Climate Change Impacts of Health Workers Without Safety Measures on Working Places

Mayanath Ghimire[1], A. K. Mishra[2], Jaishree Bolar[3] and **P. S. Aithal[4]**

[1]Post Doctorate Research Scholar, Srinivas University, India,

[2]D.Sc. Research Scholar, Srinivas University, India, Dean, Madhesh University, Nepal

[3]Professor, Institute of Education, Srinivas University, Mangalore, India,

[4]Professor, Poorna Prajna Institute of Management, Bangalore, India

Abstract

This study aims to explore the effects of climate change on health workers in Nepal, particularly in workplaces lacking safety measures. Climate change poses significant threats that can accumulate over time, leading to long-term changes in health and reliance on occupational safety and health (OSH). Factors such as rising ambient temperatures, air pollution, ultraviolet radiation exposure, and extreme weather events adversely affect OSH. Examples of climate change impacts include sea-level rise, warming oceans, shrinking ice sheets, glacial retreat, ocean acidification, and reduced snow cover. This research employs a review-based approach, utilizing systematic literature analysis to recommend pragmatic solutions. The researcher primarily employs deductive reasoning throughout the review process, employing in-depth archival analysis and intensive review strategies. The study finds that climate change affects organizational operations, leading to illnesses or injuries among health workers and increasing stress levels. Many health workers in Nepal operate without adequate safety measures; for example, healthcare personnel often lack gloves and masks, construction workers do not use protective gear, and farmers apply pesticides without safety equipment. These unsafe practices expose workers to respiratory and cardiovascular diseases, reproductive dysfunctions, vector-borne diseases, and other climate-sensitive health risks. The findings underscore the urgent need for improved occupational safety measures to protect health workers from the adverse effects of climate change.

Keywords

Climate change, Job, Safety, worker, work

Introduction

Nepal is among the countries most vulnerable to anthropogenic climate change, with its impacts felt across various sectors. The phenomenon of Loss and Damage (L&D) resulting from climate change is increasingly evident in Nepal, characterized by both slow-onset events (such as drought and glacier melting) and rapid-onset events (including floods, fires, and landslides). These events are escalating in frequency, intensity, and magnitude. L&D in Nepal is defined within a global discourse that emphasizes the country's ecological and social diversity. The proposed definition encapsulates the actual and potential negative consequences of climate change on extreme events both sudden (e.g., heatwaves, extreme rainfall) and gradual (e.g., snow loss, droughts, glacial retreat) to which communities in Nepal's diverse geographical regions are unable to adapt due to overwhelmed ecosystems and infrastructure,

leading to significant losses in life, livelihoods, and cultural heritage (Government of Nepal, MoFE, 2021).

According to NASA, climate change refers to long-term alterations in average weather patterns that define Earth's climate. The United Nations defines it as changes attributed directly or indirectly to human activities that modify the global atmosphere's composition beyond natural variability (UNFCCC, 2019). Despite contributing negligibly to global greenhouse gas emissions, Nepal is acutely vulnerable to climate change impacts across critical sectors identified in the National Adaptation Programme of Action (NAPA) 2010, including agriculture, forestry, water resources, energy, public health, urbanization, infrastructure, and disaster management.

Research indicates that climate change exacerbates health risks through vector-borne diseases and other conditions linked to extreme weather events. The working population faces daily exposure to adverse climatic conditions that increase the risks of diseases and injuries. For instance, outdoor workers are particularly susceptible to vector-borne infections due to rising temperatures expanding vector habitats. Additionally, heat exposure can significantly reduce productivity in sectors such as agriculture and construction.

Air pollution further compounds these challenges by impacting public health through increased morbidity and mortality rates associated with respiratory and cardiovascular diseases. Particulate matter (PM), nitrogen oxides, sulfur dioxide, volatile organic compounds (VOCs), dioxins, and polycyclic aromatic hydrocarbons (PAHs) are significant pollutants contributing to various health issues.

As climate change intensifies existing workplace hazards while creating new ones, outdoor workers will face increased exposure to extreme heat and infectious diseases. The ongoing climate crisis necessitates urgent action from global leaders to support vulnerable populations like those in Nepal through adequate financing and technical assistance for adaptation measures.

Statement of problem

Climate change is a global phenomenon that significantly impacts biodiversity and contributes to the reduction of emissions from deforestation and forest degradation in developing countries, particularly through initiatives like Reducing Emissions from Deforestation and Forest Degradation (REDD). The warming of global temperatures and changing climatic patterns have led to a loss of biodiversity, affecting various species, including animals, plants, insects, and pests. Among the most pressing issues arising from these changes is the impact on human health, particularly for health workers who often operate without adequate safety measures such as masks and gloves.

In Nepal, many laborers in agriculture and construction work without protective gear, exposing themselves to hazardous conditions. Health professionals frequently lack essential safety equipment, which increases their vulnerability to infectious diseases. The absence of proper safety protocols can lead to severe health consequences for both workers and the communities they serve.

The effects of climate change are evident in the increased frequency and intensity of extreme weather events, which exacerbate existing health risks. For example, rising temperatures can enhance the spread of vector-borne diseases, while air pollution contributes to respiratory and cardiovascular illnesses. As climate change continues to alter ecosystems and disrupt biodiversity, it poses significant challenges to public health, emphasizing the urgent need for comprehensive strategies to protect vulnerable populations and ensure safe working conditions. Addressing these challenges requires a multi-faceted approach that includes

improving occupational safety standards and enhancing resilience against climate-related health risks.

Objective

To analyse the effects of climate change on health workers in Nepal, particularly focusing on their working conditions without adequate safety measures.

Literature Review

This interdisciplinary study builds upon existing research regarding the future challenges that occupational safety and health (OSH) will face in light of climate change. Although practical strategies for organizational adaptation to climate change have been infrequently proposed, future research should prioritize the exploration of adaptive approaches and the development of corresponding practices (Tappura, 2022). Climate change has the potential to increase the incidence of work-related diseases and injuries, necessitating improved detection and prevention mechanisms to safeguard occupational health. Employers, governments, and policymakers must implement a multifaceted approach to protect workers from the long-term health consequences of climate change. Additionally, workers should be informed about the actions being taken to mitigate these effects (BH, 2022).

Heat exposure is a significant concern for the workforce, with recent studies emphasizing that heat-related illnesses, such as heat stroke, account for only a small proportion of health impairments, illnesses, and injuries that occur during hot periods (Narocki, 2021). In Québec, the impacts of climate change on OSH are evident through various direct and indirect factors, including heatwaves, air pollution, ultraviolet radiation, extreme weather events, and the spread of communicable vector-borne and zoonotic diseases. Furthermore, several additional factors such as changes in agricultural and animal husbandry practices, the fishing industry, forest ecosystem disturbances, degradation of the built environment, and the emergence of "green" industries have been identified as potential threats to OSH in Québec (Adam-Poupart, 2013).

The changing climate, characterized by more frequent and intense extreme weather events, is challenging workers' physical resilience, especially through prolonged heatwaves and unusually high temperatures. Certain worker groups are particularly vulnerable to the adverse health effects of these conditions (Humphrys, 2020). Climate change may directly impact the workplace and workers' health, contributing to greater exposure to extreme weather conditions, temperature-related stress (such as heatstroke and hypothermia), and other health risks such as skin and eye diseases, water contamination, storm-related injuries, dehydration, and mental fatigue. Additionally, increased exposure to air pollution and airborne particles exacerbated by phenomena like wildfires or dust storms could lead to respiratory and cardiovascular issues. The effects of climate change could also alter disease patterns, with changes in vector-borne diseases (from insects and animals) and the spread of pathogens, moulds, and allergens leading to infectious diseases, dermatitis, allergies, and asthma (CCOHS CA, 2023).

Climate-related disasters, such as floods, exacerbate malnutrition and food insecurity in vulnerable populations, particularly children under five years old in low- and middle-income countries (LMICs) (Agabiirwe, 2022). In this context, climate change also affects building operations, with insufficient attention to climate adaptation measures in many developing countries (Athauda, 2023). Without adequate control measures, climate change may increase risks of injury, disease, and death among workers, particularly from heat stress, extreme weather events, hazardous chemical exposures, air pollution, and infectious diseases. Numerous health effects have been linked to climate change, including cancer, cardiovascular diseases, respiratory conditions, and psychological impacts (ILO, 2024).

The International Labour Organization (ILO) has identified six key climate change impacts on OSH: excessive heat, solar ultraviolet radiation, extreme weather events, workplace air pollution, vector-borne diseases, and agrochemical exposure (ILO, 2024). The working population is inevitably exposed to climatic conditions based on their occupational settings, increasing the risk of diseases, injuries, accidents, and fatalities related to weather patterns such as heat, rain, and air pollution (Ferrari, 2022).

The adverse health impacts of climate change are far-reaching, encompassing heat-related disorders like heat stress, respiratory conditions worsened by air pollution, infectious diseases (including vector-borne and waterborne diseases), food insecurity, and mental health challenges such as post-traumatic stress disorder and depression following natural disasters. Reductions in fossil fuel combustion could provide substantial co-benefits, improving both public health and economic outcomes (Patz, 2023).

The Vulnerability and Impact Assessment (VIA) has shown that climate change will have significant effects across various sectors, including agriculture. In Nepal, for example, agriculture is a critical economic sector, employing two-thirds of the population and contributing approximately 27% of GDP. This sector is highly vulnerable to climate-induced hazards, such as rising temperatures and altered precipitation patterns, which affect crop and livestock production. Despite some adaptation efforts, farmers' capacity to adapt remains limited, and further initiatives are needed to assist farmers in coping with climate change (Government of Nepal, MoFE, 2021).

Climate change also affects the spread of vector-borne diseases, with malaria, kala-azar, and other diseases increasingly appearing in new geographic regions due to changes in climate patterns and vector distribution. These shifts make disease control more complex, as evidenced by the geographic spread of malaria and kala-azar in Nepal's Hill and Mountain districts over the past decade (Government of Nepal, MoHP, 2022).

In rural mountain areas of Nepal, households have reported increased temperatures, reduced winter rainfall, more frequent natural disasters, and the emergence of new insect species over the last two decades. These changes have been linked to decreased crop yields, reduced dairy production, and increased household work. Vulnerability to food insecurity is expected to worsen under future climate conditions (Poudel et al., 2017).

Flooding in the Karnali region of Nepal has also had significant impacts on child malnutrition. A study conducted by Mayanath Ghimire et al. (2023) found that children in flood-affected areas were more likely to suffer from malnutrition compared to those in unaffected areas. The annual flooding of the Karnali River, which can displace entire communities for extended periods, highlights the severe consequences of climate-induced disasters on food security and child health.

At Mangal Secondary School in Kirtipur, Kathmandu, the prevalence of wasting among students was noted, with 4.5% of children experiencing severe and moderate wasting, indicating the health impacts of local climate events (Ghimire, 2024). These findings underline the urgent need for targeted interventions to address both the immediate and long-term impacts of climate change on public health, particularly for vulnerable populations.

According to R. K. Timilsina et al. In conclusion, raising chickens in Nepal's Mid-Terai region has several advantages, such as increased income, job opportunities, and better nutrition. It does, however, also have significant limitations and drawbacks, including high production costs, problems with disease control, and volatile markets. Addressing these issues and guaranteeing the long-term survival of poultry businesses require strong enforcement and support structures. It is feasible to improve the sustainability and beneficial effects of poultry farming for Brahmin farmers and the larger society by taking into account the social effects and putting in place extensive support measures (Timilsina, R. K. et al., 2024).

According to Khadka, K. et al. The Boyar breed gives farmers significant financial rewards while giving a workable way to satisfy market demands. Therefore, adopting Boyar goat farming could be essential to developing Nepal's goat meat business and raising the standard of living for those working in it (Khadka, K. et al, 2024).

Research Methodology

This research employs a scientific review process, specifically using meta-synthesis, to investigate the effects of climate change on human residential areas. Climate change is a global issue with widespread implications, and the researcher predominantly applies deductive reasoning throughout the review process. The research strategy involved a comprehensive archival analysis, followed by an intensive review of relevant documents.

The approach in this review article includes a thorough examination and evaluation of both national and international sources, such as reports from the Intergovernmental Panel on Climate Change (IPCC), World Health Organization (WHO), national statistics, and annual publications from Nepal's Department of Health Services, in addition to other pertinent materials. This approach ensures a broad and systematic understanding of the subject, drawing on a diverse range of authoritative sources to address the issue of climate change and its impact on human habitation.

Result and Discussion

Climate change is a pressing global issue characterized by significant increases in temperature, rising sea levels, and extreme weather events. This comprehensive discussion highlights the key aspects of climate change, its effects on health and safety, particularly in Nepal, and potential adaptive measures.

Temperature Rise and Global Warming

Since the late 19th century, the Earth's average temperature has risen approximately 2.0 degrees Fahrenheit (1.1 degrees Celsius). This increase is largely attributed to carbon dioxide emissions from human activities, primarily fossil fuel combustion

Each of the last three decades has been successively warmer than any preceding decade since 1850, with most warming occurring in the past 35 years; notably, 16 of the 17 warmest years on record have occurred since 2001

The year 2016 holds the record as the warmest year recorded to date

The trend of rising temperatures correlates with various environmental changes:

Sea Level Rise: Global sea levels have risen about 8 inches in the last century due to thermal expansion and melting ice sheets.

- *Warming Oceans*: Ocean temperatures have also increased, contributing to coral bleaching and altered marine ecosystems.
- *Shrinking Ice Sheets:* Glacial retreat is accelerating, particularly in polar regions.
- *Decreased Snow Cover*: Snow cover is diminishing in many regions, affecting water supply and ecosystems.
- *Ocean Acidification*: Increased CO2 levels are leading to higher acidity in oceans, impacting marine life.

Health and Safety Concerns in Nepal

In Nepal, climate change exacerbates existing vulnerabilities among health workers and laborers. Many health personnel operate without essential protective equipment such as gloves

and masks. Construction workers often lack proper safety gear including caps and boots, while farmers apply pesticides without adequate safety measures.

These conditions expose them to various health risks. The working population faces daily exposure to adverse climatic conditions—such as extreme heat, rain, and air pollution—which heightens the risk of diseases, injuries, accidents, and even fatalities during labor. The effects of climate change can disrupt organizational operations, leading to increased stress among workers and potential job insecurity.

Health Risks Associated with Climate Change

Climate change significantly impacts public health in Nepal through:

- Vector-borne Diseases: Changes in climate patterns can expand the range of diseases like malaria.
- Diarrheal Diseases: Increased rainfall and flooding can lead to outbreaks of waterborne diseases such as cholera.
- Malnutrition: Food security is threatened by changing agricultural conditions.
- Cardiorespiratory Diseases: Air pollution exacerbated by climate change contributes to respiratory issues.
- Psychological Stress: The mental health impacts of climate-related disasters are profound.

  According to projections, between 2030 and 2050, an estimated 250,000 additional deaths per year may occur due to malnutrition, malaria, diarrheal diseases, and heat stress linked to climate change.

Adaptive Measures and Policy Recommendations

To mitigate the effects of climate change on agriculture and food security in mountainous regions like Nepal, various adaptive strategies are recommended:

- High-Yielding Crop Varieties: Utilizing genetically improved crops can enhance food production under changing climatic conditions.
- Enhanced Irrigation Systems: Improving water management can help sustain agricultural productivity.
- Fertilizers: Appropriate use of fertilizers can boost crop yields but must be managed to prevent environmental degradation.

  Policy Instruments for Food Security

  Effective policy instruments are crucial for enhancing food security amidst climate change. These may include:
- Investment in sustainable agricultural practices.
- Development of infrastructure that supports resilience against climate impacts.
- Education programs for farmers on safe pesticide use and sustainable practices.

The impacts of climate change are profound and multifaceted. In Nepal, where health infrastructure is weak, the challenges posed by rising temperatures and extreme weather events are particularly acute. Addressing these issues requires a concerted effort involving adaptive measures in agriculture, enhanced health safety protocols for workers, and robust policy frameworks aimed at mitigating the adverse effects of climate change on vulnerable populations.

Conclusion

The evidence of climate change is unequivocal, with global temperatures having risen approximately 2.0 degrees Fahrenheit (1.1 degrees Celsius) since the late 19th century, primarily due to increased carbon dioxide emissions from human activities. The past 35 years have seen a trend where 16 of the 17 warmest years on record occurred since 2001, with 2016 being identified as the warmest year in history. This alarming increase in temperature is accompanied by various adverse effects on both the environment and human health.

In Nepal, the situation is particularly concerning as health workers and other laborers often operate without essential safety equipment, exposing themselves to significant health risks. The lack of protective measures not only jeopardizes individual health but also diminishes overall working efficiency. It is imperative that employers provide minimum safety materials at every workplace to ensure the well-being of their employees and foster a healthier work environment.

The initial impacts of climate change are evident among health workers who serve as first responders in disaster scenarios, where they provide critical medical assistance and support to vulnerable populations. However, these workers frequently neglect their own safety in emergency situations, highlighting a critical gap in occupational health and safety policies.

Climate change manifests in various forms, including the disappearance of numerous species, melting ice leading to rising sea levels, decreased food supply, and an increase in tropical diseases such as dengue and malaria. These changes necessitate the integration of occupational safety and health into climate change policies and actions to create safer working environments.

Extreme weather conditions pose additional threats to worker safety. Exposure to extreme temperatures can result in heat stress or cold-related injuries, while intensified sunlight increases the risk of skin and eye diseases. Moreover, contaminated water sources and severe storm conditions exacerbate these risks, leading to greater exposure to air pollution and associated health complications.

In conclusion, addressing climate change requires a multifaceted approach that includes enhancing occupational safety standards across various sectors. By implementing effective safety measures and integrating health considerations into climate policies, we can protect workers' health while simultaneously addressing the broader challenges posed by climate change. This proactive approach is essential for safeguarding human life and promoting a sustainable future amidst ongoing environmental changes.

Acknowledgement

The author is thankful to all the professionals who took part in the discussions. The author thanks reviewers and editor for useful suggestions during the discussions.

References

Adam-Poupart, A. e. (2013). Impacts of Climate Change on Occupational Health and Safety. 1-36. doi:www.irsst.qc.ca

Agabiirwe, C. N. (2022). Impact of floods on undernutrition among children under five years of age in low- and middle-income countries: a systematic review. *Environmental Health, 21*(98), 1-21. doi:http://creativecommons.org/licenses/by/4.0/.

Athauda, R. e. (2023). Change Impacts on Occupational Heath and Safety of Facade Maintenance Workers: A Qualitative Study. 1-18. doi:https://doi.org/10.3390/su15108008

BH, R. M. (2022). Impact of Climate Change on Occupational Health and its Possible Preventive Stategies (Review Article). *Egyptian Journal of Occupational Medicine*, 47-62.

doi:CC%20effected%20on%20Health%20occupation/EJOM_Volume%2046_Issue%203_Pages%2047-62.pdf

CCOHS CA. (2023). *Climate Change: workplace Impacts.* Ontario: Canadian Centre for Occupational Health and Safety. doi:CC%20effected%20on%20Health%20occupation/9%20pub-hb-climate-change-web.pdf

Constible, J. e. (2020). On the Front Lines: Climate Change Theatens the Health of America's Workers. *NRDC*, 1-39. doi:CC%20effected%20on%20Health%20occupation/front-lines-climate-change-threatens-workers-report.pdf

Dhimal, e. a. (2017). Health-sector responses to the impacts of climate change in Nepal. *WHO South East Asia Journal of Public Health, 141*(2.2), 1-6. doi:http://www.who-seajph.org

Dhital SR, e. a. (2017). Climate Change and Its Impacts on Human Health in Nepal. *J Health Edu Res Dev, 4*(2), 1-4. doi: DOI: 10.4172/2380-5439.1000174

Ferrari, G. e. (2023). Impact of climate change on occupational health and safety. *IOS Press, 74*, 483-499. doi:DOI:10.3233/WOR-211303

Ferrari, G. N. (2022). Impactofclimatechangeonoccupational health and safety: A review of methological approaches. *ResearchGate*, 1-16. doi: DOI: 10.3233/WOR-211303

Ghimire, M. e. (2024). Measureemnt of f dry of Community school children Affect from Day Snacks. *International Journal of Health Science and Pharmacy (IJHSP), 7*(2). doi:https://doi.org/10.5281/zenodo.10091884

Government of Nepal, MoFE. (2021). National Framework on Climate Change Induced Loss and Damage (L&D). .1-93. doi:CC%20effected%20on%20Health%20occupation/Nepal%20related%20CC/1%20National%20framework%20on%20Loss%20and%20Damage%20-%20Approved%20Document-%202021_1653988842.pdf

Government of Nepal, MoFE. (2021). Nepal's third National Communication to the UNFCCC. 1-262. doi:CC%20effected%20on%20Health%20occupation/Nepal%20related%20CC/1%20TNC%20Nepal_Final_v2.pdf, www.mofe.gov.np

Government of Nepal, MoHP. (2022). *Vulnerability and Adaptation Assessment of Climate Sensitive Disease and Health Risks in Nepal.* Kathmandu: Ministry of Heath and Population. doi:CC%20effected%20on%20Health%20occupation/Nepal%20related%20CC/2%20VA_Assessment_Report.pdf

Humphrys, D. E. (2020). Heat Stress and work in the Era of Climate Change. 1-30. doi:CC%20effected%20on%20Health%20occupation/Heat_Stress_and_Work_FINAL_FINAL.pdf

ILO. (2024). Ensuring safty and health at work in a changin climate. 1-132. doi:CC%20effected%20on%20Health%20occupation/wcms_922850.pdf, ISBN 9789220405079

Levi, M. e. (2018). Imapact of climate change on occupational health and peoducitvity: a systematic literature review focusing on workplace heat. *Medicina del Lavoro*, 163-179. doi:DOI: 10.23749/mdl.v109i3.6851

Manisalidis, I. e. (2020). Environmental and Health Impacts of Air Pollution: A Review. *Front. Public Health,*. doi:https://doi.org/10.3389/fpubh.2020.00014

Narocki, C. (2021). Heatwaves as an occupational hazard. *etul.*, 1-75. doi: ISBN: 978-2-87452-614-5

Park, J. R. (2021). Temperature, Workplace Safety, and Labor Market Inequality. *IZA*, 1-29. doi:CC%20effected%20on%20Health%20occupation/dp14560.pdf

Patz, J. A. (2023). Climate Change Challenges and Opportunities for Globl Health. *312*(15), 1565-1580. doi:doi:10.1001/jama.2014.13186

Podel S., e. a. (2017). Household Perceptions about the Impacts of Climate Change on Food Security in the Mountainous Region of Nepal. *Sustainability, 641*, 1-20. doi: doi:10.3390/su9040641

Tappura, S. a. (2022). *Occupational Safety and Health Affected by Climate Change: Future Challenges and Research Agenda.* doi:https://openaccess.cms-conferences.org/#publications/book/978-1-7923-8988-7

UNFCC. (2019). Climate change.

WHO. (n.d.). Climate Change and Occupational Health. *nitro PDF Professional* .