

CLIMATE CHANGE ACTIONS: CRITICAL FACTORS TO ACHIEVE SUSTAINABLE DEVELOPMENT GOALS

Narinderjeet Kaur¹, Syed Sharizman Syed Abdul Rahim^{1*}, Zahir Izuan Azhar², Mohd Yusof Ibrahim¹, Mohammad Saffree Jeffree¹, Mohd Rohaizat Hassan³, Rozita Hod³ and Azizan Omar^{1,4}

¹ Department of Community and Family Medicine, Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah, 88400 Kota Kinabalu, Sabah, Malaysia

² Department of Public Health Medicine, Faculty of Medicine, Universiti Teknologi MARA (UiTM), 47000, Sungai Buloh, Selangor, Malaysia

³ Department of Community Health, Faculty of Medicine, Universiti Kebangsaan Malaysia, 56000, Bandar Tun Razak, Cheras, Kuala Lumpur, Malaysia

⁴ Rural Medical Education Center, Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah, 89050 Kudat, Sabah, Malaysia

Corresponding author: syedsharizman@gmail.com

ABSTRACT

Climate change has been deemed the biggest global health threat of the 21st century. Multiple factors contribute to this global phenomenon including anthropogenic causes. This review is to explore causes of climate change and recognise the impacts on population health as well as to look at strategies to mitigate climate change. This narrative review included articles searched through databases of SCOPUS, PubMed and PROQUEST from the year 2006 to 2018. Climate change is mainly due to man-made activities such as fossil fuels combustion, livestock farming and deforestation. The public health effects include increased vector-borne diseases, heat-related illnesses and respiratory illnesses. Strategies such as strengthening the adaptations to climate-related hazards, climate change integration into national policies, education, awareness-raising, impact reduction and early warnings have been put in place to tackle this crisis. The climate change agenda has been given an important platform as it is the 13th goal of the 17 United Nations Sustainable developmental goals (SDG). In conclusion, climate change has been going on for decades and is threatening the earth. Multi sectoral collaboration and working together towards a common goal is crucial as the wellbeing of our planet is our collective responsibility.

Keywords: Climate Change, Global Warming, Health Impact, SDG

Introduction:

Climate change by definition is the change in the statistical distribution of weather patterns that occurs over an extended period of time regardless of the cause (Schütte et al., 2017). Another term widely used is global warming which refers to the increase in the surface temperature of the earth and appears to be synonymous with the term anthropogenic climate change (manmade causes). Broadly, climate change includes global warming as well as every other reason for the change in weather patterns. It is therefore now widely used as a technical description of the process as well as a noun to describe the process. This change in climate has been something in the making for decades. The earth's surface temperature has warmed by 0.85°C in the past 130 years. And since the year 1850, each decade appears to be warmer than the previous decade (Smith, 2012). The 2°C increase is very crucial, because if earth's temperature rises beyond 2 degrees then there is a risk of irreversible changes to the climate and the ecosystem (Schütte et al., 2017). What is further worrying is that it has been recently projected that there will be an increase in temperature by 3.2°C by the year 2100 (Rogelj et al., 2016). Climate change effects include oceans getting warmer and sea levels rising. The Arctic ice has been shrinking 1.07 km square every decade due to the increased temperatures at the poles (Hák, Janoušková, & Moldan, 2016). Sea levels have risen by 19 cm in a mere hundred years and it is predicted that by the year 2065, sea levels will rise by 24-30cm and 40-63cm by 2100. Extreme weather patterns such as flash floods and typhoons, increasing number of infectious diseases and crop yield reductions are just some of the effects of climate change. These

events will eventually cause social, demographic, economic and health disruption to the population (McMichael, Woodruff, & Hales, 2006). By knowing the devastating repercussions of climate change, more policies need to be developed to ensure that there are adequate adaptation and mitigation strategies. The aim of this review is to understand the causes of climate change, especially on anthropogenic causes and to understand the impact of this phenomenon in contributing to individual and population health. This review looked into articles from 2006 to 2018. The focus of the review was on the causes, health effects and the strategies to mitigate climate change. The strategies reviewed were compared to the goals set under the 13th United Nations Sustainable Developmental Goal (SDG).

Methods:

This is a narrative review that focuses on causes, health effects and mitigation strategies for climate change. This review included articles searched through databases of SCOPUS, PubMed and PROQUEST. This review looked into articles in these databases from the year 2006 to 2018. Keywords used were "climate change" AND "health effects" AND "mitigation". The strategies reviewed were compared to the goals set under the 13th United Nations Sustainable Developmental Goal (SDG).

The Causes of Climate Change

The causes of climate change can be explained via the forcing mechanisms which are divided into internal and external mechanisms. Internal mechanisms are the natural processes that occur within the climate system itself. For example, the thermohaline circulation which is

part of the oceans circulation which is caused by density differences. It is commonly known as the Global Ocean Conveyor or Great Ocean Conveyor Belt. This process drives warmer surface waters originating from the equator regions towards the north and south poles (Yehudai et al., 2016).

External mechanisms can be divided into natural and anthropogenic causes (man-made). Natural causes are events such as volcano eruptions, changes in solar output, and the earth's orbit. Natural causes are rather difficult to predict and almost completely beyond our control. It has been anonymously concluded that human activities are the primary cause of climate change (McMichael et al., 2006) as it leads to an increased emission of greenhouse gasses. The main contributions to the rising greenhouse gas levels are burning of fossil fuel, livestock farming, industrial activity and deforestation. This phenomenon is called the greenhouse effect. Greenhouse gasses are carbon dioxide (CO₂), methane, chlorofluorocarbons (CFC) and nitrous oxide (Schütte et al., 2017).

Climate Change Impact on Public Health

A study conducted in 2017 concluded that by 2050, there would be a 257% increase in climate change related deaths (Schütte et al., 2017). Health impacts can be better understood based on events that occur due to climate change. The first is the disruption in the ecosystem. Vector-borne diseases are very influenced by climatic conditions (Campbell-Lendrum, Manga, Bagayoko, & Sommerfeld, 2015). Currently, vector-borne diseases are contributing significantly towards the global burden of disease. A change in climate will

increase the transmission season of mosquitoes. Previously, vectors were only active during the hot seasons, but with increasing temperatures, the hot seasons will be prolonged, allowing the mosquitoes to be active for a longer period. Taking malaria as an example, due to the altered environment, which favours the agent by having more vectors (due to the increased range and period of transmission), the hosts become more susceptible. By the end of this century, 60% of the world's population will be living in a malaria potential zone (Andrew K, et al. 2000, Campbell-Lendrum et al. 2015, D.J Rogers & S.E Randolph 2006, Badrul Hisham A.S et al 2012).

Other effects of climate change include extreme weather events which range from heat waves to typhoons. These events are triggered and heightened by climate change (McGuire, 2012). These events can either affect health directly or indirectly. Extreme high temperatures directly cause respiratory and cardiovascular diseases particularly among the elderly (Levi & Baldasseroni, 2017). This was evident when the heatwave in Europe during the summer of 2003 claimed over 70 000 deaths (Robine et al., 2008). Higher temperatures have been known to cause a rise in the ozone gas which gives rise to respiratory and cardiovascular symptoms. Elevated temperatures are usually accompanied by weak winds, causing air to stagnate, giving time for the air to rise in temperature and absorb more ozone. (Zandalinas, Mittler, Balfagón, Arbona, & Gómez-Cadenas, 2018). This also gives rise to increased circulation of allergens and pollens which gives rise to more allergies and bronchial asthma cases. Bronchial asthma already affects 300 million people annually. The

indirect health effect of these extreme temperatures can be seen from a decrease in the yields of crops of staple foods. High temperatures year-long will make the soil dry, and even with irrigation, it won't be able to sustain the moisture needed for crops like rice, wheat and corn to grow (Caruso, Petrarca, & Ricciuti, 2016). This will further increase the number of deaths caused by malnutrition which is already at 3.1 million annually. This issue is bound to be most evident in the poorest regions of the world where agriculture is the main economy of the country.

Changing precipitation is also an effect of climate change which leads to more rainfall than normal. This increased rainfall leads to floods that are considered as an extreme weather event (McGuire, 2012). For example, in Malaysia, the damages due to flooding cost of around 915 million ringgit (Akasah & Doraisamy, 2015). Floods cause people to evacuate to temporary makeshift shelters that may not have facilities such as safe water. This can lead to water-borne disease such cholera and typhoid. It also causes an increase in vector-borne diseases like dengue as increase in stagnant water is perfect for mosquito breeding. Besides that, other infectious diseases such as leptospirosis has shown to increase 2–3 weeks after heavy rainfall and flooding.

Aside from directly causing infectious diseases, flooding also causes physical injury and drowning. Massive damage to properties and infrastructures such as roads and houses can occur. It is estimated that over 1 million ringgit is needed annually to restore and repair the roads that have been damaged by floods in one district (Ismail & Ghani, 2017). This damage

also includes housing, schools and medical facilities which impacts millions of people.

Strategies to Mitigate Climate Change

Countries are targeting for cleaner and more resilient economies. People are converting to renewable energy and various strategies were introduced to reduce emissions and increase adaptation efforts. However, the required actions need to be coordinated at the international level, in order to facilitate developing countries to move towards low carbon economy. To increase the global response to climate change threat, the Paris Agreement were adopted by many countries, at the COP21 in Paris. This agreement went into force in 2016. This Paris Agreement states that all countries will work to limit global temperature rise to well below 20°C (Paris Agreement COP 21 2016).

Another strategy is to reduce energy usage. The International Energy Agency (IEA) stated that by improving energy efficiency in buildings, industrial processes and transportation could reduce the world's energy needs in 2050 by one third. This will help reduce the global emissions of greenhouse gases for example carbon dioxide. In addition to reduction of energy usage, another strategy is to improve on the efficiency of energy. This include building insulation, energy saving electrical equipments and gadgets, as well as energy efficient public transport system (IEA Report 2019).

The framework for the climate change policies have been made and policies have been implemented. However, there still lies many challenges regarding climate change policies. In regard to policy formation and construction,

a strong policy direction is needed to ensure that the goals towards reduced carbon emissions is achieved (Schütte et al., 2017).

The Intergovernmental Panel of Climate Change (IPCC) 5th Assessment Report 2014 states that given the current greenhouse emissions especially Carbon dioxide, it is likely by the end of this century, the global mean temperature will continue to rise well above the pre-industrial level (IPCC 2014). In October 2018, the IPCC issued a special report on the impacts of the global warming of 1.50 Celcius (IPCC 2018; Climate Summit 2019).

Sustainable Developmental Goal No 13 focuses on Climate Action. Climate Change is now affecting most countries of the world. The detrimental impacts are on the national economies, communities especially the vulnerable groups. There are increasing reports on changing weather patterns, sea level rise, extreme weather events becoming more frequent and the greenhouse gases emissions are at the highest level since history. Without serious and concerted actions, the global ambient surface temperature is projected to surpass the 30C by the end of this century. If this happens, the most serious impacts will be upon the vulnerable groups such as the poor communities and the elderly (IPCC Climate Report 2018).

Challenge faced is the lack of expertise regarding climate change. There are not many noted environmentalist and experts on climate change, especially among the developing nations. This can be attributed to the fact that there is always lack of funding and research for climate change in developing countries

(McSweeney, New, Lizcano, & Lu, 2010) . Ironically, due the dependence to natural resources, developing countries should have the most expertise. This leads them to rely on experts from other nations, which may delay the initiation of efforts in their own country.

Another limitation is following the public understanding and awareness towards climate change. There has not been much awareness and emphasis regarding climate change (Tiew et al., 2019). This mindset of the public needs to change. People must understand that overconsumption and wastage of electricity leads to more power demands and this means more fossil fuel burning. Another common misconception among the public is regarding the reduced use of plastic bags. Plastic bags are detrimental, as they are mostly single use, non- biodegradable and is commonly discarded into land fields, seas and ocean (Wagner, 2017). This causes harm to the flora and fauna especially in the oceans. The manufacturing process of plastics also leads to many greenhouse gas emissions and other pollutants as plastic is made from petroleum based products (Othman, Adam, Najafi, & Mamat, 2017). There have been campaigns to ban the use of single use plastic bags and it is a great long-term strategy. However, the bigger concern currently is actually regarding the proper disposal of plastics. Banning its use will not prevent ignorant people from throwing it into the seas and oceans. Therefore, current public awareness regarding plastics should be more focused on the proper disposal and not just to limit its use.

Another challenge regarding climate change policies are the issues of inequity in socio-economic development. Installing solar panels, for instance, is a way of using sustainable energy. However, it is costly to install solar panels in houses (Kardooni, Yusoff, Kari, & Moeenizadeh, 2018) . A household earning minimum wage may not be able to afford such methods. Another issue is regarding the industries such as logging. The logging industry provides an income for many and especially in the rural areas (Kaur, 2016). By shutting down the logging industries, these people will end up losing their livelihoods. The renewable energy industry has not reached the level where it can compensate and provide jobs to those who have lost jobs from logging in these affected countries. This matter, therefore, needs to be handled delicately and small steps need to be taken one at a time to ensure that the low and middle-income people do not suffer in the process.

The number of countries pledging towards the climate change agenda is still not satisfactory. Many nations still believe that climate change is

not a big issue and that the repercussions are exaggerated (Zhang, Dai, Lai, & Wang, 2017) . In actuality, the health effects are detrimental. If actions are not taken early, these effects may become irreversible. All nations must be clear that if health is not prioritized, the economy and the whole nation will be affected.

Conclusion:

From this review report, we can conclude that climate change is catastrophic, it has begun and will only get worse in years to come. Unfortunately, the main cause of climate change is us, humans. Cooperation between all the stakeholders is crucial in combating climate change. Some success has been achieved but there is still a long road ahead. Earth is our home and as inhabitants, we must take full responsibility and face this problem collectively to ensure that we do not cause further harm to our planet.

Conflicts of Interest:

The author declare no conflicts of interest.

References:

- Akasah, Z. A., & Doraisamy, S. V. (2015). 2014 Malaysia flood: impacts and factors contributing towards the restoration of damages. *J Sci Res Dev*, 2, 53-59.
- Andrew K. Githeko, Steve W. Lindsay, Ulisses E. Confalonieri & Jonathan A. Patz. 2000. Climate Change and Vector borne diseases: a regional analysis. *Bulletin of WHO*. 78(9): 1136-1147.
- Assessment Report 5 Synthesis Report: Climate Change 2014. (<http://ipcc.ch/report/ar5/syr>) (assessed on 16 April 2020).
- Badrul Hisham Abd Samad, Er Ah Choy, Hidayatulfathi Othman, Lokman Hakim Sulaiman, Mazrura Sahani, Mohd Hanif Zailani, Nik Muhammad Nizam Nik Hassan, Nurul Ashikin Zainon, C.P Ramachandran, Rozita Hod, Zainudin Mohd Ali. 2012. ASM Series on Climate Change. Kuala Lumpur, Malaysia.
- Campbell-Lendrum, D., Manga, L., Bagayoko, M., & Sommerfeld, J. (2015). Climate change and vector-borne diseases: what are the implications for public health research and policy? *Philosophical Transactions of the Royal Society B: Biological Sciences*, 370(1665). doi:10.1098/rstb.2013.0552
- Caruso, R., Petrarca, I., & Ricciuti, R. (2016). Climate change, rice crops, and violence: Evidence from Indonesia. *Journal of Peace Research*, 53(1), 66-83.
- Climate Summit 2019. World Meteorological Organization. Statement of the state of the global climate in 2019. (<http://un.org/eng/climate> change) (assessed on 16 April 2020).
- D.J Rogers & S.E Randolph. 2006. Climate Change and Vector Borne diseases. *Advances in Parasitology* Vol 62. Elsevier Ltd. United Kingdom.
- Global Energy and CO2 Status Report. 2019. Climate Change: The energy sector is central to efforts combating climate change. IEA. (<http://iea.org>)
- Hák, T., Janoušková, S., & Moldan, B. (2016). Sustainable Development Goals: A need for relevant indicators. *Ecological Indicators*, 60, 565-573.
- Intergovernmental Panel of Climate Change (IPCC). 5th Assessment Report 2018. (<http://un.org/eng/climate> change) (assessed on 16 April 2020).
- Ismail, M. S. N., & Ghani, A. N. A. (2017). *An overview of road damages due to flooding: Case study in Kedah state, Malaysia*. Paper presented at the AIP Conference Proceedings.
- Kardooni, R., Yusoff, S. B., Kari, F. B., & Moeenizadeh, L. (2018). Public opinion on renewable energy technologies and climate change in Peninsular Malaysia. *Renewable Energy*, 116, 659-668. doi:<https://doi.org/10.1016/j.renene.2017.09.073>
- Kaur, A. (2016). *Economic Change in East Malaysia: Sabah and Sarawak since 1850*: Springer.
- Levi, M., & Baldasseroni, A. (2017). 0241 Results of a systematic review on the effects of climate change on the health and productivity of workers. *Occupational and Environmental Medicine*, 74(Suppl 1), A72-A73. doi:10.1136/oemed-2017-104636.192
- McGuire, B. (2012). *Waking the giant: How a changing climate triggers earthquakes, tsunamis, and volcanoes*: OUP Oxford.
- McMichael, A. J., Woodruff, R. E., & Hales, S. (2006). Climate change and human health: present and future risks. *The Lancet*, 367(9513), 859-869. doi:[https://doi.org/10.1016/S0140-6736\(06\)68079-3](https://doi.org/10.1016/S0140-6736(06)68079-3)
- McSweeney, C., New, M., Lizcano, G., & Lu, X. (2010). The UNDP Climate Change Country Profiles: Improving the accessibility of observed and projected climate information for studies of climate change in developing countries. *Bulletin of the American Meteorological Society*, 91(2), 157-166.
- Othman, M. F., Adam, A., Najafi, G., & Mamat, R. (2017). Green fuel as alternative fuel for diesel engine: A review. *Renewable and Sustainable Energy Reviews*, 80, 694-709.
- Paris Agreement COP 21. Paris. 2016. (<http://un.org/eng/climate> change) (assessed on 16 April 2020).
- Robine, J.-M., Cheung, S. L. K., Le Roy, S., Van Oyen, H., Griffiths, C., Michel, J.-P., & Herrmann, F. R. (2008). Death toll exceeded 70,000 in Europe during the summer of 2003. *Comptes rendus biologiques*, 331(2), 171-178.
- Rogelj, J., Den Elzen, M., Höhne, N., Fransen, T., Fekete, H., Winkler, H., . . . Meinshausen, M. (2016). Paris Agreement climate proposals need a boost to keep warming well below 2 C. *Nature*, 534(7609), 631.
- Schütte, S., Depoux, A., Vigil, S., Kowalski, C., Gemenne, F., & Flahault, A. (2017). The influence of health concerns in scientific and policy debates on climate change. *Journal of Epidemiology and Community Health*, 71(8), 747-749. doi:10.1136/jech-2015-206962

- Smith, P. (2012). *Architecture in a Climate of Change*: Routledge.
- Tiew, K.-G., Basri, N. E. A., Deng, H., Watanabe, K., Zain, S. M., & Wang, S. (2019). Comparative study on recycling behaviours between regular recyclers and non regular recyclers in Malaysia. *Journal of Environmental Management*, 237, 255-263. doi:<https://doi.org/10.1016/j.jenvman.2019.02.033>
- Wagner, T. P. (2017). Reducing single-use plastic shopping bags in the USA. *Waste Management*, 70, 3-12. doi:<https://doi.org/10.1016/j.wasman.2017.09.003>
- Yehudai, M., Kim, J., Seguí, M., Goldstein, S., Pena, L., Haynes, L., . . . Raymo, M. (2016). *Changes in Equatorial Atlantic Ocean Thermohaline Circulation Across the Mid-Pleistocene Transition*. Paper presented at the AGU Fall Meeting Abstracts.
- Zandalinas, S. I., Mittler, R., Balfagón, D., Arbona, V., & Gómez-Cadenas, A. (2018). Plant adaptations to the combination of drought and high temperatures. *Physiologia plantarum*, 162(1), 2-12.
- Zhang, H.-B., Dai, H.-C., Lai, H.-X., & Wang, W.-T. (2017). U.S. withdrawal from the Paris Agreement: Reasons, impacts, and China's response. *Advances in Climate Change Research*, 8(4), 220-225. doi:<https://doi.org/10.1016/j.accr.2017.09.002>