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IMPACT OF CLIMATE CHANGE AND COVID-19 ON HEALTH

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Abstract

This study aims to extend and synthesise current evidence on the impact of climate change and covid-19 on human health. A systematic literature review is carried out by means of a thorough literature search, utilising electronic and manual databases. Results have identified the following impacts of climate change on human health: Infections, natural disasters, and heat. Climate change and the covid-19 pandemic both share commonalities of human activity and environmental degradation with highlighted disparities relating to the marginalised and poorest people in societies globally, including migrants and refugees. Decreasing climate change requires significant reductions in greenhouse gas emissions. This is possible through changing behaviours towards an enabling environment, by making better choices relating to energy use, transport, waste generation, transport, consumption, habitat, food, and sanitation. It is only by working together that we can reduce the impact of climate change and covid-19 on our health.

Keywords: Climate change, Covid-19, Global warming, Health, Pandemic

抽象的

本研究旨在扩展和综合有关气候变化和 covid-19 对人类健康影响的现有证据。系统的文献综述是通过彻底的文献检索，利用电子和手动数据库进行的。结果确定了气候变化对人类健康的以下影响：感染、自然灾害和高温。气候变化和 covid-19 大流行都具有人类活动和环境退化的共性，并且在社会边缘化和最贫困人口方面存在突出差异在全球范围内，包括移民和难民。减缓气候变化需要大幅减少温室气体排放。通过在能源使用、运输、废物产生、运输、消费、栖息地、食物和卫生方面做出更好的选择，改变行为以创造有利环境，这是可能的。只有通过共同努力，我们才能减少气候变化和 covid-19 对我们健康的影响。

关键词：气候变化，Covid-19，全球变暖，健康，大流行

1. Introduction

For thousands of years the earth's climate has been changing(WMO, 2020). Over the past 650,000 years to contemporary life, there has been seven cycles of glacial advance, retreat, and re-advance(Antoniazza & Lane, 2021). The modern era commenced approximately 11,700

years ago when the previous ice age concluded and human civilization began (NASA, 2021). Climate change can be defined as “a broad range of global phenomena created predominantly by burning fossil fuels, which add heat-trapping gases to Earth's atmosphere. These phenomena include the increased temperature trends described by global warming, but also

Received: July 02, 2021 / Revised: August 22, 2021 / Accepted: September 05, 2021 / Published: September 20, 2021

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encompass changes such as sea-level rise; ice mass loss in Greenland, Antarctica, the Arctic and mountain glaciers worldwide; shifts in flower/plant blooming; and extreme weather events”(Youmatter, 2020).

From middle of the twentieth century, the global warming trend has increased substantially, and it is predicted that more than 95% is because of human activity (SPM, 2014). In the mid-nineteenth century, the heat-trapping nature of carbon dioxide and additional gases were illustrated (Westerhold, 2020). The pre-industrial era has contributed to an increase in population growth and economic activity, with a substantial increase in anthropogenic greenhouse gas emissions. Consequently, there has been an increase in atmospheric concentrations of nitrous oxide, carbon dioxide and methane, combined with the anthropogenic drivers and water vapour. These are likely to be dominant causes of global warming which stem from middle of the twentieth century, to present. Water vapour can be perceived as “feedback” to the climate because it responds rapidly to physical or chemical changes in temperature (Zhang, Ma, & Che, 2020). Most recently impacts caused by climate change have affected human and natural systems globally. These changes have illustrated human and natural sensitivity towards a changing climate, despite the cause. Since the 1950s there have been several extreme changes in weather, resulting from the influence of human activity (Heyd, 2021). For example, a fluctuation in temperature ranging from extremely hot to extremely cold, a rise in sea levels and the heavy rainfall in several regions. On a global scale it is noted that the frequency of severe weather conditions has increased in many countries like Asian countries, parts of Europe and Australia (Nicholls, et al., 2012). The earth’s

response to greenhouse gases can be observed through evidence within tree rings, coral reefs, sedimentary rock layers and ocean sediments. We are currently experiencing global warming roughly approximately ten times faster than the average rate of ice-age-recovery warming. It has also been found that since the last Ice Age, human activity has increased carbon dioxide levels two hundred and fifty times faster than it did in natural sources (NASA, 2021). By the later part of the twenty-first century, the global mean surface warming is determined through the combination of carbon dioxide emission. The climate policy and socio-economic development determine the projections of greenhouse gas emissions over a large range. Therefore, since the late nineteenth century the average surface temperature of earth has increased by approximately 1.18 degrees Celsius or 2.12 degrees Fahrenheit, again due to human activities (Gaffney & Steffen, 2017). It has been noted that most of the global warming has taken place over the past forty years, with the most recent years from 2016 to 2020 respectively, recorded the warmest (NOAA, 2021).

As the emission of greenhouse gases continues, global warming will create further climate changes which are likely to be irreversible, severe, and prevalent for individuals and the ecosystem. Similarly, the coronavirus (COVID-19) pandemic has affected societies globally including their health, social, economic, and political factors (Somani, *Our World Before, During and After the COVID-19 Pandemic*, 2020). COVID-19 “is a highly infectious disease that has affected two international conveyances, two hundred and ten countries and territories. The first case was identified in China during December 2019 and it was declared a public health emergency on 11th March 2020 (NHS,

2020)” (Somani, COVID-19 Lockdown Impact On Education, 2021). The virus transmission occurs when “droplets of saliva or discharge from the nose when an infected person coughs or sneezes” (WHO, Health topics, 2020) and those infected droplets are penetrated into the eyes, nose or mouth of an uninfected person (Noi, 2020). To safeguard societies globally, international leaders decided to enforce laws to ensure their citizens stayed safe at home, following lockdown and social distancing regulations (Somani, The UK Lockdown and Social Distancing, 2020). This has led to physical and mental health implications (Somani, The Impact of COVID-19 on Human Psychology, 2020).

Objectives

This study aims to extend and synthesise current evidence on the impact of climate change and covid-19 on health. Two dominant features distinguish this study from previous literature, consequently towards a quality contribution. The first highlights the wide database range used within the study to obtain publications adhering to strict inclusion research content criteria. This contributes to a valuable analysis taking a broad set of research into consideration. Secondly the analysis of literary works with extensive examinations of the citations from the selected literature sources and research content. There is an endeavour to create awareness and generate sustainable objectives for implementation in the contemporary world, towards an enhanced physical and social environment aiding future generations.

This study is organised into the following sections: section 2 illustrates the data collation process on health, climate change and covid-19. It also highlights the exclusion criteria through which literature has been selected. Section 3

delivers results of the study and a discussion, while section 4 states the concluding remarks and recommendations.

2. Materials and Methods

A systematic literature review is carried out by means of a thorough literature search, utilising electronic and manual databases. The following electronic databases are searched: Google scholar, PubMed, GREENR, ERIC, CQ Researcher. A well-planned process is implemented to search, identify, extract, analyse, evaluate, and interpret existing published literature works and grey literature. The following keywords are used in the initial search: Climate change, covid-19, health, pandemic. The search resulted in the identification of many literature sources, hence the following exclusion criteria is developed

- Literature irrelevant to climate change and covid-19 are excluded.
- Literature focusing entirely on covid-19 are not included.
- Literature in languages other than English are ignored.
- Older literature with information like newer papers are omitted.
- Literature with insufficient technical information to their approach are excluded.

A total of thirty literature sources are shortlisted to aid focus to this study. Upon closely examining the papers, two are duplicated therefore not used and after reading the abstracts and introductions one is eliminated. This has equated to twenty-seven literature sources. Another literature source is eliminated due to a lack of implementation details. Thus, twenty-six primary literature sources have reached the

overall criteria and have been included within this study.

3. Results and Discussion

Results have identified the following impacts of climate change and covid-19 affecting human health including infections, natural disasters, and heat.

3.1 Infections

Climate change and the covid-19 pandemic have highlighted many disparities relating to the marginalised and poorest people in societies globally, including migrants and refugees. There have been numerous lives lost globally due to trends verifying increasing inequalities (Lancet, 2020). Currently, there is no direct evidence linking climate change to the spread of covid-19. However, climate change does alter the way humans relate to other species on the planet, which has a correlation to our health and an increase in rates of infection (Bernstein, 2021). Climate change creates an unusual migration process for animals, as they are forced to move from their natural habitats to avoid changes in extreme weather conditions. This facilitates them towards meeting other animals that they would not usually encounter, creating a foundation and opportunity for pathogens to enter new hosts. Cross contamination due to this migration creates a transmission pathway to infect humans (Bernstein, 2021). Many dominant causes of climate change also contribute towards a higher risk of pandemics. For example, the greatest cause of global habitat loss is deforestation, which usually occurs from agricultural requirements. Infections can spread through livestock in farms to humans increasing infection risks and rates. It has been noted that greenhouse gas emissions and the emerging risk of infectious diseases can be lowered by

decreasing the demand for animal meat towards a sustainable husbandry.

There is a positive correlation between water-borne diseases and climate change because insects, cold-blooded animals and other creatures like snails can carry viruses and diseases, through which serious illnesses can be spread. Geographic ranges can be altered as the changes in climate will lengthen vector-borne disease transmission. For example, in China schistosomiasis a disease transmitted through snails, and climate change is expected to expose the area to snail-borne disease significantly (Zhou, et al., 2008). Another disease induced by the climate is malaria, which is transmitted by *Anopheles* mosquitoes. Within developing worlds like Africa, reports have indicated that there are over 400,000 deaths resulting from malaria per annum, out of which a large percentage constitutes to children under the age of five years old. Another mosquito vector sensitive to climate conditions is the *Aedes aegypti*, which is the vector of several viruses including yellow fever, dengue virus, chikungunya virus and Zika virus (Powell, 2018). With the continuation of climate change, exposure to these viruses is likely to continue affecting human health.

There are a variety of factors that influence the risk of death from covid-19 including individuals with underlying or pre-existing medical conditions, healthcare access and socio-economic status. Individuals residing in areas with poor air quality are more likely to suffer death from covid-19 (Wu, Nethery, Sabath, Braun, & Dominici, 2020). Previous research has also indicated that individuals that are exposed to a greater air pollution and those that smoke cigarettes, suffer with dire respiratory infections

compared to those that do not smoke and those that breath clean air(Bernstein, 2021). This has been noticeable in India as it has been at the epicentre of the pandemic, as the Indian variant spreads across the world. Masses of infected patients struggled to obtain oxygen cylinders to facilitate breathing. This lack of clean oxygen which humans have always taken for granted as a cost-free necessity, showed its value as it entered the black market with financial implications for individuals to stay alive(Dennis, 2021). A Lancet report illustrated the requirement to address responses to the covid-19 pandemic and climate change in unison. This is due to commonalities between the two global issues involving human activity and the environmental degradation(Lancet, 2020). Research has revealed that climate change may have been involved casually in the emergence of the covid-19 virus (Beyer, Manica, & Mora, 2021).

3.2 Natural disasters

Natural disasters associated to extreme weather conditions, have increased by three-fold after the 1960s. Developing countries have been dominantly affected every year through natural disasters, particularly as more than 60,000 deaths on average have been reported (WHO, Climate change and health, 2018). With the increased rise of sea levels due to the extreme weather, essential services, people's homes, and medical institutions are destroyed, particularly as more than half of the population within the world resides approximately 60 kilometres from the sea. A consequence of these events includes individuals being forced to leave their homes. This can lead to a great impact on physical and mental health, as individuals experience stress and anxiety(Somani, Reflection of Trauma in

Gujarat Literature, 2020), simultaneously trying to protect themselves from the susceptibility of communicable diseases.

Another consequence of climate change is the unpredictable patterns in rainfall that impinge upon the supply of freshwater. Freshwater is imperative to maintain good hygiene and good health, particularly as six to eight glasses of water are recommended for daily consumption as part of maintaining a balanced diet(Wolf, Wolf, Rudikoff, & Parish, 2010). Consequently, if the water is not fresh there is risk of diarrhoeal disease, which has been noted to cause over 500,000 deaths of children under five years of age. A lack of water can also lead to famines and droughts, and it is expected that by the end of the 21st century the impact of climate change will be directionally related to the global intensity and frequency of regional droughts (SPM, 2014). In contrast, there is also an increase in extreme precipitation and floods as the intensity and frequency escalates. Through flooding, there is a contamination of freshwater supplies, with an increased risk of water borne diseases because they are ideal conditions for breeding insects that carry diseases, like mosquitoes which carry malaria. They also cause deaths due to drowning in excessive water or sustaining severe physical injuries. Quality of life is affected vastly, as there is disruption to homes, healthcare service providers and medical supplies. Excessive rainfall and extreme fluctuating temperatures affect vegetation and the growth of staple foods, particularly in rural areas. Within India, 58% of people rely on agriculture as their primary source of livelihood(IBEF, 2021). Therefore, they are dependent on the production of crops for their revenue, to feed themselves, families, and regions. However, the extreme weather conditions caused through climate change, are

likely to cause an increase in deaths from the current 3.1 million annual demises resulting from undernutrition and malnutrition globally.

3.3 Heat

Another consequence of climate change is an increase of high air temperatures, which has a direct impact on human health. This can lead to increased respiratory disease, and cardiovascular complications which can result in death, dominantly affecting the elderly generation. During extreme heat waves like the 2003 European summer, more than a staggering 70,000 deaths were reported (Robine, et al., 2008). Ozone layers and air pollutants are raised due to the high temperatures, this exacerbates respiratory diseases and cardiovascular diseases. In extreme heat there is a rise in pollen count and other aeroallergen levels, which can affect approximately 300 million people as asthma is triggered (WHO, Climate change and health, 2018). The continual increase in temperature is likely to heighten the global health burden. Climate change is believed to exacerbate existing human health problems, particularly for those in developing countries with low incomes, in comparison to developed countries, or those with a high income. The change in climate affects our air quality, water, food, and security. Although some parts of the world will experience a reduction in deaths during winter and an increase in food production within regions, in general there are more negative factors resulting from climate change than positives.

4. Conclusion

Both the covid-19 pandemic and climate change have had global implications on the environment, social and health factors. Decreasing climate change requires significant reductions in greenhouse gas emissions. By working together,

through adaptation we can limit risks directly linked to climate change. Although, climate change impacts on health are apparent, measuring the effects are approximations. The World Health Organization predicts that between the years 2030 and 2050 there will be approximately 250,000 more deaths per year. This includes 95,000 deaths resulting from childhood undernutrition, 48,000 deaths from diarrhoea and 38,000 resulting from exposure to heat affecting particularly the elderly people (WHO, Climate change and health, 2018). It is evident through this study that, every individual around the world is impacted by climate change and the covid-19 pandemic, however some populations particularly those residing in rural areas, remote regions, small islands, coastal regions, polar and mountainous regions are more affected than developed countries and urban regions. Individuals and children residing in poor economic conditions around the world are at a greater risk of health impacts. Climate change and the covid-19 are also expected to have a greater impact on the elderly or those with pre-existing or underlying medical issues. It will be more difficult for developing countries with a weaker health infrastructure to protect themselves from the impacts of climate change and covid-19 on health, particularly without support and appropriate preparedness and response.

Aware of the health impacts resulting from these global challenges is not sufficient without taking action to reduce these effects. Thus, policies have been devised, but public participation in this endeavour is a key factor to reach ultimate sustainable success and obtain a reduction of greenhouse gas emissions. Simultaneously, this will improve health implications, an example of this includes lowering carbon emissions and

working towards cleaner energy systems. We can accomplish this through promoting public transport and using the human body by walking or using a cycle, opposed to using private motor vehicles. Household air pollution contributes to approximately 4.3 million deaths every year and ambient air pollution results in approximately three million deaths per year, therefore the urgency to reduce impacts of climate change has become imperative. Simultaneously, vaccinations to protect societies developing severe symptoms of covid-19 are being administered across the world. However, precautions like social distancing and the use of personal protective equipment are still vital as the virus has not been eradicated.

Recommendations

Every country globally must work collaboration to form partnerships, resulting in a unified approach to the same goals and implementation of strategies reducing the impacts of climate change and covid-19 on health. By educating the public and creating awareness on the threats and implications, an understanding will be created to reduce carbon emissions and help improve human health. There is continuously new evidence linking climate change and health, and covid-19, however further research is required to find innovative sustainable solutions to reduce health impacts. It is also vital that developed countries help developing countries to support the implementation of better public health response teams protecting their vulnerability, reducing carbon emissions, and contributing towards better overall health.

The covid-19 pandemic has highlighted further areas through which the effects of climate change can be reduced. Technology is a key component within many industries, therefore by making better choices of energy use within industries like

food, transport, agriculture, within cities etc, collectively we can reduce greenhouse gas emissions and black carbon which are climate change pollutants, thereby we are mitigating climate change. Within building trades, new building can use low building codes to improve the material use efficiency. We can re-use and recycling materials, there will be a rise in the overall product demand reduction thus efficiently using materials. If we aim to develop an infrastructure that is sustainable through spatial planning, we can reduce intensive greenhouse gas emission pathways. If action is not taken, effects might be irreversible and involve high financial support. Simultaneously, by implementing and promoting air quality standards, a set of guidelines are structured for each country to follow and consequently facilitate and improvement in current climate conditions. Everyone globally despite their country of residence should have sustainable infrastructures in place which facilitate climate resilient health. For example, efficient energy supplies, technology assisting in waste management and appropriate sanitation and water services, all of which will reduce health impacts resulting from climate change and reduce covid-19 transmission.

Currently, deforestation is contributing to effects of climate change, therefore it is necessary to implement initiatives towards sustaining forest management towards afforestation, thereby decreasing deforestation. Simultaneously, the implementation of sanitation policies ensuring good hygiene, fresh water, and treatment of wastewater that that be reused in agricultural practices. Every industrial sector and the way humans live require alteration to decrease air pollution, not only within industries and wastewater management, but also when cooking

at home, using lighting or heating through clean fuels and clean effective technologies. Low-emission cooking stoves should replace the solid fuel stoves which are used traditionally within households. Solar, hydro, and wind based renewable sources should be implemented to generate electricity. This is better for the environment than fossil gas, oil, or coal particularly for large-scale production of energy and diesel generators on a smaller production scale. Use solar panels on rooftops and mini grids to generate energy for heat and power. Adequate infection control measures must be established within societies including with healthcare systems to ensure health safety measures are in place for future pandemics.

The covid-19 pandemic has implemented guidelines to promote excellent personal hygiene and sanitisation, this clean water is imperative so that government guidelines can be followed adequately. Thus, handwashing facilities with clean water must be available not only within homes, but also within institutions like schools, food industries and public places. Through monitoring these places and inspections, individuals will have improved health benefits. For the world to transform to a zero-carbon economy from a carbon intense economy, there is a need for humans to work in unison from the outset adhering to decisions; implement training programs that will facilitate a sustainable transition with long-term benefits; ensure adequate financial support and following social security policies.

Individuals globally need to contribute to the implementation of initiatives that will reduce the impacts of climate change and covid-19 on our health. We must all change our behaviours towards an enabling environment, by making better choices relating to energy use. This

includes our use of transport, waste generation, consumption, habitat, food, and sanitation, because it is only by working together that we can reduce the impact of climate change and covid-19 on our health.

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