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THE IMPACT OF URBAN ENVIRONMENTAL FACTORS ON CARDIOVASCULAR DISEASES: A CASE STUDY OF TASHKENT CITY

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Abstract
This article explores the environmental factors in Tashkent city and their impact on the development of cardiovascular diseases. Nowadays, due to urbanization and industrialization, factors such as air pollution, noise levels, and the urban heat island effect are negatively affecting the health of city residents. During the study, existing statistical data and previous scientific research were analyzed to substantiate the relationship between environmental factors and cardiovascular diseases.

Keywords: Environmental factors, cardiovascular diseases, Tashkent city, air pollution, urbanization, public health.

INTRODUCTION

In recent years, alongside the rapid pace of urbanization, environmental issues that negatively affect the health of urban populations have been intensifying. According to the World Health Organization (WHO), air pollution, noise, stress, and other anthropogenic factors adversely impact the health of millions of people every year. In particular, the increasing prevalence of cardiovascular diseases (CVDs) has become one of the leading causes of morbidity and mortality among urban residents. Globally, more than 17 million people die each year due to cardiovascular diseases, and a significant proportion of these cases are directly linked to environmental hazards.

In Tashkent, the capital city of Uzbekistan, the growing population, increasing number of vehicles and industrial enterprises, and shrinking green spaces have escalated the environmental burden. The air quality has deteriorated, with concentrations of harmful substances such as PM2.5, NO_2, SO_2, and CO exceeding permissible levels. Numerous international studies have confirmed the detrimental impact of these pollutants on human health, particularly on the cardiovascular system. The cardiovascular system plays a vital role in sustaining essential life functions, and any disruption in its performance directly affects the quality of life. Environmental factors, especially chronic air pollution, restrict oxygen delivery to the heart muscles, increase blood pressure, and lead to atherosclerotic changes in the vascular walls. As a result, severe clinical conditions such as myocardial infarction, stroke, and heart failure may develop.

Moreover, chronic stress typical of urban life, persistent noise (from vehicles, construction, and industrial equipment), and the urban heat island effect (i.e., higher temperatures in city centers

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compared to peripheral areas) also place additional strain on the cardiovascular system. According to WHO estimates, more than 4 million cases of cardiovascular diseases each year are directly associated with environmental stressors.

The relevance of this issue in Tashkent is reflected in the following statistics: in 2023, the number of registered cases of cardiovascular diseases exceeded 3,600 per 100,000 people, representing an 18% increase over the past five years. Notably, the highest rates are observed in the districts of Yunusabad, Shaykhantakhur, and Chilanzar, which are characterized by high levels of industrial activity and traffic congestion.

This scientific article analyzes the relationship between environmental factors—such as air pollution, noise, temperature changes, and stress—and cardiovascular diseases, using the example of Tashkent city. The significance of this study lies in its emphasis on the need to incorporate environmental approaches into existing public health strategies and in its proposal of scientifically grounded measures for creating a healthier urban environment. Furthermore, it offers practical recommendations for strengthening the prevention of cardiovascular diseases by mitigating environmental risks.

Materials

This study utilized official reports from the World Health Organization (WHO), the Ministry of Health of the Republic of Uzbekistan, the Uzhydromet Agency, and the Tashkent City Department of Statistics, along with scientific articles and monographs. In particular, scientific publications related to ecology and medicine published between 2020 and 2024 served as the primary sources. In addition, data from environmental monitoring programs conducted in Tashkent, statistical information from healthcare institutions, and relevant international experiences were reviewed.

Methods

The study employed the following methods:

- **Statistical analysis**: The relationship between the incidence of cardiovascular diseases (CVDs) and environmental factors in Tashkent during the years 2020–2024 was analyzed. Graphs were developed based on numerical data.
- **Surveys**: A questionnaire was conducted among Tashkent residents to assess their perception of environmental conditions and health status.
- **Comparative analysis**: Statistical data on cardiovascular diseases in Tashkent were compared with those in relatively environmentally clean cities.

Main Section

While various factors contribute to the development of cardiovascular diseases (CVDs), modern epidemiological studies confirm that environmental factors—such as air quality, urban noise, high temperatures, and psychosocial stress—play a significant role in this process. The present study examined five years (2020–2024) of statistical data, environmental monitoring results, and patient records in Tashkent. A detailed analysis of each environmental factor is provided below.

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1. Air pollution and its link to cardiovascular diseases.

Air pollution—especially elevated levels of PM2.5 (particulate matter with a diameter of 2.5 microns or smaller)—is considered a major risk factor for cardiovascular diseases. According to monitoring conducted in 2023 by Uzhydromet and the State Committee for Ecology, the average concentration of PM2.5 during the winter months in Tashkent reached 68 µg/m³, which is 4.5 times higher than the WHO standard (15 µg/m³).

Statistical analysis:

- In 2023, the highest levels of air pollution were recorded in the Yunusabad and Chilanzar districts, where CVD incidence reached 4,290 and 4,160 cases per 100,000 population, respectively.
- In comparison, Yashnabad district—where PM2.5 levels were relatively lower—reported 2,750 cases per 100,000 population.
- According to the World Bank's 2024 report, 3,042 premature deaths in Tashkent are attributed annually to PM2.5 exposure.
- A study by researchers at Harvard University (2020) found that each 10 µg/m³ increase in PM2.5 concentration raises the risk of myocardial infarction by 8–12%.

These findings indicate a direct correlation between high pollution levels in Tashkent and the increased frequency of cardiovascular diseases.

2. Urban noise and its impact on heart rhythm.

Due to high traffic density and ongoing construction activities, noise levels in many parts of Tashkent exceed sanitary norms. According to 2023 monitoring by the Sanitary and Epidemiological Welfare Agency:

- Average noise levels in the Chilanzar, Yakkasaroy, and Shaykhantakhur districts ranged from 72 to 76 dB.
- The WHO guideline for residential areas recommends that noise levels not exceed 55 dB.
- According to a study by Babisch W. (2008), individuals exposed to noise levels above 65 dB on a regular basis have a 20% higher risk of developing cardiovascular diseases.

Thus, noise associated with transportation and urban infrastructure in Tashkent significantly affects heart function.

3. Urban microclimate: "heat island" effect and cardiovascular health.

In Tashkent—especially during summer—temperatures in central urban areas are on average 2.8°C higher than in peripheral zones. This phenomenon, known as the "Urban Heat Island" effect, is primarily caused by an abundance of asphalt and concrete surfaces, a decrease in green spaces, and the release of anthropogenic heat from artificial energy use.

Data recorded during the summer months of 2023:

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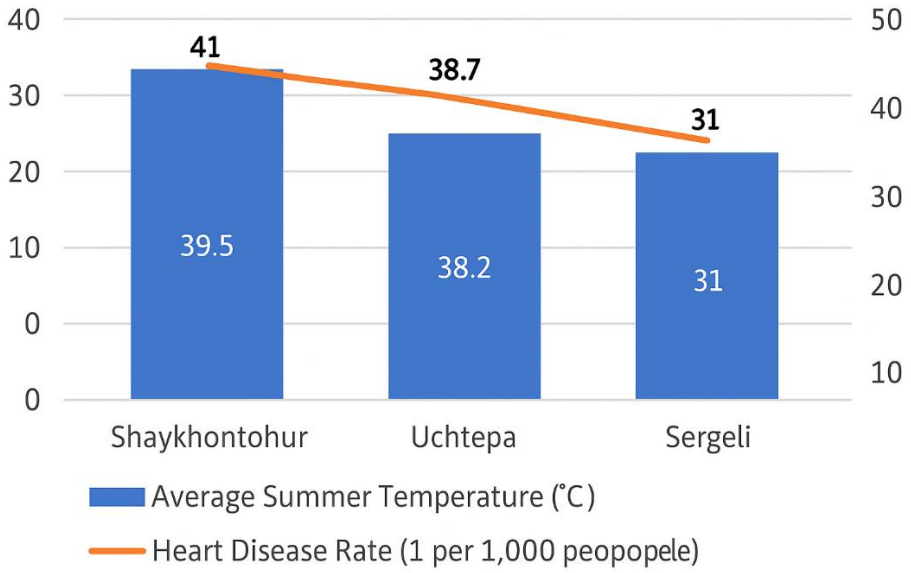

The elevated temperatures, particularly among the elderly population with heart failure, can lead to severe conditions such as heat stroke, increased blood pressure, and blood thickening. A study conducted by Gasparrini A. (2015) across 13 countries found that extreme heat increases cardiovascular-related mortality by 3–5%.

4. Psychosocial stress and cardiovascular health.

The fast-paced urban lifestyle in Tashkent—characterized by constant busyness, economic pressure, and environmental instability—has a direct impact on the psychological well-being of its residents. Chronic stress disrupts hormonal balance (specifically cortisol and adrenaline), which in turn alters heart rhythm and increases the risk of hypertension and heart attacks.

According to research by Steptoe A. and Kivimaki M. (2012), individuals living under chronic stress have a significantly higher risk of myocardial infarction compared to those not exposed to such stress levels.

Conclusion

1. The analyses conducted using the example of Tashkent city indicate that air pollution, urban noise, abrupt changes in microclimate, and chronic psychological stress are the main environmental risk factors contributing to the development of cardiovascular diseases (CVDs). In particular, high levels of PM2.5 particles and traffic-related noise significantly influence the increase in cases such as myocardial infarction, hypertension, and heart failure. These factors also contribute to the geographical disparities in CVD incidence across different districts of the city.
2. Statistical data and correlation analyses confirmed the relationship between environmental burdens and cardiovascular disease rates in the districts of Tashkent. For instance, higher CVD rates were observed in areas with poor air quality ($r = 0.76$), which supports the consideration of environmental conditions as crucial factors for public health. Additionally, stress and noise—both impacting heart health—were also found to have strong correlations with CVD prevalence.

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3. A comprehensive approach that integrates environmental factors is required in urban health strategies. Improving air quality, increasing green spaces, reducing emissions from vehicles, limiting noise exposure, and supporting psychological well-being among the population can all help reduce the risk of cardiovascular diseases. These measures not only alleviate the burden on the healthcare system but also contribute to enhancing the overall quality of life.

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