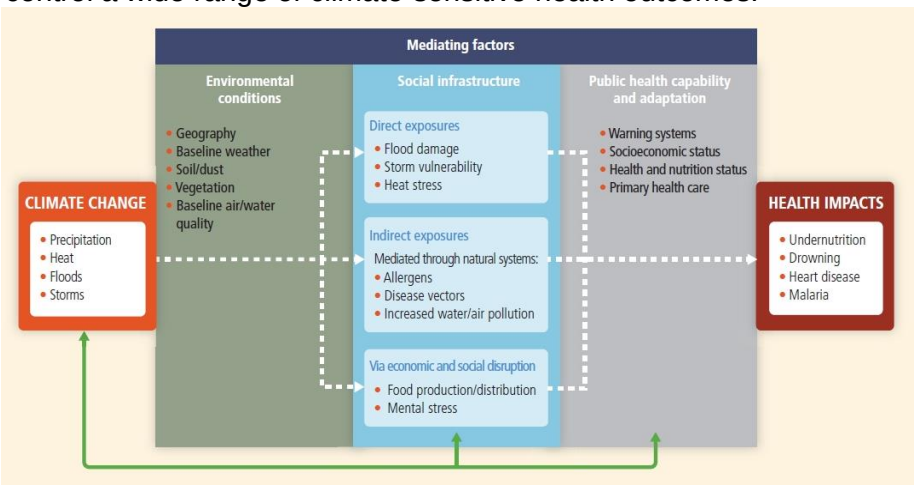

Figure 2. Conceptual model of basic pathways by which climate change affects health
Source: IPCC 2014. p. 716.

3.2 Potential climate change effects in Hungary

The increasing number of extreme weather events often remind us that climate change is not one of the threats of the future, but a current and accelerating process. Many scientific evidences show that the potential climate change effects in Hungary are based on the following climatic factors [18]:

- Changes in annual mean temperature: with increasing number of summer days and decreasing number of frost days [21].
- Relative change in annual mean precipitation: it can result flash floods, while droughts are becoming more frequent during summer period.
- Increase in frequency of extreme weather events: such as extreme thunderstorms and windstorms.

The increase of the temperature and frequency of extreme weather events are predicted as the most visible effects of expected climate change and have most serious impacts on human health in Hungary.

3.3 Health impact assessment in Hungary

Health impact assessments are based on mortality indicators and health care data. Studies are also integrating territorial and social aspects to analyze health impacts of climate change, because it is a growing demand to use different socio-economic indicators which can provide comparable information of the impact of climate change on mortality and morbidity in different geographic regions.

During the last 15 years when the health impacts of climate change were started to examine Hungary, many scientific results and evidences are born. Firstly, health effects of UV-radiation was studied, then the health impact assessments of climate change were carried out, while the effects of heat/heat waves based on real-time health data were continuously followed.

Climate change related research on health started in Hungary at the end of the 1990s. Firstly, health effects of UV-radiation was studied, then the health impact assessments of climate change was carried out, while the effects of heat/heat waves based on real-time health data was continuously followed. The number of publications dealing with heat-related mortality and morbidity has been increasing for the last 10 years in Hungary. There are some active research groups and authors dealing with this topic [12] [17] and some institutions coordinating these research projects (e.g. National Institute of Environmental Health, Eötvös Loránd University, National Directorate General for Disaster Management, Hungarian Meteorological Service).

One of Hungarian climate change vulnerability assessments has studied public health challenges of heat waves in Hungary. This research project was part of an international project (CLAVIER) in the second half of the 2000s managed by Tamás Pálvölgyi and his research group [17]. According to its results and experiences 52% of total area of Hungary is vulnerable by heat waves, that means 37% of total population is vulnerable. Vulnerability related to heat waves is increasing from North Western part of the country to South Eastern part. The most vulnerable area is the Southern part of Hungary where on the one hand, exposure is high, but on the other, disadvantaged socio-economic position can result higher level of sensitivity and lower level of adaptive capacity. Disadvantaged socio-economic position of this area is caused by unfavourable quality of life, poor health status, lower income, higher rate of elderly people, higher level of ethnicity groups etc. [17] [18].

4 Discussion

Meticulously detailed surveys of the health risks caused by heat waves accompanying rising average temperature are particularly abundant in Hungarian scientific literature. They draw attention to the increased likelihood of the occurrence of deaths and the evolution of health conditions (e.g. heat stress, cardio-vascular diseases and related deaths, respiratory complaints, infections and skin rashes) triggered by heat waves in the summer, with young children, the elderly, the chronically ill and the multiply disadvantaged exposed to particularly high risks [16].

Under the relevant climate scenarios (RegCM – A1B), there will be a 20 to 70% increase in the frequency of heat alerts (announced when the average temperature exceeds 25°C on three

successive days) across the country between 2021 and 2050 [1] [14]. The connection between daily excess mortality rate and mean temperature will be stronger: if air temperature will increase of 1 °C then daily mortality rate of days with mean daily temperature >25 °C will increase by 4.9% between 2021 and 2050.

By comparing daily death rates and meteorological data, Anna Páldy et al. studied the interdependency between temperature and the total and cause-specific daily number of deaths in the summer between 1970 and 2000. They found that a 5°C increase in the average daily temperature raised the risk of death, irrespective of the cause of death, significantly, by 6%, and the risk of cardiovascular deaths to the largest degree, by approximately 10% [14]. It is also observed that 10 °C increase in the mean daily temperature raised the risk of emergency ambulance calls due to cardiovascular diseases by 6%. Co-researchers Anna Páldy and János Bobvos applied this interdependency to Budapest's population in 2007. As there were 54,777 excess deaths registered in Hungary in the summer of 2007 (between 1st May and 30th September), assuming that the percentage increase in deaths due to climate change remains the same, we can expect 150 more deaths on average in Hungary each year between 2021 and 2050 [12] [13].

The expected increase in the number of excess death rate due to heat waves involves mainly the population aged 65 and above. Therefore, close attention must be paid during heat alerts to the most-at-risk chronically ill elderly, who are one of the most vulnerable groups affected by climate change [2]. The need for adaptation to climate change also draws attention to the socio-economic implications of aging. In Hungary climate change increases the likelihood of heat waves, which pose a risk mainly to the elderly. Based on the forecasts, the adverse impact of heat waves on health will affect most of Hungary's territory because of the high number of the elderly [4] [7]. Due to the high sensitivity of the Hungarian population more effective preventive measures would be desirable to decrease vulnerability and enhance adaptive capacity to adverse health impacts of climate change.

5 Conclusions

"*Climate change will be the most serious public health threat in the 21st century*" [6]. According to the scientific evidences, climate change and its local consequences will adversely affect the health status in the following decades. Identification of local communities vulnerable to climate change can help health policymakers prevent associated adverse health impacts. The discourse on climate-change-related health draws attention the role of integrated approaches in the possible responses.

The model of heat-health vulnerability is focusing particularly on the vulnerability of society to the impacts of heatwaves on human health and is dedicated to the possible interventions at national and local level. It shows the primary responsibilities of national and local authorities and it spells out what preparations both individuals and organizations can make to reduce health risks and includes specific measures to protect at-risk groups. In the future it is necessary to prepare heatwaves plan for those societies which are mostly affected by heatwaves. This heatwave plan providing guidance on how to prepare for and respond to a heatwave which can affect everybody's health, but particularly the most vulnerable people in society. The role of heatwave plan will become more important at a local level where live the most of vulnerable people at risk. At a local level, responsibility for public health has transferred to local authorities. The heatwave plan builds on existing measures taken by local authorities to protect individuals and communities from the effects of severe heatwaves and encourage community resilience. Providing extra help, where possible, to care for those most at risk, including isolated older people and those with a serious illness or disability. This could come from local authorities, health and social care services, the voluntary sector, communities, families and others.

Acknowledgment

Study is supported by EEA Grants (EEA-C12-11). "The Long-Term Socio-economic Forecasting for Hungary" project benefits from a grant from Iceland, Liechtenstein and Norway through the EEA Grants.

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