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Climate Change Impacts on Public Health and Welfare

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ABSTRACT: Climate change is one of the most pressing challenges of the 21st century, with far-reaching implications for public health and welfare. The increasing frequency and intensity of extreme weather events, such as heat waves, floods, and storms, as well as long-term environmental shifts like rising sea levels and changing precipitation patterns, are having profound effects on human health. These impacts include the exacerbation of existing health conditions, such as respiratory diseases, cardiovascular diseases, and heat-related illnesses, alongside the emergence of new public health threats, including the spread of vector-borne diseases like malaria and dengue. The most vulnerable populations, including low-income communities, elderly individuals, children, and those with preexisting health conditions, are disproportionately affected by these changes. Vulnerabilities are compounded by socio-economic factors that limit access to healthcare, clean water, and adequate housing. Climate change also disrupts food security, leading to malnutrition and undernutrition, particularly in regions already struggling with poverty. Additionally, mental health issues related to climate anxiety, displacement due to extreme weather events, and the loss of livelihoods are emerging as significant public health concerns. The economic toll of climate change on public health is immense, with increased healthcare costs, diminished labor productivity, and heightened social inequality. As health systems face the dual challenge of responding to both chronic and emerging health crises, proactive adaptation strategies are critical.

KEYWORDS: Climate Change ,Public Health ,Environmental Impacts , Extreme Weather Events

I. INTRODUCTION

Environmental pollutants can cause health problems like respiratory diseases, heart disease, and some types of cancer. People with low incomes are more likely to live in polluted areas and have unsafe drinking water. And children and pregnant women are at higher risk of health problems related to pollution. Climate change significantly impacts public health and welfare by increasing the risk of heat-related illnesses, spreading vector-borne diseases, worsening air quality, disrupting food security, causing mental health issues due to extreme weather events, and disproportionately affecting vulnerable populations, particularly the elderly and children, due to their increased susceptibility to environmental changes. The risks to public health and the environment from climate change are substantial and far-reaching. Scientists warn that carbon pollution and resulting climate change are expected to lead to more intense hurricanes and storms, heavier and more frequent flooding, increased drought, and more severe wildfires - events that can cause deaths, injuries, and billions of dollars of damage to property and the nation's infrastructure. Carbon dioxide and other greenhouse gas pollution leads to more frequent and intense heat waves that increase mortality, especially among the poor and elderly.³ Other climate change public health concerns raised in the scientific literature include anticipated increases in ground-level ozone pollution⁴, the potential for enhanced spread of some waterborne and pest-related diseases, and evidence for increased production or dispersion of airborne allergens.



II. KEY IMPACTS OF CLIMATE CHANGE ON PUBLIC HEALTH

Climate change presents a fundamental threat to human health. It affects the physical environment as well as all aspects of both natural and human systems – including social and economic conditions and the functioning of health systems. It is therefore a threat multiplier, undermining and potentially reversing decades of health progress. As climatic conditions change, more frequent and intensifying weather and climate events are observed, including storms, extreme heat, floods, droughts and wildfires. These weather and climate hazards affect health both directly and indirectly, increasing the risk of deaths, noncommunicable diseases, the emergence and spread of infectious diseases, and health emergencies.

Climate change is also having an impact on our health workforce and infrastructure, reducing capacity to provide universal health coverage (UHC). More fundamentally, climate shocks and growing stresses such as changing temperature and precipitation patterns, drought, floods and rising sea levels degrade the environmental and social determinants of physical and mental health. All aspects of health are affected by climate change, from clean air, water and soil to food systems and livelihoods. Further delay in tackling climate change will increase health risks, undermine decades of improvements in global health, and contravene our collective commitments to ensure the human right to health for all.

III. CLIMATE CHANGE IMPACTS ON HEALTH

Climate change is impacting health in a myriad of ways, including by leading to death and illness from increasingly frequent extreme weather events, such as heatwaves, storms and floods, the disruption of food systems, increases in zoonoses and food-, water- and vector-borne diseases, and mental health issues. Furthermore, climate change is undermining many of the social determinants for good health, such as livelihoods, equality and access to health care and social support structures. These climate-sensitive health risks are disproportionately felt by the most vulnerable and disadvantaged, including women, children, ethnic minorities, poor communities, migrants or displaced persons, older populations, and those with underlying health conditions.

Extreme heat events:

Rising temperatures lead to increased heat stress, heatstroke, and mortality, especially among vulnerable populations like the elderly and those with pre-existing health conditions.

Air pollution:

Climate change exacerbates air pollution by increasing ground-level ozone and particulate matter, which can lead to respiratory issues, cardiovascular diseases, and premature deaths.

Infectious disease spread:

Changing weather patterns can expand the geographic range of disease-carrying insects like mosquitoes, leading to increased cases of vector-borne diseases like malaria, dengue, and Zika.

Waterborne diseases:

Flooding caused by extreme weather events can contaminate water supplies, increasing the risk of waterborne diseases like cholera and typhoid fever.

Food insecurity:

Droughts, floods, and extreme weather events can disrupt agricultural production, leading to food shortages and malnutrition, particularly in vulnerable regions.

Mental health impacts:

Stress and anxiety related to climate change impacts like extreme weather events, displacement, and loss of livelihoods can significantly affect mental health.



Disproportionate impacts:

Vulnerable populations, including low-income communities, children, the elderly, and people with pre-existing health conditions, are often most severely affected by climate change due to limited access to healthcare and adaptation measures.

Important considerations:

Adaptation strategies:

Public health systems need to adapt to climate change by developing heatwave action plans, improving surveillance for infectious diseases, and implementing measures to protect water quality.

Mitigation efforts:

Reducing greenhouse gas emissions to mitigate climate change is crucial for protecting public health.

Health equity:

Addressing the disproportionate impacts of climate change on vulnerable populations is critical to ensuring equitable access to healthcare and adaptation measures.

Environmental Pollution:

Environmental Pollution refers to the introduction of harmful materials into the environment. In other words, environmental pollution is the contamination of the physical and biological components of the environment to such an extent that normal environmental processes are adversely affected.

Pollutants;

Any harmful material that, by getting introduced into the environment, causes environmental pollution is called a **pollutant**. In other words, a pollutant is any substance that contaminates air, water, soil, etc, and damages their quality. Pollutants can be natural, such as volcanic ash, or created by human activity, such as trash or factory runoff.

Types of Pollutants

Pollutants can be categorised into various types based on different parameters, as shown below.

Based on the nature of disposal, pollutants are of the following two types:

Non-Biodegradable Pollutants:

Pollutants that cannot be broken down into simpler, harmless substances in nature are called **non-biodegradable pollutants**. For example, DDT, plastics, polythene, insecticides, pesticides, mercury, lead, arsenic, aluminium cans, synthetic fibres, glass objects, iron products, silver foils, etc. Through bioaccumulation and biomagnification, these pollutants may appear in greater concentration as we move along the higher trophic levels of the food chain.

Biodegradable Pollutants:

Biodegradable Pollutants can be broken down into simpler, harmless substances in nature over time. For example, Domestic wastes, urine, faecal matter, sewage, agriculture residues, paper, wood, cloth, cattle dung, animal bones, leather, wool, vegetable stuff or plants etc.

Based on Form of Persistence:

Depending upon the form in which they persist after being released into the environment, the pollutants are categorised into the following two types:

Primary Pollutants:

Primary Pollutants are those emitted directly from the source and persist in the environment in the form in which they were added.

Examples: ash, smoke, fumes, dust, nitric oxide, sulphur dioxide, hydrocarbons, etc.

Secondary Pollutants;

Secondary Pollutants are formed from primary pollutants by chemical interaction with some constituents present in the atmosphere. Examples are Sulphur trioxide, nitrogen dioxide, aldehydes, ketones, ozone, etc.

Based on Nature of Pollutants



Depending upon their existence in nature, pollutants are of the following two types:

Quantitative Pollutants: These substances normally occur in the environment but acquire the status of pollutant when their concentration increases due to human unmindful Ness. For example, Carbon Dioxide (CO₂).

Qualitative Pollutants:

These substances do not usually occur in nature but are added by man. For example, insecticides.

Causes of Environmental Pollution

The causes of environmental pollution are based on the following factors:

Rapid Industrialisation:

The concentration of industries in urban areas releases pollutants into the air, water, and soil, causing environmental pollution. The rapid pace of urbanisation also increases waste generation and resource consumption, exacerbating pollution and causing severe environmental pollution. Industries also generate hazardous wastes in many forms, including liquids, solids, gases, and sludge.

Rapid Urbanization:

The increased pace of urbanisation in recent times has led to worsening environmental pollution. It creates issues such as deforestation and habitat loss, increased emissions and waste generation, etc.

Forest Fires:

The frequency of forest fires or wildfires has increased because of human actions, such as land clearing, encroachment, etc. These wildfires are a huge source of environmental pollution, adding large amounts of gaseous and other pollutants to the environment.

Improper Agricultural Practices: According to the IPCC report, the agriculture sector produces at least 23 per cent of global greenhouse gas emissions (second only to the energy sector). Using chemical fertilisers, pesticides, and herbicides in agriculture contributes to soil and water pollution and environmental pollution. Intensive farming practices also lead to deforestation, soil erosion, habitat destruction and environmental pollution.

Deforestation:

Deforestation refers to the decrease in forest areas worldwide that are lost for other uses, such as agricultural croplands, urbanisation, or mining activities. This causes an imbalance in the local ecology and reduces nature's capability to absorb pollutants, leading to environmental pollution.

Other Causes: Other prominent causes of environmental pollution include continued reliance on fossil fuels, vehicular emissions, and improper waste management.

Types of Environmental Pollution:

Environmental pollution can be categorised into several types based on the nature of the pollutants and the media they affect. Some of the major types of environmental pollution are described below.

Air Pollution :

Air Pollution is the contamination of the atmosphere with harmful substances that can adversely affect human health, ecosystems, and climate. Air pollution is caused by releasing harmful gases and particulate matter into the atmosphere. Significant sources of air pollution include industrial emissions, vehicular exhaust, and burning fossil fuels, which causes environmental pollution. Air Pollution is linked to respiratory diseases, cardiovascular problems, and global phenomena like acid rain and climate change.

Water Pollution

Water Pollution refers to the contamination of water bodies such as rivers, lakes, and oceans with pollutants such as industrial effluents, sewage, agricultural runoff, and oil spills. Water Pollution occurs when pollutants are discharged into water bodies, leading to water quality degradation. Industrial effluents, agricultural run-off, and domestic sewage



contribute to Water Pollution. Contaminated water affects aquatic life, disrupts ecosystems, and poses serious health risks to humans.

Soil Pollution

Soil Pollution refers to soil contamination with harmful substances, including heavy metals, pesticides, and industrial waste. Major sources of soil pollution include – the deposition of hazardous chemicals, heavy metals, and waste on land. Key factors are agricultural practices involving excessive use of pesticides and fertilisers, industrial waste dumping, and improper disposal of solid waste, which also causes environmental pollution. Soil pollution reduces soil fertility, contaminates crops, and affects food security.

Noise Pollution

Noise Pollution refers to excessive noise that can adversely affect human health and wildlife. Significant contributors to noise pollution include noise from industrial activities, traffic, construction, and urbanisation. Chronic exposure to high noise levels can lead to hearing loss, stress, and other health issues, which in turn can lead to environmental pollution.

Thermal Pollution

Thermal Pollution is defined as the sudden increase or decrease in the temperature of a natural body of water, such as an ocean, lake, river, or pond. This sudden change in water temperature is mainly due to anthropogenic activities. For example, a power plant takes water from a source, such as a river, as a coolant and then discharges the warm water back into the water body. Thermal Pollution leads to several issues in the aquatic ecosystem, such as decreased Dissolved Oxygen (DO) levels, algae growth, and a surge in toxins.

Nuclear Pollution or Radiation Pollution

Nuclear Pollution or Radiation Pollution can be defined as the release of high-energy particles into the air, water or surface. It is caused by radioactive materials contaminating the environment by decaying natural or anthropogenic activities. Breaches at nuclear power plants, scientific laboratories, chemical spills, etc, are some of the prominent causes of Nuclear Pollution or Radiation Pollution. Radiation modifies and destroys cells and genetic materials in living organisms, resulting in ill impacts on health.

Plastic Pollution

Plastic pollution is the contamination of the environment with plastic waste, such as discarded plastic items and debris. Plastic pollution is a major environmental problem because it takes hundreds of years for plastic to decompose. Plastic wastes can accumulate in landfills, waterways, and oceans, causing harm to wildlife and ecosystems. Plastic pollution severely impacts the health of humans, wildlife and the overall ecosystem.

Light Pollution:

Light Pollution refers to excessive artificial light that can disrupt ecosystems and nocturnal activities. Over-illumination in urban areas disrupts natural light cycles, affecting wildlife and human health. It contributes to energy waste and interferes with astronomical observations.

Consequences of Environmental Pollution

The consequences of environmental pollution are as follows:

Public Health:

Pollution is a significant cause of diseases and premature deaths globally. Different types of pollution have different impacts on human health. Air pollution alone is responsible for millions of deaths annually, with children and the elderly being particularly vulnerable.

Environmental Degradation:

Pollution disrupts ecosystems, leading to the loss of biodiversity, degradation of natural habitats, and alteration of ecological processes. All these, in turn, lead to issues such as disruption of food chains and environmental pollution.



Economic Costs:

The economic burden of pollution is immense, including loss of productivity and ecosystem damage. The expenses on environmental pollution control measures and increased healthcare costs also add to the economic costs of pollution.

Social Impacts:

Pollution can reduce overall quality of life by affecting people's health, well-being, and enjoyment of their environment. Environmental degradation and its associated consequences, such as droughts, water crises, etc, can cause social unrest and conflicts, forced displacement of communities, etc.

Suggested Measures for Addressing Environmental Pollution:

To mitigate the effects of environmental pollution, a comprehensive and multi-faceted approach is necessary, including:

Policy and Regulation: Governments must implement strict environmental regulations to limit emissions, control waste, and promote sustainable practices.

Public Awareness and Education: It is crucial to tackle pollution by educating the public about the causes and consequences of pollution and encouraging environmentally responsible behaviour.

Sustainable Practices: Promoting sustainable consumption patterns and resource management. The principles of the circular economy, which emphasise recycling and reusing resources, should be widely adopted.

Technological Solutions: Innovations in clean energy, waste management, and pollution control technologies can significantly reduce human activities' environmental footprint.

International Cooperation: Environmental pollution is a transboundary issue that requires coordinated international efforts. Through treaties, conventions, and collaborative initiatives, global impact.

IV. CONCLUSION

In climate change represents an unprecedented and escalating threat to public health and welfare worldwide. The direct and indirect impacts—ranging from increased incidences of heat-related illnesses and respiratory diseases to the spread of infectious diseases and mental health challenges—require urgent, comprehensive action. Vulnerable populations, particularly those in low-income communities and developing regions, bear a disproportionate burden of these health risks, making climate change not only an environmental issue but a critical social justice concern. As the evidence of climate change's impacts grows stronger, it becomes increasingly clear that public health systems must be adapted to meet these emerging challenges. Strengthening healthcare infrastructure, improving resilience through early warning systems, and enhancing climate-sensitive health policies are fundamental steps in reducing the health risks associated with climate change. Furthermore, mitigation strategies aimed at reducing greenhouse gas emissions are crucial in preventing the worst outcomes, while efforts to promote sustainable development can address both environmental and health disparities. Ultimately, addressing the health and welfare impacts of climate change requires a coordinated, global effort that integrates climate action into all aspects of public health planning. Governments, public health professionals, and communities must collaborate to build a more resilient future, ensuring that both present and future generations can withstand the inevitable health challenges posed by a rapidly changing climate.

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