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단보

Health Geography: Exploring Connections between Geography and Public Health

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건강지리학: 지리학과 공중보건 간의 연관성 탐색

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Abstract: Health geography has gained importance due to healthy smart cities, regions, and the integration of geo-internet and blockchain technologies. This study explores the intersection of geography and health, focusing on specific health challenges faced by individuals and groups. Using observational and descriptive methods, the study takes a regional approach to illuminate the socio-economic factors that are critical to addressing global health challenges. Drawing on academic literature and practical research, a concise case study of health challenges in Uzbekistan is presented, offering valuable insights. The analysis of data from informative articles and UN publications highlights the interdisciplinary nature of health geography and its practical applicability for researchers and policymakers. The findings underscore the important role of geography and health sciences in addressing region-specific diseases while highlighting the importance of spatial analysis in understanding environmental hazards and health impacts, including disease outbreaks.

Key Words: health geography, place and health, space and time, hybrid science, public health policies

요약: 스마트 건강도시, 지역, 지오인터넷(geo-internet) 및 블록체인 기술의 통합으로 인해 건강지리학이 중요해졌다. 본 연구는 개인과 집단이 직면한 특정한 건강 문제를 중심으로 지리와 건강의 교차점을 탐구한다. 학술 문헌들을 바탕으로 관찰 및 기술적 방법을 사용하여 세계적인 건강 문제를 해결하는데 중요한 사회경제적 요인을 탐색하고, 지역적 접근방식을 취한다. 본 연구의 의의는 우즈베키스탄의 보건 문제에 대한 간결한 사례 연구를 제시하여 귀중한 통찰력을 제공하는데 있다. 본 연구에 사용된 기사와 UN 출판물의 데이터를 바탕으로 한 분석은 건강지리학의 학제 간 연구의 특성을 보여주고, 분석 결과는 연구자와 정책 입안자에게 실용적인 적용 가능성을 제공한다. 또한, 전체적인 연구 결과는 지역별 질병을 해결하는 데 있어 지리학 및 보건 건강과학의 중요한 역할을 강조하는 동시에 질병 발생을 포함한 환경 위험 및 건강 영향을 이해하는 데 있어 공간 분석의 중요성을 강조한다.

주요어: 건강지리학, 장소와 건강, 공간과 시간, 혼합 과학, 공중 보건정책

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1. Introduction

The global impact of the COVID-19 pandemic has highlighted the urgent need for effective measures to prevent the spread of infectious diseases. Given the potential of viruses to evolve and cause further harm, the importance of robust public health strategies has become increasingly clear. In addition, the prevalence of chronic diseases and their potential for localised outbreaks require a targeted approach to address health threats in specific areas. In this context, the field of health geography has proven to be a valuable tool for scientific investigation and the search for solutions. Geographical spatial analysis, for example, studies the occurrence, spread and persistence of diseases and produces maps that help to understand their patterns (Lee, 2013). The field of geography offers insightful and practical means to address both local and global health problems. In addition, the emergence of innovative concepts such as healthy smart cities, healthy regions, geo- internet and blockchain technology has opened up new avenues of exploration that are in line with the evolving landscape of healthcare. In light of these developments, this study aims to highlight the importance of geography in better understanding the complex relationships between health and place and their associated characteristics (Park *et al.*, 2013; Yang, 2018; Koo, 2020).

Any research project requires a well-defined technique and approach, and this study places particular emphasis on methods geared towards geographical research. Adopting a regional perspective is central to addressing a wide range of diseases and related challenges with far-reaching implications. Therefore, this paper is structured to first lay the theoretical and scientific groundwork before exploring the intricate relationship between location and health in more detail. Furthermore, health geography is highlighted as an interdisciplinary synthesis that draws from different fields of study. To illustrate the practical aspects, a case study on health issues in Uzbekistan will be presented to highlight specific problems and challenges in this field. This study relies on observational and descriptive methods to gain comprehensive insights. The contextual framework of the article is provided by a careful review of academic and practitioner research published on this topic.

The case study data is drawn from analytical and informative contributions from the United Nations, ensuring a solid and credible foundation. The main body of the study shows that geography and health sciences converge as a hybrid science, providing practical tools and a knowledge base for scientists and policy makers. Most importantly, the case study findings highlight the incomparable importance of both disciplines in eradicating diseases in specific regions. Thus, by exploring the multi-layered relationship between geography and health, this study aims to contribute to our understanding of the complex dynamics between time, place and health. It also highlights the critical role of spatial analysis in identifying environmental hazards and understanding their impact on wider public health, including disease

outbreaks. Integrating geography into health research and policy has immense potential for improving population health and promoting a more comprehensive approach to public health challenges (Kistemann *et al.*, 2019).

2. Geography's Role in Addressing Health Challenges: An Integrated Approach

Throughout history, the field of knowledge and scientific thought has undergone significant transformations, leading to the emergence of specialized sub-disciplines such as health geography (Kuhn, 1962). However, a noticeable gap remains within the health geography literature, particularly in terms of comprehensive research (Kearns, 2002). While some geographers have delved into social geography (Moss and Dyck, 2003) and health geography (Mayer, 1990; Verhasselt, 1993; Litva *et al.*, 2002), the body of work in health geography remains limited. To grasp the impact of climate change, global warming, and environmental-human interactions on human health, the application of geographical techniques becomes imperative. In this regard, mapping and geographic information systems (GIS) have proven invaluable in studying disease transmission (Hazen and Anthamatten, 2011), shedding light on the genetic, environmental, cultural, and socio- economic factors underlying health and disease dynamics. Health geography systematically examines current global health trends, with GIS serving as a successful tool in this field (Kistemann *et al.*, 2002; Crooks *et al.*, 2018).

The COVID-19 pandemic had a profound global impact, necessitating swift responses to contain its spread. The use of spatial and geographic methods is crucial for understanding the pandemic's worldwide ramifications and related issues, garnering significant attention in geography, health, and their interrelationships (Dummer, 2008). The integration of GIS, global positioning systems (GPS), and health systems is another prominent area of research. For instance, studies on dementia assessment and care have explored the application of GIS and GPS, emphasizing the unique role of geography in healthcare (Firouraghi *et al.*, 2022). Likewise, spatial methods incorporating mental health, child and adolescent characteristics, and the natural environment have demonstrated the benefits of GIS (Nigg *et al.*, 2022). Analyzing the data also underscores the growing importance of location in healthcare. It is important to note that health geography research is not solely conducted by geographers; experts from various disciplines contribute to the field. Given the extensive array of scholarly sources available on health geography, compiling a comprehensive and exhaustive list poses a significant challenge. Therefore, this study draws upon diverse sources to shed light on the topic, highlighting the particular significance of geography as a discipline and valuable source of information.

Once again, the role of geography in addressing health issues in Uzbekistan is emphasized to enable a thorough analysis of the chosen case study topic. A comprehensive review of existing health studies was conducted to

gather relevant data. So, integrating geography and health research is critical to tackling the specific challenges faced in Uzbekistan. Health geography recognizes the substantial influence of geographical factors, including the accessibility and location of health facilities, as well as environmental and social elements, on human health. By integrating these elements, geography contributes to the development of effective policies and meaningful regulations. Certain regions continue to grapple with significant health problems despite advancements in immunization and access to healthcare facilities, highlighting the importance of examining these factors more closely. Ensuring equal access to health facilities regardless of socio-economic status is crucial for promoting health equity. Accessibility refers to the ease with which health services can be reached and utilized. Studies have examined the suitability of land for building hospitals, considering factors such as urban density, land use, and transportation networks (Soltani *et al.*, 2019). Urban planning of health facilities plays a critical role in meeting the medical needs of the local population. The natural environment, including geographical features such as mountains and rivers, also plays a part. Rugged slopes, for example, act as natural barriers to accessing health facilities. Existing elements encompass both technical and natural processes within a given area that affect social well-being and health.

Rapid industrial development in emerging economies, driven by economic growth, has led to increased air and water pollution. Air pollution alone can cause various diseases, with pollutant-enriched haze hindering air purification by wind. Proximity to such polluted air can result in respiratory and eye problems for residents. Deforestation and subsequent temperature rises create a hot and humid environment that facilitates the spread of diseases carried by parasites like mosquitoes. Health geography plays a crucial role in addressing these challenges and developing appropriate solutions. For instance, GIS has been employed to explore the relationship between air pollution, traffic, and health outcomes by conducting comparative statistical analyses for people living at different distances from pollution sources. These studies underscore the value of GIS in investigating such issues (Ghimire *et al.*, 2019). Other studies have examined the geographical distribution of air pollution-related illnesses and mortality, considering socioeconomic determinants and the location of vulnerable populations, particularly in low-income and rural areas (Manisalidis *et al.*, 2020; Aturinde *et al.*, 2021). The findings of these studies underscore the importance of adopting a multidisciplinary approach and raising social awareness to effectively address these health challenges. Analyzing the impact of the social environment on health reveals the complex interaction between people and their surroundings. Factors such as behavior, community dynamics, disease susceptibility, and population density influence disease transmission. In densely populated areas, effectively implementing social distancing measures can be challenging, thereby reducing the effectiveness of disease control measures. Additionally, similar diseases may manifest in individuals or

groups residing in different geographical locations. Prevalent phenomena such as Hikikomori Recluse, observed in various countries, highlight the influence of the social environment shaped by increasing internet use and dependence on virtual life (Sakamoto, 2005; Rosenthal and Zimmerman, 2012; Soldatova *et al.*, 2019). Geographical classification and analysis of diseases and epidemics, both regionally and globally, assume critical importance in health geography, enabling targeted solutions for specific populations. Health geography is a hybrid science that combines geographical knowledge and methods with the study of diseases and health problems on a global scale. Traditionally, geographical studies adopt two approaches: analyzing disease patterns, causes, and transmission, and studying health services and their delivery. Geographic epidemiology encompasses disease clustering, mapping, and ecological analysis (Rezaeian *et al.*, 2007). Concepts such as optimal distribution have been employed to investigate geographical inequalities in disease prevalence and health service delivery (Oh *et al.*, 2018).

The recent COVID-19 pandemic has further highlighted the necessity of a geographic framework for understanding the spread of infectious diseases and conducting spatial analyses (Oh *et al.*, 2018). A holistic approach that connects place and health has emerged as a valuable perspective within health geography, offering broader insights into health problems. Despite the potential of health geography, challenges must be addressed. Interactive maps, particularly those utilizing GIS applications, are essential for policymaking and effective representation of health data. However, interpreting these results necessitates careful selection and organization of local institutions and data collection. Technical challenges involve the availability of suitable computer software for data collection and analysis, while ethical challenges encompass responsible use and security of personal data. Avoiding ecological fallacies and ensuring that policies derived from geographical studies align with ecological principles are important considerations. Consequently, health geography is a hybrid science that incorporates geographical knowledge and methods to analyze and interpret geographical data in the context of global health issues (Kistemann *et al.*, 2010). By examining the influence of geographical factors such as accessibility, environment, and social dynamics, health geography contributes to addressing health problems and proposing effective solutions. However, to fully unlock the potential of health geography in improving global health, challenges related to data collection, analysis, ethics, and environmental issues need to be confronted (Gatrell *et al.*, 2014).

3. A Case study: Health Geographic Assessment of the Territory of Uzbekistan

1) Introduction

This case study aims to provide an in-depth

analysis of the health geography assessment, focusing on regional differences within Uzbekistan. It recognizes the significant influence of geography in understanding and addressing health challenges in the region. The assessment takes into account the diverse natural conditions, socio-economic factors, and environmental characteristics that shape the health landscape. Moreover, it acknowledges the historical prevalence of certain infectious diseases (Komilova and Mamatkulov, 2021) and the shifting burden towards non-communicable diseases such as cardiovascular diseases, respiratory diseases, and malignancies (Atamuratova *et al.*, 2021).

The study also highlights the impact of various geographical factors, including industrialization, urbanization, and drinking water composition, on health outcomes. By adopting an integrated approach that considers the interplay between geography and health, this case study seeks to shed light on the specific health challenges faced by different regions within Uzbekistan. To ensure a comprehensive understanding of the situation, the study extensively reviewed available statistical data and official reports published online. These sources served as a valuable collection of relevant data, enabling a thorough analysis of the health problems prevalent in specific regions. By carefully analyzing and interpreting this information, the study aims to provide insights into the health disparities and dynamics within Uzbekistan.

2) Global and Regional Trends in Health

It is important to consider global and regional trends in health care and disease patterns. The burden of non-communicable diseases (NCDs) has increased globally, posing major challenges to health systems worldwide (Armocida *et al.*, 2022). Uzbekistan can be placed in this broader context to highlight the country's particular challenges and opportunities in addressing NCDs. In addition, regional trends within Central Asia, such as the prevalence of certain diseases or common environmental issues, should be highlighted to provide a comprehensive understanding of the health landscape (Reznikova *et al.*, 2022).

Climate change and environmental issues can impact on health and their inclusion in the study would provide valuable insights. The impact of changing climatic conditions, such as higher temperatures, altered rainfall patterns and extreme weather events, can influence disease transmission, vector-borne diseases and respiratory health (Biswas, 2022). Analysis of these factors in the context of the health geographic assessment of Uzbekistan can provide recommendations for climate resilience strategies and integration of environmental considerations into health planning (Vakulchuk *et al.*, 2023).

The case study should also explore the policy and political implications of the findings. It can highlight the importance of evidence-based decision-making, effective resource allocation and intersectoral collaboration to address identified health inequities. It can also highlight the importance of health reforms and policies that address geographical inequalities and take into account the underlying social determinants

of health (World Health Organization, 2022). Key findings from health geographic assessments, including the influence of anthropogenic and geo-environmental factors on health outcomes in specific regions (Wang *et al.*, 2022). It should emphasise the need for tailored interventions to address identified health inequalities, taking into account global and regional trends, climate change and policy considerations (Chirinos *et al.*, 2022). With the knowledge gained from this case study, policy makers and public health actors can work to improve access to and quality of health care in Uzbekistan.

3) Related Explanations

The case study has highlighted the unique health geography challenges faced by different regions in Uzbekistan, focusing on the industrial region of "Angren-Almalyk", the economic region of "Tashkent-Almalyk" and the health geography region of Lower Zarafshan. These regions have different patterns of disease prevalence and health problems influenced by various factors such as industrialisation, population density, pollution and geographical features (Karshibaevna *et al.*, 2022). The industrial region of "Angren-Almalyk" stands out in Central Asia due to its high concentration of industrial enterprises and associated pollution. The presence of a large population and environmentally hazardous industries, including chemical plants, thermal power plants and metallurgy, contribute to the non-geographic health situation of this region. Disease groups related to blood circulation, malignant tumours, nervous system disorders and birth defects are mainly observed in the densely populated and industrialised centres of this region. The environmental problems posed by this industrial area require urgent attention to mitigate their impact on public health (Abduvalieva, 2022).

"Tashkent-Almalyk" economic region has a high burden of social diseases compared to other regions in Uzbekistan. It ranks first in terms of diseases related to narcotics, as well as diseases related to the nervous system and mental disorders. These health problems are often found in large cities with a developed transport and industrial sector. Such diseases are often referred to as developmental or civilisation diseases, which highlights the impact of urbanisation and changing lifestyles on the health of the population. The Tashkent Geographic Health Region is emerging as an important focal point for addressing these diseases in Uzbekistan (Komilova, 2021).

The Lower Zarafshan geographic health region, particularly in the Bukhara region, is characterised by particular health-related features. The proximity of groundwater to the surface and the increasing salinity of the soil, including increased salinity in drinking water, directly affect the health of the population in this region. Health problems related to salt accumulation in organs, urinary tract and skin as well as tuberculosis are common here. Analysis of the spread of tuberculosis shows that the Aral Basin in Karakalpakstan within the Lower Amudarya region is a typical centre for this disease (Komilova and Mamatkulov, 2021). The natural and ecological conditions of Karakalpakstan,

coupled with social challenges, contribute to the spread of tuberculosis in this region. The Lower Amudarya and Tashkent regions also face relative difficulties in terms of diseases of the circulatory system, oncology and the endocrine system (Komilova, 2021). In addition, the territorial composition of diseases, taking into account natural geographical aspects such as deserts, oases, valleys, mountains, foothills and river basins, shows the formation of specific

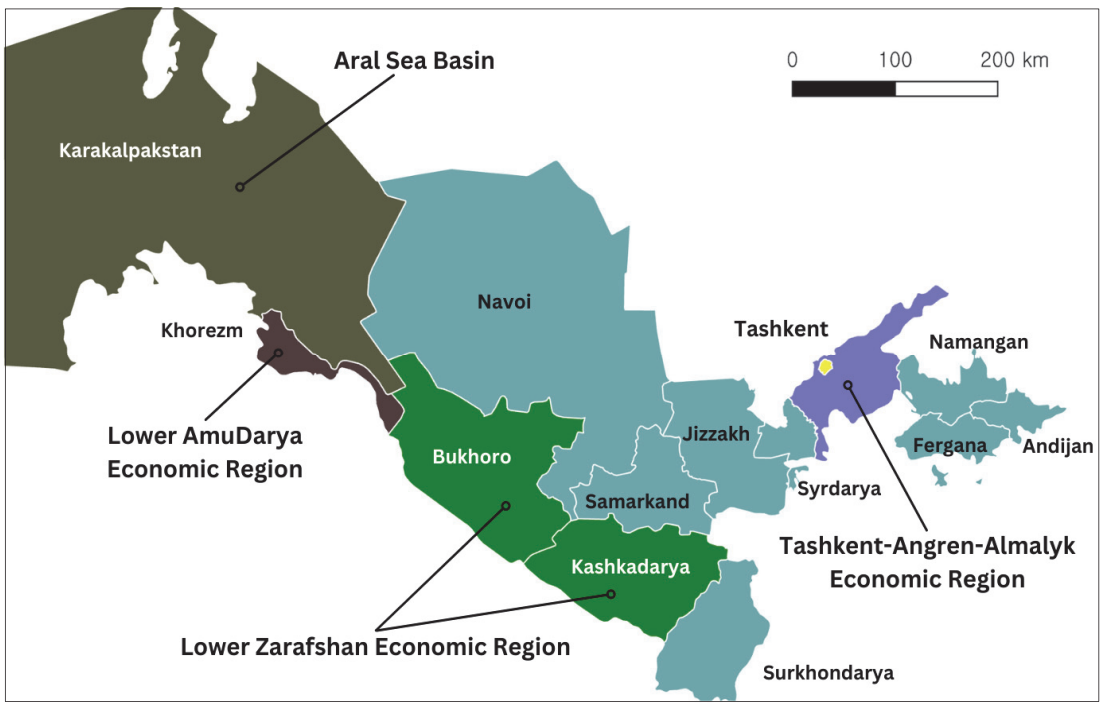

Figure 1. Uzbekistan: Map of Health–Geographic Regions

Table 1. Health Geographical regions of Uzbekistan and common diseases

Area Name	Spread Diseases
Tashkent-Angren-Almalyk Economic Region	Blood circulation disorders
	Malignant tumors
	Nervous system diseases
	Birth defects
Lower Amudarya Economic Region	Circulatory diseases
	Oncological diseases
	Endocrine system diseases
Aral Sea Basin	Tuberculosis
Lower Zarafshan Economic Region (especially, Bukhoro)	Salt accumulation in kidneys, urinary organs, and skin
	Tuberculosis

nosogeographical foci in the upper and lower parts of the river basins (Karshibaevna *et al.*, 2022).

These findings highlight the importance of understanding the intersection of health and geography in Uzbekistan. The case study highlights the need for targeted interventions and policies to address the unique health challenges in each region. Efforts should be made to reduce industrial pollution, promote healthier urban environments and improve access to health services. In addition, in the Tashkent–Almaliq economic region, strategies to address social diseases, drug problems and mental health issues should be prioritised. In the Lower Zarafshan geographic health region, initiatives are needed to address the effects of salt accumulation and tuberculosis prevalence, taking into account the specific natural and social conditions of the region. Further research and collaboration are critical to deepen the understanding of health geographic patterns and their underlying causes in Uzbekistan (Komilova and Mamatkulov, 2021). Comparative studies with other countries or regions facing similar challenges would help to share knowledge and identify effective strategies (Coccia, 2022). By prioritising health geography, policy makers and health professionals can develop targeted interventions and use resources more efficiently, ultimately improving health outcomes and overall population well–being.

4) Findings

The study found that the "Tashkent–Angren–Almalyk" economic region in Uzbekistan faces significant health challenges due to the high concentration of industrial enterprises and dense population. Disease groups such as circulatory disorders, malignant tumours, nervous system diseases and birth defects were found to be more prevalent in this region. Pollution from environmentally hazardous industries, including chemical plants, thermal power plants, cement manufacturing and metallurgical plants, has significantly shaped the health landscape of the region. In the case of the Lower Zarafshan health geographic region, particularly the Bukhara region, the study identified several health problems. The proximity of groundwater to the earth's surface and the increasing salinity of the soil, including increased salinity in drinking water, posed an immediate health risk to the population. Common health problems in this region included salt deposits in the kidneys, urinary organs and skin, and a high incidence of tuberculosis.

The findings also highlight the differences in health between urban and rural areas. Urban centres, characterised by higher levels of industrialisation and population density, had a greater burden of diseases related to industrial pollution and lifestyle factors. Rural areas, on the other hand, faced challenges related to limited access to health services and the impact of environmental factors such as agricultural practises and water quality. The study highlights the need for targeted interventions and policies to address the specific health challenges in the regions studied.

4. Discussion: Global and Regional Concerns

Climate change poses major challenges to health geography globally and in Central Asia. Rising temperatures, changing rainfall patterns and extreme weather events can affect disease transmission, vector-borne diseases and water availability, thus affecting the health status of populations. It is critical to consider the potential impact of climate change on disease patterns and health infrastructure when assessing the health geography in Uzbekistan and across the Central Asia region. Environmental degradation, including air and water pollution, deforestation and soil erosion, also has an impact on population health. Industrial activities, such as those seen in the "Angren-Almalyk" industrial area, contribute to pollution that can lead to respiratory diseases, cancer and other health problems. Addressing pollution and promoting sustainable practises are critical to improving health outcomes and maintaining the integrity of health geographic assessments.

In this case, socio-economic disparities and inequalities within and between regions are important aspects of health geography. In Uzbekistan, the Tashkent-Almaliq economic region has a higher burden of social disease compared to other regions, reflecting underlying socioeconomic factors. Understanding the socio-economic determinants of health and their spatial distribution can enable targeted interventions to reduce inequalities and promote equitable access to health services. In addition, rapid urbanisation in Central Asia, including the growth of large cities with developed transport and industrial sectors, presents both opportunities and challenges for health geography. Urban areas often concentrate population density, industrial activities and lifestyle changes, leading to increased risk of non-communicable diseases, mental health problems and substance abuse.

Addressing the health impacts of urbanisation requires comprehensive planning, including the provision of adequate health infrastructure, the promotion of healthy lifestyles and urban design that prioritises the well-being of the population. Therefore, effective disease surveillance and control systems are essential to understand and address health challenges in a geographically diverse region such as Central Asia. Joint efforts are needed to strengthen surveillance networks, share data and implement evidence-based disease prevention and control strategies. This includes monitoring the distribution of diseases, identifying hotspots and implementing targeted interventions to reduce the burden of disease and improve the overall health of the population. In addition, ensuring equitable access to health services in different geographical regions is an important concern.

In countries such as Uzbekistan, differences in health infrastructure, distribution of health workers and transport networks can lead to inequalities in access to health care, especially in remote or underserved areas. Efforts should be made to improve access to health care. This includes the use of mobile health stations, telemedicine services and targeted interventions

to address geographical inequalities in health care. By addressing these global and regional issues, policymakers, researchers and health professionals can better understand the interplay between health and geography in Uzbekistan and Central Asia. Implementing evidence-based interventions that take into account the unique geographical context can lead to more effective health strategies, improved health care and ultimately better health outcomes for the population.

5. Conclusion

To conclude, this study has highlighted the important role of geography in addressing health problems, especially in regions where certain health problems are prevalent despite advances in medical care. The study has shown the importance of geography in understanding the spread of diseases, identifying their sources and determining prevalence patterns. Integrating geography into the health sector provides a holistic perspective that takes into account spatial location and place. Geographers, equipped with medical knowledge, play a crucial role in analysing the spatial patterns of health-related phenomena and studying the prevalence of diseases. By examining the specific case study of health problems in Uzbekistan, this study has demonstrated the practical application of geography in addressing health problems. Economic geography and health geography offer valuable insights into the health challenges of Uzbekistan.

Economic geography helps identify economic factors that contribute to poor health outcomes, including poverty, income inequality and limited access to health services. It offers recommendations for improving economic development and addressing regional inequalities to promote overall health. Health geography, on the other hand, makes it possible to understand the spatial distribution of diseases, environmental health risks and access to health services in Uzbekistan. This science makes it possible to identify vulnerable areas and develop targeted interventions to effectively mitigate health risks. In addition, health geography examines the social determinants of health such as education, income and housing and sheds light on their influence on health outcomes in Uzbekistan.

A combined approach of economic and health geography thus provides a comprehensive understanding of the complex factors contributing to health challenges in Uzbekistan. This knowledge serves as the basis for developing effective strategies and interventions to address these challenges. Ultimately, geography and health science together form a hybrid science dedicated to the study of specific places, environments and time periods with their spatial dimensions. Their findings and insights contribute significantly to the formulation of appropriate strategies in the health sector.

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