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Important Aspects and Risk Factors for Hypertension in the Environment and Adverse Climate

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Abstract: Low temperatures, high altitude, loud noises and air pollutants are all factors that can significantly increase blood pressure. Despite the fact that short-term exposure dramatically increases blood pressure, prolonged exposure can lead to the development of sustained hypertension. At the global public health level, environmental factors may play a role in worsening blood pressure control and increasing overall cardiovascular risk. Overall, the data show that numerous environmental factors can rapidly increase blood pressure, causing control problems. This means that doctors and patients with hypertension should be aware of these aspects and pay more attention to blood pressure levels during these exposures. To maintain control over blood pressure, antihypertensive therapy and medications may need to be changed. In this review, we will look at the effect of various environmental factors on hypertension. We will talk about possible molecular and cellular mechanisms and clinical data from large population studies. We emphasize the interrelationship of these environmental factors, since even minor changes in one of them can affect others, including the health of the cardiovascular system. We will also discuss the importance of socio-economic elements and how they affect different communities with economic inequality. Finally, we discuss the prospects and challenges of new research aimed at expanding knowledge about the molecular mechanisms by which environmental factors influence the development of hypertension and other cardiovascular diseases.

Keywords: CVD, acute coronary syndrome, chronic cardiovascular diseases, systolic blood pressure, environmental factors, low temperatures.

Introduction. About 40 million people die from noncommunicable diseases worldwide every year, and this figure accounts for 70% of deaths from diseases in economically developed countries and more than 86% in low-income countries. The main component of CVD is formed by cardiovascular diseases (CVD), including acute and chronic cardiovascular diseases (CVD), acute (AHF) and chronic heart failure (CHF), acute coronary syndrome (ACS), myocardial infarction, arrhythmias and arterial hypertension (AH) and, to a certain extent, stroke, chronic respiratory pathologies and metabolic disorders. [1,2,3]. The occurrence and development of hypertension and CVD are inextricably linked to each other, and CVD is the direct cause or risk factor for most cases of CVD. Because more than 40% of patients suffering from hypertension have various infectious diseases. In particular, severe diseases such as left ventricular hypertrophy, chronic heart failure, acute coronary syndrome, and myocardial infarction were observed in patients with hypertension. [4,5,6]. In this regard, the rapid increase in the spread of hypertension is also a serious and urgent public health problem due to the lack of proper control during treatment and the fact that hypertension is the leading cause of death worldwide. In particular, until 2008, about 8 million people died annually from elevated systolic blood pressure (SBP), and only in 2019 - about 11 million people. In addition, according to the World Health Organization (WHO), 30% of all deaths are attributed to hypertension, one of the most common chronic nonspecific diseases. As a result of hypertension and its complications, not only the number of deaths increases, but also the number of severe cases, such as a decrease or loss of working capacity and life potential of patients. [7,8,2,3,9].

It should be noted that there is increasing evidence of a significant contribution of physical and chemical environmental factors, along with causes such as genetic predisposition to the development or intensification of hypertension, diabetes mellitus, hypercholesterolemia, atherosclerotic changes in vascular walls, the presence of bad habits, and malnutrition. Hypertension has serious risk factors, such as high blood glucose levels, bad habits such as chronic smoking, and a high body mass index, which cause about 30 million deaths worldwide each year. [7]. At the same time, according to the World Heart Federation, hypertension is the most important risk factor for stroke, causing about 50% of ischemic strokes [2,9]. The influence of environmental factors is increasing at a time when medical preventive measures are being introduced in connection with the early detection and treatment of hypertension, which is one of the main causes of the loss of the labor and life potential of our society. Environmental stressors such as air pollution, noise generated by vehicle traffic, artificial lighting at night, extreme temperatures, desert storms and forest fires were noted as physical and chemical environmental factors. [2,10,11,12,13,14,15]. Despite the progress made in reducing the incidence of hypertension, atherosclerosis, kidney disease, stroke and cardiovascular diseases, in particular, are the main leading risk factors for myocardial infarction and heart failure, which are mainly caused by environmental risk factors [16].Thus, hypertension is a major risk factor for the development or intensification of CVD, the main cause of premature death worldwide, and plays an important role in the development of national and international health policies for the prevention and control of this disease [10,12,14,17].

For this reason, effective prevention and treatment of hypertension or its development or intensification require interdisciplinary, social and integrated approaches to health policy at the state level, in areas such as agriculture, environment, finance, food, international relations, in addition to maintaining a healthy lifestyle, the use of medicines.

The main purpose of the presented manuscript is to conduct a brief analysis of environmental factors that reduce the effectiveness of treatment for the occurrence or occurrence of blood pressure disease, and measures aimed at reducing these negative influencing factors.

Epidemiology. According to the recommendations of the European Association of Cardiology in 2013 and 2018 and the Russian Association of Cardiology in 2015, systolic and diastolic blood pressure is 140/90 mmHg, respectively. An increase in blood pressure as a result of cardiovascular diseases increases the risk of their occurrence, and these complications are assessed using a score. Arterial hypertension is an important risk factor for the development of cardiovascular diseases, chronic kidney diseases, as well as complex and severe pathological conditions that occur in the brain. [16,17,18,19,20,21,22]. In recent years, despite the progress made in diagnostic and therapeutic measures, up to 25-30% of the world's adult population have noted an increase in the incidence of hypertension and the number of causes that lead to it [23,24]. In particular, economically In developed countries, the incidence of hypertension, which is one of the main factors of disability and mortality of the population, reaches 50% ([11], while in Uzbekistan this indicator has amounted to 39.5% over the past 10 years [22,24]. In turn, there is a specificity in the prevalence of the disease among people of different ages and genders, including 40-45% among the population under the age of 40 and 50-65% among people over 65, as well as a higher incidence rate in men compared to women. A significant part of the above-mentioned incidence rates of hypertension is due to the influence of risk factors such as environmental changes and AH. According to the conducted research, in 1990 there were more than 12 million cases of CERS caused by environmental and adverse climatic conditions, while in the period up to 2019 this figure approached 19 million and is estimated to increase by another 10% by 2030. [2,25].

Arterial hypertension in environmental conditions and unfavorable climate. Since high temperatures have pathophysiological consequences, an increased risk of acute coronary heart disease is biologically plausible. Increased sweating, rapid heartbeat and breathing, vasodilation and an increase or decrease in blood clotting are all the results of physiological reactions to changes in body temperature as a result of heat stress. These changes can increase local blood pressure, cause systemic inflammation, worsen blood clotting and disrupt the autonomic regulation of the heart [5,6,7,21,26].

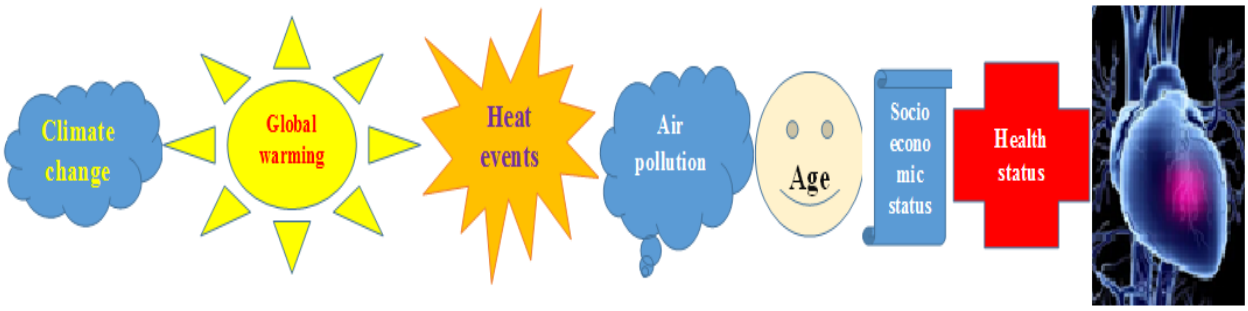

Figure 1. Factors contributing to the cardiovascular risks of climate change.

When these hemostatic disorders combine, they can increase the risk of atherosclerotic plaque rupture and subsequent myocardial infarction. Similarly, people with heart failure and a reduced left ventricular ejection fraction are likely to be unable to compensate for the effects of high temperatures on the cardiovascular system. It is possible that the pathophysiological effect of high temperatures on right ventricular heart failure is also the reason for the observed association between exposure to high temperatures and increased mortality from respiratory diseases [24,25,26,27,28].

The effect of seasonality and temperature on blood pressure. The researchers propose using the term "environmental hypertension" to study the influence of environmental factors on blood pressure in clinical and research settings, taking into account the approach to the introduction of data and knowledge into clinical practice, which links various environmental factors with blood pressure [28]. However, when studying the effects of climate factors on human health, obtaining reliable exposure data is a big challenge, especially if the goal is to distinguish the effects of climate from seasonality. The relationship of blood pressure with the season and outdoor temperature, taking into account seasonal fluctuations in diseases associated with blood pressure, is closely related in the elderly, especially in 80-year-olds aged 65 years and older. Careful monitoring of blood pressure and treatment of hypertension during extreme temperatures can help reduce the effects of changes in blood pressure in the elderly [17,18,28]. The purpose of studying the relationship of seasonality and temperature with blood pressure is to consider methodological aspects useful for studying the influence of environmental factors on blood pressure in clinical and research settings, as well as informing medical professionals about blood pressure [4,15,23]. The hourly ambient temperature indicates in favor of the inverse dependence of blood pressure in outpatient settings. It also highlights the linear relationship between low ambient temperature and high blood pressure, which may be important for the prevention and treatment of hypertension in sensitive populations [27,28]. Although this is not among the risk factors associated with hypertension (e.g. obesity), measures should be taken to reduce exposure to prevent or control hypertension when necessary. Healthcare professionals should be aware that the environment can play an important role in changing blood pressure [21,26,29].

Discussion. The main cause of cardiovascular diseases is hypertension, which annually claims the lives of almost 9 million people worldwide. There is increasing evidence that even in the absence of genetic risk factors, in addition to pathophysiological processes, numerous environmental factors such as geographical location, lifestyle, socio-economic status and cultural traditions affect the risk of development, progression and severity of hypertension [2,4,5,6]. Blood pressure can be significantly increased by many environmental factors, such as cold weather, winter season, high altitude, loud noises and polluted air. The development of chronic hypertension can be caused by prolonged exposure to many of these environmental factors. Healthcare professionals should be aware of these connections and carefully monitor blood pressure during exposure to these factors to prevent hypertension from worsening [14,17,21,24,27].

Blood pressure rises within a few hours to several days at a lower outdoor temperature. Studies conducted in many climatic conditions and population groups consistently show the relationship

between blood pressure and ambient temperature over the previous few days. In a large-scale study involving more than 500,000 people across China, it was found that an increase in systolic pressure by 5.7 mmHg was associated with a decrease in temperature by 10 °C [24,25,26,27]. Unfortunately, climate change not only affects temperature, but also has a negative impact on other environmental conditions, including air pollution due to an increase in the number of forest fires. Diseases and deaths from cardiovascular diseases are caused by small solid particles. Studies have convincingly shown that episodes of exposure to high temperature and particulate matter have a general and serious effect on mortality from cardiovascular diseases [1,2,13,17,29].

Conclusions. In conclusion, it should be noted that in the coming decades there will be an increase in the number of deaths from heat due to the combined effects of global warming, air pollution and individual factors such as age, socio-economic status and health status. As climate change is already increasing the risk of cardiovascular disease in the general population, urgent policy measures are needed to implement the Paris Agreement. Environmental changes, even in the best case, are already leading to quantifiable and preventable acute cardiovascular diseases, and they should be part of our efforts to prevent and treat cardiovascular diseases.

Due to climate change, extreme heat-related weather events have become more frequent in many regions of the world. The combination of factors such as heat, air pollution, age, socio-economic status and health status leads to acute cardiovascular diseases that could have been avoided, and they must be taken into account for effective prevention and treatment of cardiovascular diseases.

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