

REVIEW ΑΝΑΣΚΟΠΗΣΗ

Global health and health crisis preparedness in light of climate change and natural disasters

Global health is increasingly threatened by the escalating impacts of climate change and natural disasters. Rising temperatures, more frequent extreme weather events, and environmental degradation are intensifying public health risks around the world. These shifts contribute to the spread of communicable diseases, exacerbate respiratory and cardiovascular conditions, and increase malnutrition due to food insecurity. Vulnerable populations, particularly in low- and middle-income countries, are the most affected, facing limited access to healthcare and resources. Building resilience and preparedness within global health systems is more urgent than ever. Integrating climate change into national and international public health strategies can support the development of responsive and adaptive health policies. This approach involves investing in early warning systems, sustainable infrastructure, emergency preparedness training, and climate-informed healthcare planning. Collaboration between governments, international organizations, and local communities is critical to forming a coordinated and effective response. Addressing climate change is an environmental priority but also a fundamental public health imperative. By aligning climate resilience with health policy, the global community can better protect populations, prevent health emergencies, and build a safer future for all.

1. INTRODUCTION

As an ever-evolving sector, global health is facing increasing challenges linked to climate change and natural disasters. Health crises, such as pandemics and epidemics, affect the well-being of populations and the resilience of health systems, leading to an increase in health risks, such as the spread of disease and deteriorating living conditions. Thus, there is an urgent need for preparedness and preparation for these crises, especially in a context where natural disasters are becoming increasingly frequent and severe.¹ The importance of the issue is obvious, as climate change affects health security globally. Natural disasters, such as floods, droughts and extreme temperatures, may worsen the public health situation and cause increasing demands for medical care and support. The combined impact of climate change and natural disasters on vulnerable populations makes the study of these issues vital

for the development of resilient health systems.² It is also crucial to consider how health policies and preparedness strategies can be strengthened to meet these challenges.

2. GLOBAL HEALTH AND CLIMATE CHANGE

2.1. Climate change and public health

Climate change has been identified as one of the biggest factors affecting public health globally. It influences the natural environment, human living conditions and the spread of diseases, such as malaria and dengue, resulting in serious health impacts on populations. These diseases are intertwined with changes in temperature and fluids, as these factors have a great impact on the life and reproduction of mosquitoes that carry viruses and parasites. Temperature increases cause temperature changes that affect the health status of populations. Higher temperatures can lead to di-

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Παγκόσμια υγεία και ετοιμότητα για κρίσεις υγείας υπό το πρίσμα της κλιματικής αλλαγής και των φυσικών καταστροφών

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rect effects, such as heat stroke and health-related diseases, but also indirect ones, such as ecosystem restructuring that allows new viruses and parasites to spread to areas that previously had no such challenges.³ Due to the rise of epidemics, health authorities are forced to cope with the increase in disease incidents, as well as requirements to prevent and respond to public health crises. This requires developing strategies to strengthen health systems to be more resilient to the challenges brought about by climate change. Understanding the link between climate change and public health is critical to preparing for and resilience to future health crises.⁴

2.2. Public health impacts

On the other hand, natural disasters, such as floods, droughts and hurricanes, have multidimensional and severe public health impacts that disrupt the lives of populations and the functions of health systems. Floods affect physical infrastructure, leading to direct health effects, such as injuries and deaths, and indirect ones, like water contamination, respiratory problems, and mental disorders, due to stress and insecurity. The security of drinking water is also severely affected by natural disasters, causing spread of hydro-pathogenic diseases, such as cholera and typhoid fever.⁵ Additionally, droughts prevent access to clean water and lead to food crises, which are necessary for the health of populations. Lack of drinking water and poor sanitation resulting from natural disasters can have long-lasting effects on public health, causing increased vulnerability of populations and deterioration of health systems.⁶

The resilience of health systems is also undermined by natural disasters, as health infrastructure can be severely damaged. This can result in disruption of access to health-care services, limiting authorities' ability to respond to health needs during and after disasters. Social inequalities are likely to increase, as the most vulnerable populations are often the most affected and least able to cope with the effects of these disasters. Overall, natural disasters highlight the need for better preparedness and resilience of health systems in order to be able to manage the multi-layered impact on the health of populations.

2.3. Environmental change and pandemics

The link between deteriorating natural ecosystems and the increasing risk of new pandemics is a core issue in modern public health. Environmental changes, such as deforestation, urbanization and climate change, contribute to disrupting ecosystems and affect the interaction between

humans, animals and microorganisms.⁷ Deforestation, for example, can lead to increased contact between humans and wildlife, leading to the possibility of transmitting zoonoses to humans. The transformation of natural ecosystems has been shown to facilitate the transition of pathogens that previously lived in isolated environments.

In addition, climate change, through rising temperatures and extreme weather events, affects the distribution and life cycle of pathogens and their vectors. This results in the spread of diseases to new geographies and populations, as conditions become more favorable for the transmission of diseases such as malaria, dengue, and COVID-19. In particular, changes in temperature and humidity affect the dynamics of arthropods, which are carriers of many infectious diseases, accelerating their spread to new areas, where local populations have no previous exposure and therefore lack immunity.⁸ The deterioration of ecosystems and the natural disasters have a significant social and economic impact, reinforcing poverty and inequality, making communities more vulnerable to health crises. Therefore, the link between environmental change and pandemics underlines the need for a multidimensional approach combining environmental management with health policy in order to prevent and manage the risks associated with new health crises.

3. PREPARING FOR HEALTH CRISES

3.1. Strengthen health preparation

The need to strengthen health preparedness is more urgent than ever, as natural disasters and health crises are often exacerbated by climate change, threatening the health of populations worldwide. To ensure the resilience of healthcare systems, strategies need to be well developed and implemented to enable the arising challenges to be effectively addressed. A key strategy is to invest in health-care infrastructure and technologies. Countries need to develop resilient systems that can cope with overload during health crises. This includes improving access to health services, strengthening hospital capacity, and integrating digital tools to manage data and resources.⁹ In addition, the development of monitoring and predictive analytics systems can help detect and respond early to health crises.

The education and training of health professionals is also precarious. Education on resilience and crisis preparedness should be integrated into undergraduate and postgraduate studies. Health professionals must be prepared to recognize and deal with the effects of natural disasters and epidemics, while understanding the importance of

working with other areas, such as environmental policy and public administration. Empowering communities through education and awareness on health preparation and resilience issues is also of vital importance to develop a culture of resilience.¹⁰ Funding and securing resources are also essential for the effective implementation of these strategies. Governments and international organizations must work together to ensure adequate funding for crisis preparedness and response. Public-private collaboration can enhance the creation of innovative solutions and ensure the sustainability of health preparation efforts.¹¹

3.2. Programs and international partnerships

Moreover, the preparation and resilience of healthcare systems to crises related to climate change and natural disasters requires the cooperation of various international organizations and programs. The World Health Organization (WHO) has taken a central role in formulating strategies aimed at strengthening the resilience of health systems. One of WHO's main programs is the "Health Emergency Programme", which provides support to countries in developing contingency plans and strengthening their preparedness to deal with natural disasters and epidemics.¹² These strategies include staff training, infrastructure improvement and the development of crisis prevention and response mechanisms.

In addition, organizations such as the Food and Agriculture Organization (FAO) and UNICEF make an important contribution to the preparation and resilience of health systems to climate change. FAO focuses on food security and health of populations, while UNICEF focuses on children's rights and healthcare for vulnerable groups.¹³ Through transnational partnerships, these organizations work to develop and implement policies that will enhance crisis preparedness and ensure continued access to health services during disasters. International cooperation is also necessary for the development of sustainable health preparation strategies. Multilateral organizations, such as the European Union (EU) and the United Nations (UN), develop initiatives that focus on strengthening cooperation between member states to share knowledge and good practices. For example, the WHO "One Health" strategy integrates public health, animal health and the environment, promoting cooperation to address common challenges linked to climate change and health crises. These international partnerships create a framework for resilience, allowing countries to share resources and information and better prepare for future challenges.¹⁴

3.3. Technological and innovative approach

Technology plays a critical role in enhancing health systems' preparedness and response to crises related to climate change and natural disasters. The development of digital platforms and applications enables effective monitoring and analysis of public health data. For example, digital health platforms provide the ability to collect and analyze real-time data, making it easier to monitor the spread of diseases and the health needs of populations. Apps such as "COVID Alert" used geolocation and alerts to inform citizens in a timely manner about epidemics and prevention measures.¹⁵ Early warning systems are also decisive for identifying and assessing risks associated with natural disasters and health crises. Data analysis and the use of artificial intelligence (AI) tools provide additional capabilities to prevent and respond to health crises. AI can be used to predict epidemics and model the spread of diseases, facilitating the preparation of health systems. By using innovative approaches, the global community can strengthen its own capacity to respond to health crises exacerbated by climate change.

4. MULTILATERAL GOVERNANCE AND INTERNATIONAL ORGANIZATIONS

4.1. The role of international organizations

Cooperation and coordination between international organizations is vital for effective preparedness and management of health crises, especially in a context of increasing climate change and natural disasters. WHO plays a central role in this process, acting as the main coordinator of global health security efforts. Through initiatives such as the Health Emergency Programme (HEP), WHO is strengthening countries' capacity to prepare for and respond to health crises.¹²

International organizations, such as the World Bank and the UN, also work with WHO to provide technical and financial support to countries, especially in the most vulnerable regions. This collaboration includes developing strategies to strengthen the resilience of health systems and ensure accessibility to essential healthcare services during crises.¹⁶ The importance of cooperation is further reinforced by the need for interoperability and common strategies in responses to health crises. International treaties and initiatives, such as the "Global Health Security Agenda" (GHSA), aim to improve collaboration between governments, international organizations, and the private sector to reinforce global health security. This cooperation is of crucial importance to identify and react quickly to new

threats, such as climate-related pandemics, and to promote international solidarity in addressing common challenges.¹⁷

International cooperation has proven instrumental in responding to health crises and natural disasters, with many countries and organizations working together to share knowledge and resources. A prime example is the COVID-19 pandemic, as WHO together with other bodies, such as GAVI and the Coalition for Epidemic Preparedness Innovations (CEPI), founded the COVAX initiative, which aims at equitable access to vaccines for low- and middle-income countries.¹² Also, the EU has created the “European Health Data Space” platform, which enables the secure exchange of health information between member states and enhances the ability to respond to health crises. Another important example of international cooperation is the response to the humanitarian crisis caused by the earthquake in Haiti in 2010. International organizations, governments and non-governmental organizations (NGOs) worked together to provide immediate humanitarian services, such as medical assistance and water supplies. The concerted effort of these actors has helped restore public health and prevent the spread of disease, underscoring the importance of international cooperation in crisis situations.¹⁸

To tackle climate change on a global scale, it is of utmost importance to provide, at first, psychological support to victims, including psychological support sessions and direction to access more specialized mental health services. Building support networks with psychologists, social workers and volunteers can also provide those affected with the necessary resources and support for their recovery.¹⁹ Continuity of care during and after disasters is much critical to ensure the health and well-being of patients, especially to those with chronic conditions, elderly and vulnerable populations. Seamless access to medical services can significantly affect health outcomes and individuals’ ability to cope with the challenges posed by disasters.¹⁹

5. PROPOSALS TO IMPROVE GLOBAL PREPAREDNESS AND RESILIENCE

5.1. Strengthening health systems

The resilience of health systems concerning the challenges of climate change and natural disasters is of vital importance in order to protect public health. Countries need to adopt contemporary strategies that integrate sustainability and preparation at all levels of their health infrastructure. By strengthening health systems, as well as health infrastructure governments could incorporate prevention and preparedness measures to respond to

natural disasters and health crises through risk assessment and vulnerability analysis.²⁰ Moreover, they can upgrade buildings and healthcare facilities to be resilient to extreme weather events and have adequate supplies in case of crises. Training health workers and the community to prepare for and respond to climate-related health crises is urgent. Education initiatives can include training programs to recognize and respond to epidemic situations, as well as to promote public awareness of the health impacts of climate change.²¹

Countries should also actively participate in international networks and partnerships focusing on health resilience and crisis response. Working with organizations such as the WHO can provide access to resources and expertise to manage the health impacts of climate change.¹² Additionally, the integration of technology and digital tools in health services can enhance the monitoring and analysis of data on climate change impacts. Early warning systems and public health monitoring tools can help prevent and respond quickly to crises.²²

5.2. Building international cooperation and a common framework for action

Building international cooperation and creating a common framework for action are fundamental factors in managing health crises, especially in light of the challenges posed by climate change and natural disasters. Consequently, it is pretty much important to give more emphasis to the formulation of new international agreements that integrate the aspects of public health and climate change. The success of such agreements requires the participation of all states and support from international organizations such as WHO and the UN. Improving cohesion policy between different sectors (e.g., health, environment, development) leads to effectively managing health crises. Thus, countries should integrate health priorities into their environmental and development strategies to achieve an integrated approach to their policy.²³

Promoting transparency and accountability in international partnerships is essential for building trust and enhancing effectiveness. Furthermore, implementing education and awareness programs for countries and communities regarding the importance of international cooperation in health management can strengthen countries’ preparedness and capacity to respond to health crises.

5.3. Need for education and awareness

Apropos the need for education and awareness it should

be mentioned that health personnel must be continuously trained on the health impacts of climate change. This includes knowledge on the transmission of diseases that may arise due to climate change, such as communicable diseases (e.g., malaria, dengue) and the management of health risks arising from natural disasters.²⁴

Public awareness is equally important, as citizens need to understand the impact of climate change on their health and be ready to react to urgent matters. Awareness campaigns may include workshops, seminars, and education programs to help communities identify risks and plan appropriate responses.¹² Developing and making available educational materials tailored to the needs of communities and health professionals can be much significant, too. Information needs to be understandable and accessible to different populations, including vulnerable groups, to ensure inclusion and an effective response. Cooperation with universities and educational institutions can promote research and innovation in education about the effects of climate change on public health. The design and implementation of curricula that include environmental health, public health, and climate policy can prepare the next generations of health professionals to be better equipped to face the challenges associated with climate change.²⁵

7. CONCLUSIONS

To conclude, the importance of global health and the need to prepare for health crises in light of climate change and natural disasters was much emphasized. Initially, growing concern about the impact of climate change on the health of populations was highlighted, with a focus on the increase in communicable diseases, temperature changes and epidemics.²⁶ The link between climate change and public health is a key factor influencing the resilience of health systems. The multi-layered impact of natural disasters, such as floods, droughts and hurricanes, on health and infrastructure was then examined, and how these disasters can increase the need for health support.²⁷ The need to strengthen health preparation through strategies that reinforce the resilience of health systems was stressed. The effective use of technological tools, the building of international cooperation and the need for education and awareness have been important axes for preparing for health crises resulting from the effects of climate change.¹⁵ Climate change is emerging as one of the most important

determinants of public health globally. Its impact is not limited to the environment, but also extends to the health of populations, bringing increased risks to the spread of disease, access to clean water and the infrastructure of health systems.

The complex relationship between climate change, natural disasters and health crises makes preparedness and resilience strategies imperative.²⁸ Natural disasters, such as floods and droughts, not only affect infrastructure, but also the security of drinking water and the function of health systems, making the resilience of health services a fundamental condition for ensuring public health. Mainstreaming climate change into health policies could contribute to the development of an integrated framework linking environmental, social and health challenges. Understanding climate change as a driver of global health can result in policy strategies that promote resilience and preparedness for future health crises.²⁹ Its integration into health policies can contribute to the development of an integrated framework linking environmental, social and health challenges. Strengthening cooperation between international organizations, governments and communities is of crucial importance to realize this framework. Concerning the limitations of the current literature review, as the relationship between climate change, natural disasters, and health outcomes was complex and multifactorial owing to socio-economic status, healthcare infrastructure, geography, it was difficult to establish clear-cut, universal conclusions. In addition, access to primary data as well as the quality of studies was not always feasible, as there were methodological weaknesses, small sample sizes, and biased approaches.

In conclusion, an effective response to climate change is essential to protect public health and prevent any crises that could arise. A strategy focused on climate change can bring positive changes to health policy and create a safer future for all. This dimension requires not only scientific and political will, but also the involvement of all stakeholders in health and environmental governance.³⁰ Preventing and managing health crises requires integrated strategies that integrate environmental challenges to ensure a sustainable future for generations to come. International cooperation and joint action are the central pillars for effective preparation and response to climate change-related health crises, as the success of these efforts depends on everyone's dedication and active participation.

ΠΕΡΙΛΗΨΗ

Παγκόσμια υγεία και ετοιμότητα για κρίσεις υγείας υπό το πρίσμα της κλιματικής αλλαγής και των φυσικών καταστροφών

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Η παγκόσμια υγεία απειλείται ολοένα και περισσότερο από τις κλιμακούμενες επιπτώσεις της κλιματικής αλλαγής και των φυσικών καταστροφών. Οι αυξανόμενες θερμοκρασίες, τα συχνότερα ακραία καιρικά φαινόμενα και η υποβάθμιση του περιβάλλοντος εντείνουν τους κινδύνους για τη δημόσια υγεία σε όλο τον κόσμο. Οι μεταβολές αυτές συμβάλλουν στην εξάπλωση μεταδοτικών ασθενειών, επιδεινώνουν τις αναπνευστικές και καρδιαγγειακές παθήσεις και αυξάνουν τον υποσιτισμό λόγω της επισιτιστικής ανασφάλειας. Οι ευάλωτοι πληθυσμοί, ιδίως σε χώρες χαμηλού και μεσαίου εισοδήματος, πλήττονται περισσότερο καθώς διαθέτουν περιορισμένη πρόσβαση στην υγειονομική περίθαλψη και στους πόρους. Η οικοδόμηση ανθεκτικότητας και ετοιμότητας εντός των παγκόσμιων συστημάτων υγείας είναι πιο επείγουσα από ποτέ. Η ενσωμάτωση της κλιματικής αλλαγής στις εθνικές και στις διεθνείς στρατηγικές δημόσιας υγείας μπορεί να υποστηρίξει την ανάπτυξη ανταποκρινόμενων και προσαρμοστικών πολιτικών υγείας. Η εν λόγω προσέγγιση περιλαμβάνει την επένδυση σε συστήματα έγκαιρης προειδοποίησης, βιώσιμες υποδομές, εκπαίδευση σε καταστάσεις έκτακτης ανάγκης και σχεδιασμό υγειονομικής περίθαλψης. Η συνεργασία μεταξύ κυβερνήσεων, διεθνών οργανισμών και τοπικών κοινοτήτων θεωρείται κρίσιμη για τη διαμόρφωση μιας συντονισμένης και αποτελεσματικής αντίδρασης. Η αντιμετώπιση της κλιματικής αλλαγής δεν αποτελεί μόνο περιβαλλοντική προτεραιότητα, αλλά και θεμελιώδη επιταγή για τη δημόσια υγεία. Ευθυγραμμίζοντας την ανθεκτικότητα στο κλίμα με την πολιτική υγείας, η παγκόσμια κοινότητα μπορεί να προστατεύσει καλύτερα τους πληθυσμούς, να αποτρέψει καταστάσεις έκτακτης ανάγκης στον τομέα της υγείας και να οικοδομήσει ένα ασφαλέστερο μέλλον για όλους.

Λέξεις ευρετηρίου: Δημόσια υγεία, Καταστροφές, Κλιματική αλλαγή

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