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CLIMATE RESILIENT STRATEGIES FOR ENHANCING EYE HEALTH CARE FOR SUSTAINABLE DEVELOPMENT IN NIGERIA

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ABSTRACT

Eye health is an essential component of universal health coverage; It must be included in planning, resourcing, and delivery of health care The eyes are unique organs of the body susceptible to developing diseases resulting from environmental factors especially as they are exposed directly to the environment and changes in weather. Climate change is affecting every aspect of human health, and ophthalmology is not an exception. The stability of eye health care systems, governments, and local communities are all significantly impacted by climate change. Through systematic literature review and participant observation, this study identifies the climate resilient strategies for enhancing eye health care for sustainable development in Nigeria.This study recommends green financing from multilateral organizations such as the World Bank Group towards mitigating the impacts of climate change on eye health in Nigeria. This study concludes by reiterating that climate change is affecting eye health care in Nigeria and there's a clarion call for more research and advocacy for enhancing eye health in Nigeria.

Keywords: Advocacy, Climate Change, Education, Eye Health, Ophthalmology, Sustainable Development

1. INTRODUCTION

Weather and Climate are inextricably linked. While weather refers to the atmospheric conditions at a given time. Climate, in contrast, can be thought of as the "average weather" for a particular region over some period of time(Edmond & Jason, 2018). Edmond and Jason (2018) opined that climate itself is changing, a weather average must always be defined over a specific time interval that may be different if determined over another. Climate change refers to the long-term changes in the Earth's climate, including changes in temperature, precipitation, and atmospheric conditions, that have occurred over the past century or more, largely as a result of human activities such as the burning of fossil fuels and deforestation (WHO,2021). Climate change is a rising global concern; it refers to changes in atmospheric gaseous composition by anthropogenic activities, in addition to natural climate variability (Moser & Dilling, 2004). The effects of climate change are far-reaching and include heat waves and severe weather, deteriorated air quality, displacement and migration of vectors resulting in increase of a range of diseases related to water and ecological factors. Increasing

incidences of mental health issues are being recorded and identified as a consequence of environmental change (Lu, 2016; PAHO, 2013). Researchers have recently identified the impacts of climate change on biodiversity in Nigeria (Anabaraonye, Amaechi, et al,2022). The impacts of climate change which include flooding, land pollution, erosion, etc. also affect soil fertility in Nigeria in a profound way(Anabaraonye, Okafor, et al,2021).The impact of climate change is also being felt on Nigeria's sustainable economic growth(Onnoghen, Orji, et al,2024). There is therefore a great need for climate change education across various communities, cities, companies and campuses in Nigeria thereby enhancing climate resilience (Anabaraonye, 2017). Climate resilience is the capacity for a socio-ecological system to absorb pressures and maintain function in the face of external stresses imposed upon it by climate change (Folke et al., 2010; Moench, 2014; Shamsuddin, 2020). It also includes the ability and capacity of an ecosystem to adapt, reorganize, and evolve into more desirable configurations that improve the sustainability of the system, leaving it better prepared for future climate impacts (Carpenter et al., 2001; Folke, 2006). Climate change presents a substantial peril to local, national and global health especially as it relates to eye health. Climate change is a global challenge that requires multi-stake holder partnerships to adapt and mitigate the impacts(Anabaraonye, Anukwonke, et al, 2022). The impact of climate change is being felt on eye health in Nigeria in a profound way(Anabaraonye, Ukpanyang & Asam-Utim, 2024).The influence of climate change on eye health is a developing matter of worry, supported by research indicating heightened vulnerabilities to illnesses including cataracts, conjunctivitis, and other eye problems as a result of changes in the environment (Femi, 2020). The correlation between climate change and eye health is complex and has several aspects. Fluctuations in temperature, air quality, and UV radiation levels may worsen pre-existing eye diseases and give rise to new health problems. For instance, there is a correlation between elevated UV radiation and a greater occurrence of cataracts and other retinal problems. Moreover, alterations in air quality caused by climate change might worsen symptoms such as dry eye and conjunctivitis (Chawda & Shinde, 2022; Alebrahim et al., 2022). Climate change has significant impacts on eye health care systems and local communities in Nigeria(Anabaraonye, Ukpanyang & Asam-Utim, 2024). The rise in temperature, changes in precipitation patterns, and increasing air pollution levels have resulted in a high prevalence of eye diseases such as dry eyes, cataracts, and allergic conjunctivitis. Additionally, these changes have created an environment that favours the breeding of vectors that carry diseases such as trachoma, onchocerciasis, and river blindness, which are prevalent eye diseases in Nigeria (Oladimeji & Okoye, 2019).Comprehending these connections is vital for formulating efficient climate resilient strategies. This study identifies the climate resilient strategies for enhancing eye health care for sustainable development in Nigeria.

2.1. METHODOLOGY

Data used for this study is derived from published works including academic articles, journals, conference papers, textbooks, and internet materials. This paper examined "Climate resilient strategies for enhancing eye health care for sustainable development in Nigeria" through systematic literature and participant observation. 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 care in Nigeria.

2.2. RESULTS AND DISCUSSION

Eye health is an essential component of universal health coverage; It must be included in planning, resourcing, and delivery of health care(Burton et al,2021;Anabaraonye, Ukpanyang & Asam-Utim, 2024).A number of well-known factors, including exposure to UV radiation, genetics and aging, can lead to cataracts, a condition affecting roughly 94 million people in which the lenses of the eyes get cloudy, causing blurry

vision. But in recent years, researchers have found another causative factor for cataracts and other eye disorders: climate change (Jain,2025; Burton et al,2021). Climate change is increasing risk to eye health in multiple ways. First, it is making the planet hotter—Earth's average surface temperature in 2024 was the warmest on record. Body temperatures reaching 104 degrees Fahrenheit can cause heatstroke, a condition that disrupts biological processes throughout the body. In the eyes, heatstroke damages the natural defense systems that normally counteract the buildup of harmful molecules called reactive oxygen species(Jain, 2025; Burton et al,2021; Wong et al,2024).Cataracts are one of the most common causes of vision impairment worldwide. But climate change is also causing an uptick in other eye conditions. These include keratitis, an inflammation of the cornea, the eye's clear, outermost layer; pterygium, an overgrowth of fleshy pink tissue over the white part of the eye (called the sclera); and conjunctivitis, an eye infection or irritation also called pinkeye(Wong et al,2024). Numerous health consequences have been identified, encompassing threats to eye health. The risks of blindness and emerging of ocular conditions impact the most vulnerable countries with a lack of access to healthcare and governmental funding due to global and gender disparities(Wong et al,2024; Eye News,2021). More recently, The Lancet Commission on Global Eye Health stated that planetary health is a key component to improving quality of eyecare and emphasized that the eyecare community strongly consider environmentally sustainable eye health services to make progress towards the SDGs(Burton et al,2021). In 2019, WHO published the *World report on vision*, which was endorsed by the 73rd World Health Assembly in 2020. The report and resolution call for the advancing of eye health as an integral part of universal health coverage, by implementation of integrated people-centred eye care, following the approach outlined in a broader health services framework(IAPB,2024).

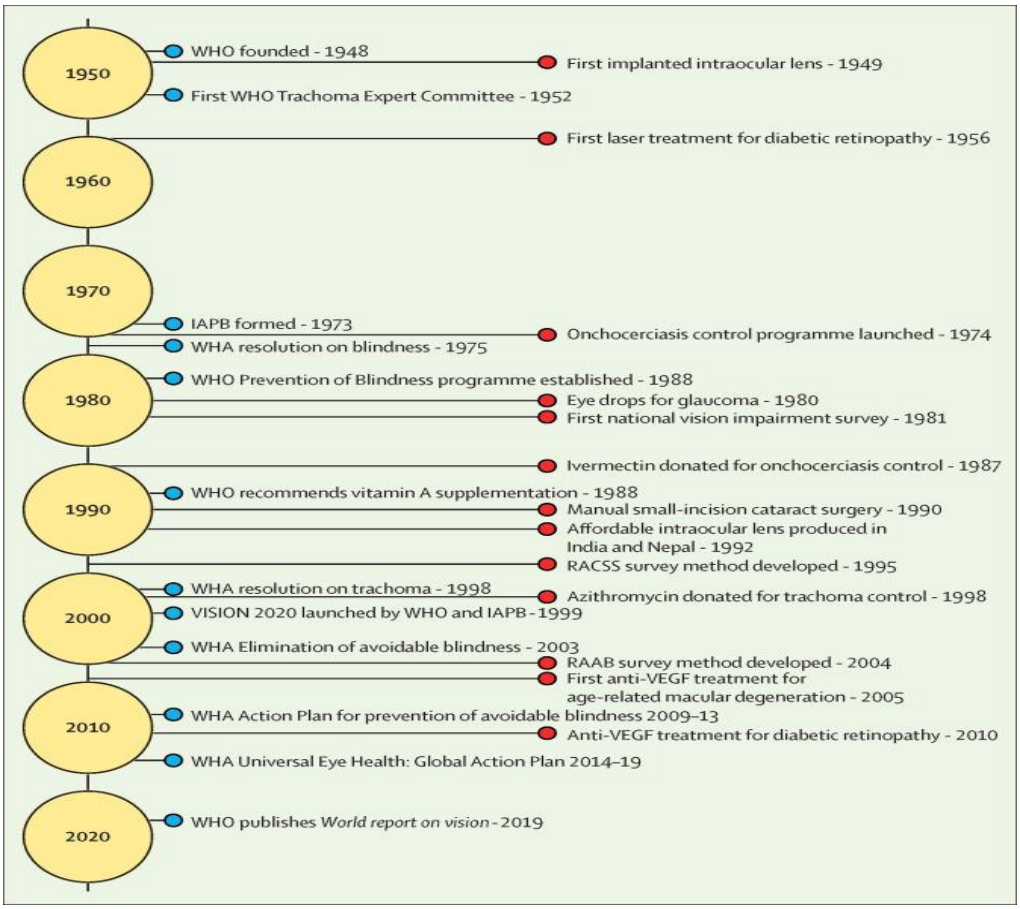

Figure 1: The development of global eye health (Source: Burton et al,2021)

From the mid-20th century onwards (figure 1), there has been major technological advances in microsurgical techniques for cataract and other conditions, and equipment for diagnosis and treatment of major non-communicable eye diseases, resulting in more effective interventions. There has been an enormous demographic transition, with ageing populations and epidemiological changes from infectious diseases and towards non-communicable diseases, requiring accessible and affordable eye services with long-term follow-up. The increase in demand, emphasis on better quality, and higher cost of more sophisticated diagnostic and treatment services is requiring an increase in resources, which presents enormous public health challenges(Burton et al,2021).

2.3. BUILDING CLIMATE-RESILIENT EYE CARE: A LANDMARK RESOLUTION AT THE WORLD HEALTH ASSEMBLY

Exciting developments are unfolding in the realm of climate change and eye health(Anabaraonye, Ukpanyang & Asam-Utim, 2024). At the recently concluded 77th World Health Assembly, a landmark resolution on climate change and health was unanimously adopted by all 194 World Health Organization (WHO) Member States, with 37 countries co-sponsoring the resolution(IAPB,2024).This resolution marks a significant step forward in recognizing the profound threat that climate change poses to global public health, including its impacts on eye care. Key points of the resolution include:

i) **Health Protection Policies**: The resolution urges member states to develop and implement policies and plans to promote health protection from climate change and environmental determinants of health. For eye care, this means integrating eye health considerations into broader health and environmental policies.

ii) **Strengthening Health Systems**: It calls for strengthening health systems' capacity to protect against climate change impacts. This includes building climate-resilient infrastructure, early warning systems, and emergency preparedness. For eye care, this translates to ensuring that eye care facilities can withstand extreme weather events and that they are equipped to handle climate-related eye health issues.

iii) **International Cooperation and Financing**: The resolution emphasizes the need for increased international cooperation, financing, and support for developing countries to build climate-resilient health systems. This is crucial for eye care services, particularly in regions where healthcare infrastructure is already under strain.

iv) **WHO Guidance and Technical Support**: It requests the WHO to provide guidance and technical support to member states on assessing and addressing the health risks of climate change. This includes promoting the development of affordable technologies and services for climate change adaptation and mitigation. For the eye health sector, this could mean new tools and resources to help eye care professionals manage the impacts of climate change on eye health.

v) **Multisectoral Collaboration**: The resolution highlights the importance of multisectoral collaboration, including with relevant UN agencies, to address the health impacts of climate change and promote sustainable development. For eye care, this collaboration can help integrate eye health into broader health and environmental initiatives, ensuring a holistic approach to public health.

This resolution presents an opportunity to seize the momentum and redouble commitment to mitigating and adapting eye care to the climate crisis(IAPB,2024). The Federal Ministry of Health will do well to enhance

awareness creation, incentivization and policy enacting towards achieving these resolutions for achieving climate resilient eye health care in Nigeria.

2.4. THE IMPACT OF CLIMATE CHANGE ON EYE HEALTH CARE SYSTEMS IN NIGERIA

Climate change is recognized as a public health threat in Nigeria, with significant impacts on the health of vulnerable populations. With the growing body of evidence suggesting a link between climate change and eye health, attention to the potential impact of climate change on eye health is gaining momentum(Anabaraonye, Ukpanyang & Asam-Utim, 2024). Climate change is linked to a rise in eye diseases such as cataracts, glaucoma, and conjunctivitis due to increased exposure to UV radiation, heat, and dust (Akande, 2020). Researchers suggest that climate change impacts on eye health may worsen given the increasing frequency of heat waves, dust storms, and other extreme weather events in Nigeria(Anabaraonye, Ukpanyang & Asam-Utim, 2024).Another study by Ovenseri-Ogbomo et al. (2020) analyzed the association between climate factors and dry eye disease in Nigeria. They found a significant increase in the incidence of dry eye disease during the dry season (November – February), which is typically characterized by low humidity and high temperatures. Furthermore, climate factors such as temperature and humidity were significantly associated with increased incidence of dry eye disease. They suggest that climate-informed public health interventions, such as increasing access to eye health services during the dry season, could help to mitigate the impact of climate change on eye health in Nigeria(Anabaraonye, Ukpanyang & Asam-Utim, 2024).In addition to increasing the frequency of natural disasters leading to ocular trauma, malnutrition, and prolonged homelessness from increased environmental refugees, climate change has had other important ocular health impacts in some parts of the world. In Nigeria, hot ambient conditions have been identified as clumsily tied to an increase in the prevalence of many ocular diseases including blepharitis, endophthalmitis, cataract, dry eye syndrome, infectious keratitis, ocular hypertension, conjunctivitis, pinguecula, pterygium, photokeratitis, solar retinopathy, ultraviolet radiation retinopathy, and retinal ischemia(Ovenseri-Ogbomo et al, 2020. The eye health sector has been notably absent from discussions on climate change(Ovenseri-Ogbomo et al, 2020). This is really disturbing and surprising given that among the organs in the human body, the eye is the only one external to the body and is, therefore, also the only internal organ directly exposed to radiation. In addition, many conditions of which blindness and visual impairment are common such as photokeratitis and pterygium are directly caused by solar or ultraviolet radiation. Mounting evidence in recent years has also associated increased heat with increased risk of many ocular diseases exposure to outdoor heat, and other early-life environmental exposures increase the risk of Exudative Age-Related Macular Degeneration (AMD) (Ovenseri-Ogbomo et al, 2020). The impacts of climate change on eye health care systems are significant. The increase in the prevalence of eye diseases has resulted in a significant demand for eye health care services,which has stretched the capacity of existing health care systems. Additionally, climate change impacts such as flooding and extreme weather events have disrupted the delivery of eye health care services in affected areas, making it challenging for patients to access essential eye care services. Local communities have also been significantly impacted by climate change, resulting in poverty, displacement, and food insecurity. These impacts have made it challenging for local communities to access eye health care services, as they are often far from health care facilities, and the costs of transport and treatment are too high for those who are poor and vulnerable(Oladimeji & Okoye, 2019).

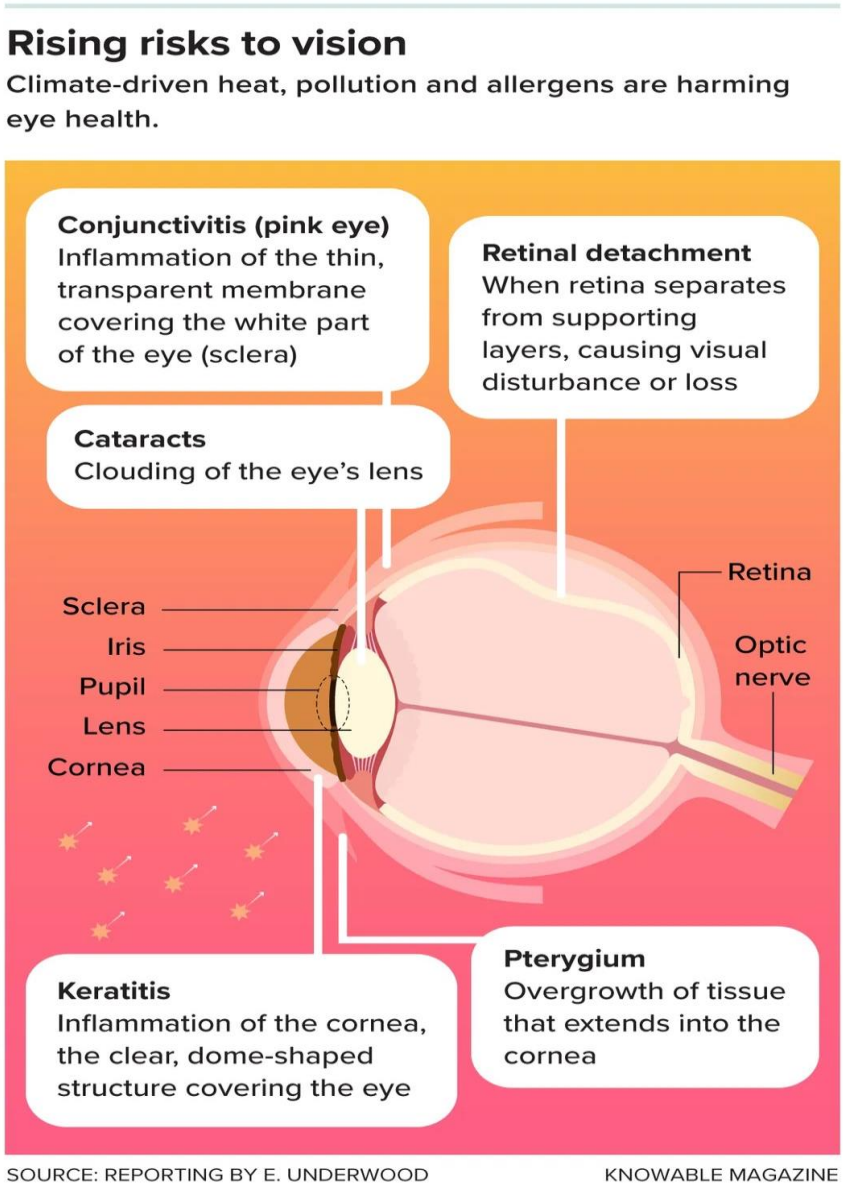

Figure 2: Rising Risks To Vision (Source: Smithsonian Magazine)

Fig. 2 identifies and illustrates that rising heat, pollution and airborne allergens—fueled by climate change—can contribute to a range of eye disorders, from infections and inflammation to cataracts(Jain,2025).Climate change has significant impacts on eye health care systems. Climate-related disasters and migrations lead to an influx of patients, straining already limited eye health care resources (WHO, 2021). Climate-related events, such as storms and flooding, lead to an increased risk of eye injuries (CDC, 2020) Disruption of eye care services: Climate-related events damage or destroy eye care facilities, disrupting services and leaving communities without access to essential eye health care (UNFCCC, 2019). Climate change exacerbates poverty, reducing individuals' ability to afford eye care services, leading to delayed or foregone treatment. There is therefore need for climate resilient strategies to enhance eye health care for sustainable development in Nigeria.

3.1. ENHANCING CLIMATE-RESILIENT EYE HEALTH CARE IN NIGERIA

To enhance eye health care in Nigeria in a climate-resilient and sustainable manner, it's crucial to integrate climate-resilient strategies into existing health systems and national development plans. This includes strengthening health infrastructure, improving early warning systems for climate-related health issues, and promoting sustainable agriculture to address food security and malnutrition, which are linked to eye health.

1. **Strengthening Health Systems:**
   a) **Climate-Resilient Infrastructure:** Eye care facilities should be built to withstand extreme weather events, ensuring their continued functionality during natural disasters or periods of high heat.
   b) **Early Warning Systems:** Implementing early warning systems for climate-related health hazards, such as heatwaves or droughts, can help health professionals prepare for potential outbreaks of climate-sensitive eye diseases.
   c) **Emergency Preparedness:** Developing and maintaining emergency preparedness plans for eye care services in the event of climate-related emergencies is crucial.

2. Integrating Eye Care into National Development Plans:
   a) **National Eye Health Strategic Development Plan:** The National Eye Health Strategic Development Plan 2024-2028 should incorporate climate resilience strategies to ensure that eye care services are sustainable and can adapt to changing environmental conditions,
   b) **Sustainable Development Goals:** Connecting eye care services with Sustainable Development Goals (SDGs), particularly SDG 2 (Zero Hunger) and SDG 3 (Good Health and Well-being), can help promote food security and address nutrition-related eye conditions.

3. Promoting Sustainable Agriculture:
   a) **Climate-Smart Agriculture:** Adopting climate-smart agricultural practices can enhance food security and improve access to nutritious foods, which are essential for good eye health.
   b) **Vitamin A Deficiency:** Addressing Vitamin A deficiency, a common cause of blindness in developing countries, through improved nutrition and sustainable agriculture can significantly impact eye health.

4. Climate Change Adaptation and Mitigation:
   a) **Strategic Tree Planting:** Engaging in strategic tree planting activities can help mitigate the impacts of climate change on eye health by providing shade, reducing heat exposure, and improving air quality.
   b) **Sustainable Land Use Practices:** Promoting sustainable land use practices can help protect ecosystems and reduce the risk of climate-related health impacts, including those on eye health.

3.2. THE ROLE OF ADVOCACY IN ENHANCING EYE HEALTH CARE IN NIGERIA

The information and communication technology can be used innovatively in advocacy programs towards enhancing climate resilience in eye health care in Nigeria (Oboti, Orji & Anabaraonye,2024). Advocacy on the impact of climate change on eye health in Nigeria has the potential to modify people's behaviour, elicit a more comprehensive response from national and global leaders, and stop future catastrophes(Orji et al,20240. Some advocacy approaches that can impact positively on eye health include;

i) **Raising awareness:** Educating the public about the link between climate change and eye health can encourage individuals to take preventive measures, such as wearing protective eyewear and seeking medical attention for eye problems (Akande, 2020).

ii) **Influencing policy**: Advocacy efforts can push policymakers to implement measures to mitigate the effects of climate change on eye health, such as increasing access to eye care services and promoting sustainable practices (WHO, 2018).
iii) **Encouraging community engagement:** Community-based initiatives can foster a sense of responsibility and ownership, leading to collective action to address climate change and its impact on eye health (UNFCCC, 2019).
iv) **Supporting research and development:** Advocacy can drive investment in research and development of innovative solutions to address climate-related eye health issues, such as affordable eye care technologies and sustainable eye care services (NIH, 2020).
v) **Eco-poetry:** eco-poetry can be used innovatively in advocacy events towards enhancing climate resilience for sustainable development in Nigeria(Anabaraonye,2024).
Overall, advocacy on the impact of climate change on eye health in Nigeria can contribute to behaviour change, elicit a more comprehensive response from national and global leaders, and stop future catastrophes. However, sustained efforts are required to ensure the impact and longevity of such advocacy efforts.

4. CONCLUSION

Climate change is having a negative impact on eye health in Nigeria, with the incidence of environmental eye disorders such as dry eye syndrome and cataracts increasing due to climate change. In response, there is a growing need for more research to understand the impacts of climate change on eye health, as well as to develop climate-informed public health interventions to mitigate these impacts. Green financing from multilateral organizations such as the World Bank Group, World Health Organization(WHO) and United Nations Environment Programme(UNEP) towards mitigating the impacts of climate change on eye health in Nigeria is greatly encouraged. Continued funding from government at all levels towards climate change adaptation and mitigation is vital for increasing the resilience of Nigeria's eye healthcare system in the face of climate change.

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