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IMPACTS OF CLIMATE CHANGE ON EYE HEALTH IN NIGERIA

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ABSTRACT

Climate change is one of the global issues which we must of necessity tackle with alacrity in order to prevent a global warming too unbearable for the survival of mankind. Through literature review, participant observation and data collection from relevant agencies, this study identifies the impacts of climate change on eye health in Nigeria. It further identifies the adaptation and mitigation strategies to the impacts of climate change on eye health in Nigeria for sustainable development. The impacts of climate change on the health sector in Nigeria implies that due considerations to health issues as part of climate change mitigation and adaptation efforts has become a pressing issue. Mitigation and adaptation strategies are therefore necessary for effective management of the health sector in Nigeria. This study concludes with a clarion call to medical professionals, scholars and researchers to conduct more in depth research to further highlight the need to adapt and mitigate the impacts of climate change on eye health in Nigeria.

KEYWORDS: ADAPTATION, CLIMATE CHANGE, EYE HEALTH, MITIGATION, RESILIENCE

INTRODUCTION

Climate change with the resultant warming of environment is caused both by natural and human force multipliers, however, human actions on the environment account for the majority of the impacts. The natural causes of climate change is as a result of variations in earth's orbit, variation in ocean circulation, variation in Albedo of the continents, as well as variation in solar radiation. The human causes are, however, results of deforestation, air pollution, and poor agricultural practices such as bush burning, excess and wrong application of inorganic fertilizer, burning of fossil fuels, urbanization, industrialization, inefficient transport system, among others(Anabaraonye, Ewa.& Wala, 2020). Climate change was once a distant concern, but now an existential threat and the greatest challenge

facing this generation. The impacts of climate change is felt on Nigeria's health sector in a profound way (Anabaraonye, Ewa.& Wala, 2020). The impacts of climate change on Nigeria's health sector will also go a long way to affect directly and indirectly agriculture, biodiversity and sustainable economic growth (Anabaraonye, Okafor & Hope, 2020; Onnoghen, Orji, Olisah & Anabaraonye, 2024; Anabaraonye, Amaechi, Okolo, Adeniyi. & Nwobu, 2022). Human beings have five senses which empower us to enjoy our existence. The very thought of losing just one of these senses reduces the quality of our life. Whether it is the sense of taste, touch, sight, smell or hearing, none of them can be traded for anything else. The eyes give us the ability to see. With a reduced quality of sight, our entire lives can be greatly altered. The eyes allow illumination waves that deflect off objects to land on the cornea and are transmitted to the retina and then the brain. These illumination waves (light rays) are what the brain interprets as objects that we can see. Climate change has a significant impact on our eye health, as well as the stability of eye healthcare systems across campuses, companies and local communities in Nigeria. Climate change is a global emergency that affects us on a personal, community, national, and global scale. As highlighted by a 2019 report of the *Lancet Countdown*, "The life of every child born today, will be profoundly affected by climate change, shaping the health landscape at every stage of their lives" (Smith & Woodward, 2014). Climate change is not just a global environmental issue; it's a direct threat to eye health and the delivery of essential eye care services. Environmental degradation, air pollution, and climate change are having devastating effects all over the world, with vulnerable and low-income communities bearing the brunt of the burden. Climate change is set to exacerbate a range of ocular conditions. The accelerated development of cataracts due to increased UV exposure, heightened risks of severe allergic eye diseases, glaucoma, age-related macular degeneration, infections such as trachoma, vitamin A deficiencies, dry eye syndromes, and ocular injuries are all expected to rise in prevalence (Christidis et al, 2010; Fouillet et al, 2008). Not only do these conditions affect quality of life on an individual level, but they also increase the burden on healthcare systems. Moreover, the increasing frequency of extreme weather events can disrupt physical infrastructure of eye care facilities and interrupt the supply chain of essential medical supplies. The eyes are one of the delicate organs of the body susceptible to developing diseases resulting from environmental factors. Since the eyes are exposed directly to the environment, any changes in weather, climate, dry conditions, and air pollution can affect them. Indeed, it is estimated that approximately 20% of cataract cases are the direct result of ultraviolet (UV) radiation overexposure (Johnston et al, 2012). Excessive emission of greenhouse gases lead to further depletion of the ozone layer which could therefore yield a significant jump in the incidence of cataracts and ocular diseases such as pterygium, acute photo-keratitis, acute solar retinopathy (solar burn to the retina), photo-conjunctivitis and various other serious ocular conditions (Johnston et al, 2012).



Fig. 1.1: Close up of a mature cataract. (Courtesy of Dr. Kingsley A. Ukpanyang)



Fig. 1.2 Pterygium

METHODOLOGY

Data used for this study is derived from published works including academic articles, journals, conference papers, textbooks, and internet materials. This paper examined "the impacts of climate change on eye health in Nigeria" through existing literature review and data collection from relevant agencies. The main purpose of this research work was to survey theoretical backgrounds and previous studies on the subject matter, as well as proffer solutions to the impacts of climate change on eye health in Nigeria.

RESULTS AND DISCUSSION

The eye is a unique organ because it is particularly vulnerable to environmental factors. It is only 22 mm long, but it is susceptible to the air, to UV light, to everything in the environment. Because the eye is directly exposed to the environment, changes in UV radiation, air pollution, and dry conditions can affect eye health. The National Eye Institute (NEI) also warns of the effect of climate change on the eye, reported the American Optometric Association (AOA), "specifically focusing on an increase of UV radiation and dry climate, leading patients already disposed to dry eye to worse outcomes" (Rice et al, 2014). In terms of eye health, there is evidence of the effect of heat on the inflammatory response of the corneal cells (Tsai et al, 2013). Furthermore, this has been related to the predisposition to infectious viral processes such as herpes and viral conjunctivitis, besides bacterial, fungal processes, and allergies (Ludema et al, 2013; Kawai et al, 2020). Moreover, Van DerLeun et al. (2008) noted that an effective dose of ultraviolet radiation (UVR) could increase by 2% for every degree celsius as the temperature rises. This phenomenon could also suppress cell immunity and

increase sensibility to infections, facilitating the activation of latent viruses (Aragonés & Alemañy, 2009; Caspi, 2010). Additionally, increasing UVR, in conjunction with summer thermal maximum, is related to the increase of ocular tumors and cataracts (Cullen, 2011; Consejería et al ,2012; Yam & Kwok, 2014; IARC, 2020), along with an increased risk of retinal detachment (Auger et al, 2017).

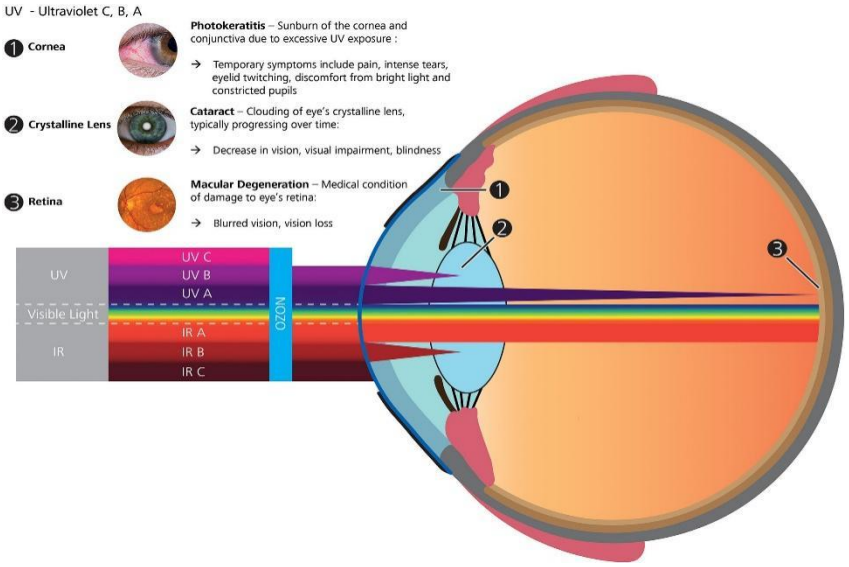


Fig. 2: Ultraviolet radiation oxidative stress affects eye health (Source: Ivanov et al, 2018).

Studies have linked increased trachoma infection to high temperatures and low rainfall – both of which are exacerbated by climate change. Because of the loss of the ozone layer and increased UV rays that affect the eye, global warming can contribute to the onset and acceleration of cataracts. Furthermore, traffic-related air pollution is linked to severe allergic eye diseases, glaucoma, and age-related macular degeneration. Extreme weather events will cause an increase in physical injuries, including eye injuries, and previous research has shown that people with visual impairments and disabilities are particularly vulnerable. Hurricanes and windstorms around the world have caused the temporary closure or destruction of medical facilities and supply chains for essential medical supplies such as medications, surgical supplies, eye glasses and visual aids. Climate change is expected to push already vulnerable populations into extreme poverty, further limiting their access to health care. The combination of predicted increase in eye diseases and disruptions in eye care services will worsen the prevalence of vision impairment and blindness in our communities, with vulnerable populations being disproportionately affected. This further highlights the immediate need to appreciate and understand the urgency of climatic changes and how detrimental they can be to eye health as well as communicate this urgency to change the conduct of people, trigger a more inclusive response from world leaders, and prevent a catastrophic onset of eye diseases in the future.

CLIMATE CHANGE ADAPTATION AND MITIGATION ON EYE HEALTH IN NIGERIA

The environment with which we interact influences eye health. As this environment changes, so will the prevalence and severity of a wide range of ocular diseases. As the world begins to better understand the effects of global temperature rises on our communities, it is critical to determine the climate risk as it relates to the eyes and visual system. Studies have found a link between many ocular diseases and their surroundings, but

more research is needed to fully understand these interactions. Future research should focus on assessing disease prevalence along lines of socio-economic development and inequity caused by historic and ongoing colonialism because the effects of the climate crisis are expected to disproportionately affect marginalized communities. Air quality has also been related to several complications of the ocular surface, implying damages to the cornea and the conjunctiva, and several disorders such as cataracts, conjunctivitis, glaucoma, and dry eye, among others (Caspi, 2010; Cullen, 2011; Consejería et al, 2012). As an effect of climate change, mismanaged human systems lead to malnutrition, work-related health problems and mental disorders. Thus, malnutrition or undernourishment is a direct effect of changes in harvest because of temperature changes or rainfall regimes, especially in those areas where agriculture and livestock have naturally low productivity (Yam & Kwok, 2014; IARC, 2020) and are sensitive to price fluctuations. This leads to the consumption of food without crucial active principles of nourishment (Auger et al, 2017). Malnutrition is implied in xerophthalmia, a disease caused by a deficiency of Vitamin A, which provokes blindness in children under the age of five, with high mortality (Barcena, Molina & Ruiz-Sinoga, 2019; Medina. M. F, 2016). Malnutrition is also responsible for ocular problems in adulthood (Bárcena et al, 2020). causing diseases such as AMD (Age-related Macular Degeneration), cataracts, or glaucoma (IARC,2020). In addition, outdoor workers (farmers, building and clean-up workers) directly suffer heat waves, reducing their productivity in order to avoid them (Auger et al, 2017; Medina.M. F, 2016). Moreover, they also suffer vector-borne outbreaks, psycho-physical damage and secondary ocular diseases such as pterygium, glaucoma and retino-choroidal injuries. Farmers have eight times higher possibilities of suffering ocular damage than other professionals. Thus, Anabaraonye, Okafor & Hope (2020) identified the need to educate farmers especially in rural areas in Nigeria on climate change adaptation for global sustainability.

HEAT WAVES AND HIGH AMBIENT TEMPERATURES

Heat waves have particularly affected major cities in the World and are occurring three times more often than they did in the 1960s (Consejería et al, 2012). Several ocular diseases have been implicated in rising ambient temperatures associated with heat waves, including cataracts. The epidemiological link between cataract formation and UV radiation has been established in several studies (Yam & Kwok, 2014; IARC ,2020; Auger et al, 2017). Independent of that association, a link has also been drawn between ambient environmental temperatures and several forms of cataract (Sinoga et al, 2010; Senciales et al, 2013; Polgreen & Polgreen, 2017). An epidemiological study pointed to a predominance of nuclear subtype cataract in tropical and subtropical areas, possibly linked to the high ambient temperature of that region (Burton, 2007). In addition, a case-control study conducted in India found a relationship between heat-wave induced dehydration and increased incidence of pre-senile cataract (Last et al, 2020) although it is important to note this result was not replicated in subsequent studies (Angelini et al, 2008; Bai., Morton & Liu, 2013). It is evident that current understanding of temperature related cataract formation appears to be multifactorial but poorly understood (Caminade et al, 2010). There is great need for awareness creation across communities, cities, campuses and companies in Nigeria on the impacts of climate change on eye health and innovative strategies for adaptation and mitigation for sustainable development in Nigeria.

RECOMMENDATIONS

It is advisable for other medical professionals, scholars and researchers to conduct similar studies to emphasize the need to adapt and mitigate the impacts of climate change on eye health in Nigeria. The health care costs of non-intervention and negligence to the trivial matters of eye health and climate change will probably be unaffordable. In addition, more frequent contacts between climate and environmental scientists and medical specialists for joint research would also be desirable. This fact is especially remarkable in those areas where the effects of climate change have the greatest impact: arid and semiarid zones. Poetry is further recommended as a valuable tool which can be used innovatively to educate communities, cities, campuses and companies in Nigeria on the impacts of climate change on eye health in Nigeria (Anabaraonye, Ewa. &, Hope, 2021). The socio-economic and therapeutic benefits in the use of poetry and music in climate change and eye health education towards enhancing climate resilience in Nigeria are further identified (Anabaraonye, Ewa., Hope, Anthony & Okoro, 2020). Green entrepreneurial opportunities in environmental photography can further be employed in educating communities and institutions in Nigeria on the impacts of climate change on eye health and ways to adapt and mitigate for sustainable development (Okolo, Orji & Anabaraonye,2024). Climate change adaptation and mitigation strategies such as strategic tree planting activities will also go a long way to enhance climate resilience against the impacts of climate change on eye health in Nigeria (Anabaraonye et al, 2022).

CONCLUSION

It is obviously clear that business as usual is no longer good enough when it comes to issues of climate change and its impact on the health sector in Nigeria. Responsive, deep and transformative action is needed throughout – not only to reduce emissions and stabilize global temperatures, but to build a safer, healthier and more resilient health sector for the future. Climate change adaptation and mitigation strategies which includes strategic tree planting activities, proper waste management practices, and the use of renewable energy sources will go a long way to reduce the negative impacts of climate change on eye health in Nigeria. Furthermore, we hope that this research work will guide researchers interested in climate change and eye health issues to dig deeper into this novel field. This study will also help policy makers to redress the economic damage associated with a policy of non-intervention regarding climate change and eye health issues in Nigeria. For climate-related decision-making to be inclusive and all-encompassing, healthcare, especially eye care should not be an afterthought. As governments and world leaders develop policies that have climate implications at the national and global levels, the healthcare sector should be adequately represented and involved in this process. Furthermore, Multilateral Organizations such as the World Health Organizations (WHO), World Bank Group (WBG) and the United Nations Environment Programme (UNEP) should go the extra mile to release more grants to researchers in this field of climate change and eye health to achieve more productive outcomes in Nigeria.

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