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Advancing a Cleaner Society: Exploring the Impact of Storytelling, Social Media, Humor, and Celebrity Influence in Research Communication for Pollution

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Abstract

Rationale: Humanity's pollutive activities pose significant threats to biodiversity, agricultural productivity, and human health. Effective communication about these issues is crucial for fostering awareness and understanding. To achieve a more impactful dialogue, it is essential to facilitate collaboration across disciplines through an interdisciplinary system approach.

Objectives: This paper specifically aims to examine the role of storytelling, humor, and celebrities' influence in reinforcing pro-environmental behaviors. The focus is on reducing pollution and its impact through experiential, emotional, and aesthetic learning.

Methods: To ensure the validity of the review, articles were systematically collected from accredited journal sites indexed by Scopus, Web of Science, and other reputable sources.

Results: The analysis indicates that anthropogenic pollutants, ingested through food, soil, air, or water, can have disastrous effects on human and environmental health. The study emphasizes the potential of storytelling, humor, and celebrities' influence to significantly mitigate these impacts.

Conclusion: The integration of humor, storytelling, and the influence of celebrities in the media, as powerful communication tools, can contribute to a drastic reduction in pollution and its associated effects. These approaches serve as universal languages that resonate with diverse audiences.

Recommendation: The study advocates for strong advocacy and effective communication strategies employing humor, storytelling, and celebrity influence. Celebrity influencers, with their substantial social influence, can act as

science communicators, translating complex pollution statistics to inform the public about their contribution to pollution and motivating behavior change for environmental health improvement.

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Introduction

Environmental pollution has significantly increased, since the era of civilization and industrialization, due to the ever increasing environmental degradation which is caused by anthropogenic activities (Akas et al, 2017; Omoyajowo et al, 2017; Raimi et al., 2019; Raimi et al., 2022a, b). It is well understood that technological improvements, particularly the industrial revolution which began in the mid-19th century and the expansion of the human population have brought about new and unparalleled levels of pollution in society (Kader et al., 2023; Oshatunberu et al., 2023). Anthropogenic activities, such as the burning of fossil fuels for energy, transportation, and industrial processes, have resulted in the release of harmful pollutants into the air, water, and soil. Additionally, the use of synthetic chemicals in agriculture, industry, and consumer products has also contributed to environmental pollution. At that time, people, generally, had just started to become aware of the importance of protecting the environment from pollution. Perhaps, because more valid scientific research, and some high-profile environmental disasters, such as oil spills, toxic waste spills, and air pollution events have just began to unfold (Raimi and Sabinus, 2017; Odipe et al., 2018; Afolabi and Raimi, 2021; Raimi et al., 2022; Raimi and Sawyerr, 2022). However, there was little understanding of the natural sources of pollution which are mostly triggered by excessive radiation from the sun, erosion and flooding from rainfall (Odubo and Raimi, 2019). Some anthropogenic

activities especially mining and extraction, transportation and agriculture have placed an enormous strain on the environment, causing the release of unwanted toxic free elements, called heavy metals. As human populations continue to grow, these activities are likely to intensify, further increasing environmental pollution and degradation. The first documented instance of pollution dates to the Quelccaya core from Inca metallurgy in the year 1480. Then, it was believed that airborne trace amounts of the metal bismuth were released during the production of the alloy known as bismuth bronze, which was found in the Inca citadel at Machu Picchu. (Gabrielli, 2015). Nine (9) million people died from pollution worldwide in 2015 (Beil, 2017; Carrington, 2017). A case study of the Minamata disease tragedy was first found in the city of Minamata, Kumamoto Prefecture, Japan, in 1956. Mercury poisoning occurred in a small fishing town, causing its residents to suffer from neurological and congenital disorders that ultimately led to their untimely death. It was found that the residents consumed aquatic food contaminated with methylmercury (MeHg) from industrial wastewater. This contamination was traced to a chemical factory owned by the Chisso (Hamdy and Noyes, 1975; Otitoloju, 2016; CHE, 2019). The largest known outbreak of lead poisoning in history occurred at the Zamfara Lead Poisoning disaster in Northern Nigeria. Thousands of youngsters had unsafe levels of lead (Pb) in their blood, and hundreds of kids and animals have perished throughout the region because of lead (Pb) tainted ore pollution (CDC/NCEZID, 2016; Otitoloju, 2016). The neurological system, kidneys, bones, and the brain are some of the physiological systems vulnerable to the deleterious effect of lead contamination in the human ecosystem. Other potential sources of groundwater contamination include leaking septic tanks, oil spillage, pesticides, and fertilizers (Raimi et al., 2020; Hussain et al., 2021; Asiegu et al., 2022; Modupe et al., 2023). These can cause epidemics of disease that can decimate populations, such as cholera and typhoid fever (Raimi et al., 2017). However, the suffocating tide of plastic waste brought on by high volume production, heavy single-use, and careless disposal of plastic wastes may encourage the spread of microplastics as the oceans are teeming with plastic, with upwards of 170 trillion particles floating around (see figure 1 below). Plastic entering the world's waters is predicted to rise to roughly 2.6 times its 2016 level by 2040 (Lebreton et al, 2020). According to reports, drastic policy changes are required to shift responsibility from consumers to producers. producers of plastic products should bear greater responsibility for managing the waste generated by their products. The research findings underscore the imperative for the formulation of new policies geared towards addressing various facets of pollution (Dine et al., 2023). Notably, there is a pressing need to concentrate efforts on curbing the production and usage of single-use plastics, advocating for the adoption of sustainable alternatives, and enhancing waste management infrastructure (Omoyajowo et al., 2021; Omoyajowo et al., 2022a, b). Also, pesticide misuse, exemplified by substances like DDT and other persistent chemicals, represents an additional environmental challenge with the potential for severe consequences. These chemicals can accumulate in the food chain, posing a significant threat to ecosystems and disrupting their natural balance (Raimi et al., 2021; Raimi et al., 2022a, b; Saliu et al., 2023; Sylvester et al., 2023; Jacob et al., 2023; Ayibatonyo et al., 2024a, b). While, air pollution remains a multifaceted problem, is predominantly attributed to various sources, including automobile emissions, open-air burning of waste, careless disposal of e-waste, and the combustion of fossil fuels (refer to figure 2 below) (Raimi et al., 2018; Raimi et al., 2020; Raimi et al., 2021; Clinton et al., 2022; Raufu et al., 2023; Yusuf et al., 2023; Rauf and Raimi, 2023). Particularly in densely populated cities of developing nations such as Nigeria and India, elevated levels of air pollution are a recurrent issue. This arises from the persistent accumulation of particles and greenhouse gases emitted by industrial activities, heating processes, and transportation. Notably, methane and carbon

dioxide emissions stand out as significant contributors to global warming, posing serious threats to both human health and biodiversity (Raimi et al., 2021; Raimi et al., 2022a, b; Saliu et al., 2023; Sylvester et al., 2023; Jacob et al., 2023; Ayibatonyo et al., 2024a, b). A striking statistic further accentuates the global scale of the issue, revealing that the United States and China are responsible for 14% and 30% of the world's emissions, respectively (ClimateTrade, 2021). The overarching goal of pollution control efforts is to mitigate the adverse impacts on human health, wildlife, and ecosystems while steering towards a sustainable future for the planet. However, the challenge is particularly formidable in less developed nations where the scale of pollution frequently surpasses the capacity of existing control measures. Examining a specific case, the Niger-Delta crisis exemplifies the dire consequences of overexploitation and gas flaring activities, leading to a series of misfortunes for local communities (see figure 2 below). In the core Niger Delta, decrepit refineries and illegal refining operations significantly contribute to air pollution, affecting areas as far as 120 miles south in Port Harcourt including Bayelsa and Delta state, a city with a population of 1.4 million and situated at the heart of Nigeria's oil-producing region (Searcey, 2018). The bustling metropolis of Lagos, formerly Nigeria's capital and currently home to approximately 22 million residents, is grappling with a multifaceted pollution challenge emanating from the extensive use of aging buses, cars, and trucks. These vehicles predominantly rely on high-sulfur diesel and gasoline, resulting in not only road congestion but also posing significant health risks to the densely populated city. The health implications for Lagos residents are alarming, with an estimated 6-10 million people anticipated to suffer from enduring health defects. These consequences span a spectrum from fertility complications to a heightened risk of succumbing to non-communicable diseases (NCDs), particularly cancer. The prevalence of NCDs has exhibited a worrying trend, with the global incidence of cancer alone witnessing a 40% increase in just over a decade. In 2019, NCDs accounted for a staggering three out of four deaths worldwide, a stark rise from 57% in 1990 (Gunsburg et al., 2017; Denny et al., 2017). This upward trajectory served as a catalyst for the United Nations' political declaration on NCDs and the subsequent adoption of Sustainable Development Goals (SDGs) target 3.4, aiming to reduce premature mortality from major NCDs by one-third by 2030 (Union for International Cancer Control, 2017). Cardiovascular diseases and cancer have emerged as the leading causes of premature death among women in over 130 countries, including the core Niger Delta region. Notably, cancer has claimed the top spot in 82 of these nations. The intricacy of the interplay between various pollutants in different regions underscores the pressing need for tailored and comprehensive pollution control measures. The global concern of air pollution compounds these health challenges, contributing significantly to millions of premature deaths annually. Of particular concern is its impact on respiratory health, notably affecting older children who actively participate in outdoor activities. This raises additional health concerns, given the global surge in respiratory diseases among this vulnerable demographic. The alarming statistics and projections necessitate urgent and context-specific interventions. Comprehensive pollution control measures are imperative to address the intricate web of health hazards posed by vehicular emissions and air pollution. Such measures must encompass stringent regulations on fuel quality, emissions standards, and the promotion of sustainable transportation alternatives. Additionally, public awareness campaigns and community engagement initiatives can play a pivotal role in fostering a collective commitment to reducing pollution and safeguarding public health. The gravity of the situation calls for a concerted effort from policymakers, urban planners, healthcare professionals, and the community at large to enact sustainable changes that will mitigate the immediate risks and pave the way for a healthier, more resilient future for Lagos and beyond (Raimi et al., 2018; Raimi et al., 2020; Raimi

et al., 2021; Clinton-Ezekwe et al., 2022). The prevalence of chronic obstructive lung diseases among these vulnerable populations is underscored by the data presented in (figures 3, 4, and 5 below). The repercussions extend beyond the immediate health implications, translating into increased hospital admissions and the exacerbation of various vascular health problems, with the potential for enduring consequences. In the context of Nigeria, the most populous country in Africa, the perilously high levels of $PM_{2.5}$, a fine particulate matter, are intricately linked to some of the nation's most persistent challenges, including pervasive poverty, malfunctioning municipal services, and regrettably, political corruption. The World Bank's estimation reveals a dire scenario, with an average annual exposure of $PM_{2.5}$ in Nigeria reaching 38 micrograms per cubic meter of air for the country's vast population ranging from 182 million to 198 million people. This level is nearly four times higher than what international health officials consider safe. Compounding the issue, pollution control efforts in the country face significant hurdles due to a scarcity of reliable and easily accessible data. Despite the presence of three reported air quality monitoring stations in Abuja, the nation's capital, monitoring and reporting practices in Nigeria are characterized as rudimentary, discontinuous, and limited in scope and duration, as noted by the Indian Center for Science and Environment. The challenges are exacerbated by an erratic power supply. The most recent official $PM_{2.5}$ data for Port Harcourt dates back to 2016, recording a high reading of 270 micrograms per cubic meter in the city. To put this in perspective, the US Environmental Protection Agency considers anything above 55 over a 24-hour period as unhealthy and anything above 250 as hazardous. Within a 15-month period ending in June, Port Harcourt experienced a mere 45 days with $PM_{2.5}$ concentrations within the EPA's safe limits for 24-hour exposure. On 240 days, the air quality was deemed “unhealthy,” with 85 days categorized as “very unhealthy,” and 13 days as “hazardous.” Adding to the gravity of the situation is the prevalence of fine black soot, attributed by some to official refineries and by others to illegal oil processing operations outside the city. Amidst the bureaucratic debates between federal and state governments over culpability for the pollution soot in Port Harcourt, the visible fallout is the city's infrastructure and its inhabitants being coated with the black dust. A radio host and co-founder of #StopTheSoot, a grassroots campaign in Rivers State advocating for clean air, aptly describes the situation, stating, “It's covering my feet's soles. It's contaminating my food. It's just a little frightening.” This vivid depiction underscores the urgent need for comprehensive and coordinated efforts to address the multifaceted challenges posed by air pollution in Nigeria. Unfortunately, the Nigerian government is grappling with a lack of essential statutory capabilities and financial provisions to effectively manage the far-reaching consequences of industrialization. A prevailing belief among government officials persists that "pollution is the price to pay for much-needed industrialization." Despite the considerable revenue generated from petroleum exploration, which significantly underpins the country's investments and expenditures, the detrimental aftermath of oil spills from wells and pipelines presents a dire environmental challenge. Numerous studies, including those by Raimi and Sabinus (2017), Suleiman et al. (2019), Afolabi and Raimi (2021), Ifeanyichukwu et al. (2022), and others (Raimi et al., 2019; Raimi et al., 2022a, b; Raimi and Sawyerr, 2022; Raimi et al., 2022a, b, c; Olalekan et al., 2023; Raimi et al., 2023), have meticulously documented the pervasive impact of oil spills on farmland and water bodies. This has led to the contamination of crucial resources and exposed residents to toxic chemicals. The compounding effect of these environmental disruptions includes catastrophic fish extinctions and a significant decline in local food production, exacerbating poverty in communities within the Niger Delta. The World Bank's 2016 report sheds light on the staggering volume of gas flared in Nigeria, amounting to 15.1 billion cubic meters (BCM), equivalent to one-sixth of the total gas flared globally (see figure 6 below). This chart visually

emphasizes the extensive prevalence of gas flaring in the Niger Delta region of Nigeria, often occurring in close proximity to densely populated areas. The ramifications of these industrial practices extend beyond immediate environmental concerns, creating a socio-economic crisis with profound implications for local communities. The lack of effective governmental oversight exacerbates the challenges, underscoring the urgent need for comprehensive policies and regulatory frameworks to address the environmental toll of industrialization in Nigeria.

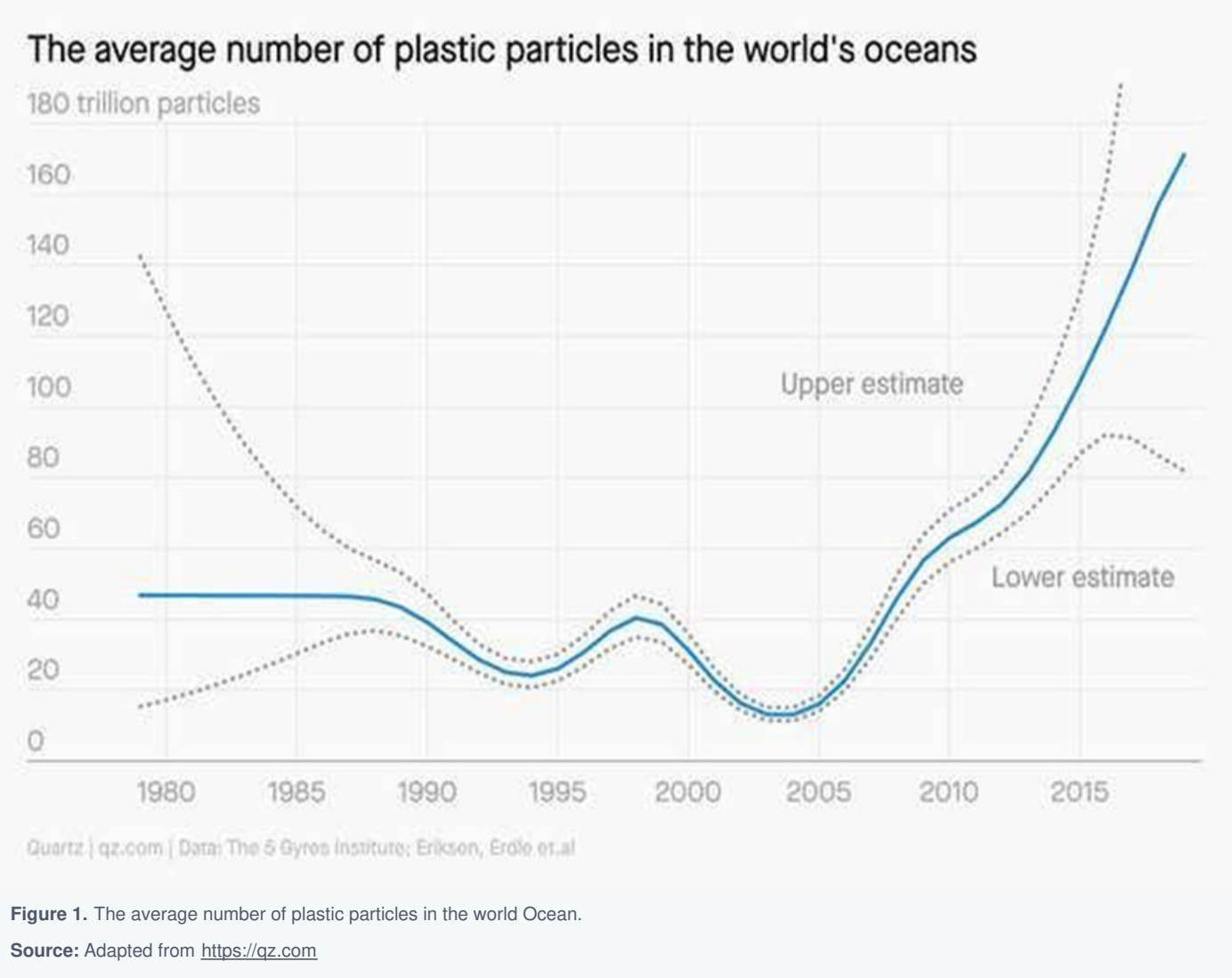

Figure 1. The average number of plastic particles in the world Ocean.

Source: Adapted from https://qz.com

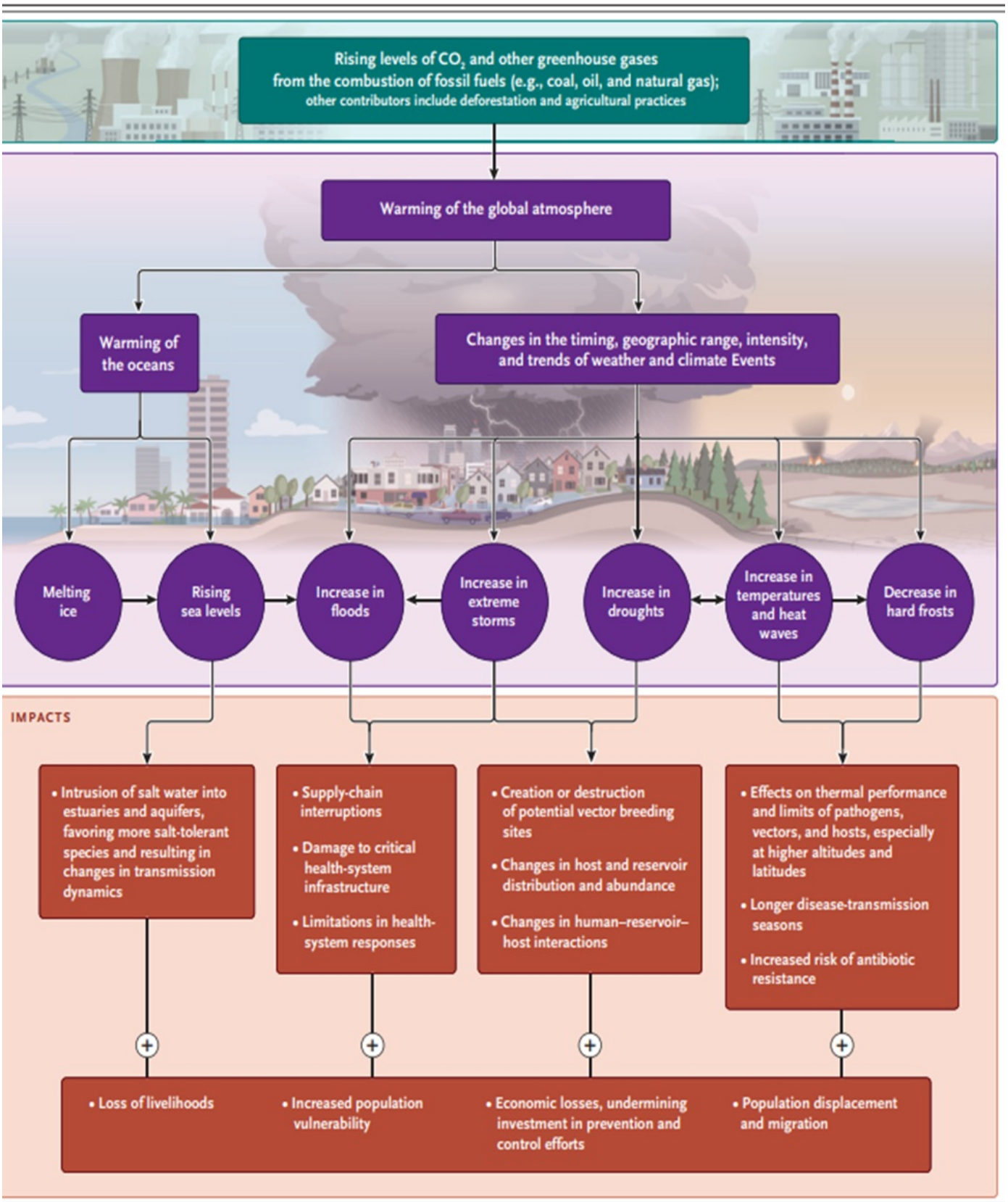

Figure 2. Pathways between Fossil Fuels and Rising Greenhouse Gases and Vectorborne Diseases.

The climate observed at a given place and moment is a result of the interplay between natural climate variability and the growing influence of climate change. The accumulation of greenhouse gases is causing a rise in global temperatures, consequently amplifying the frequency, severity, or both of extreme weather events.

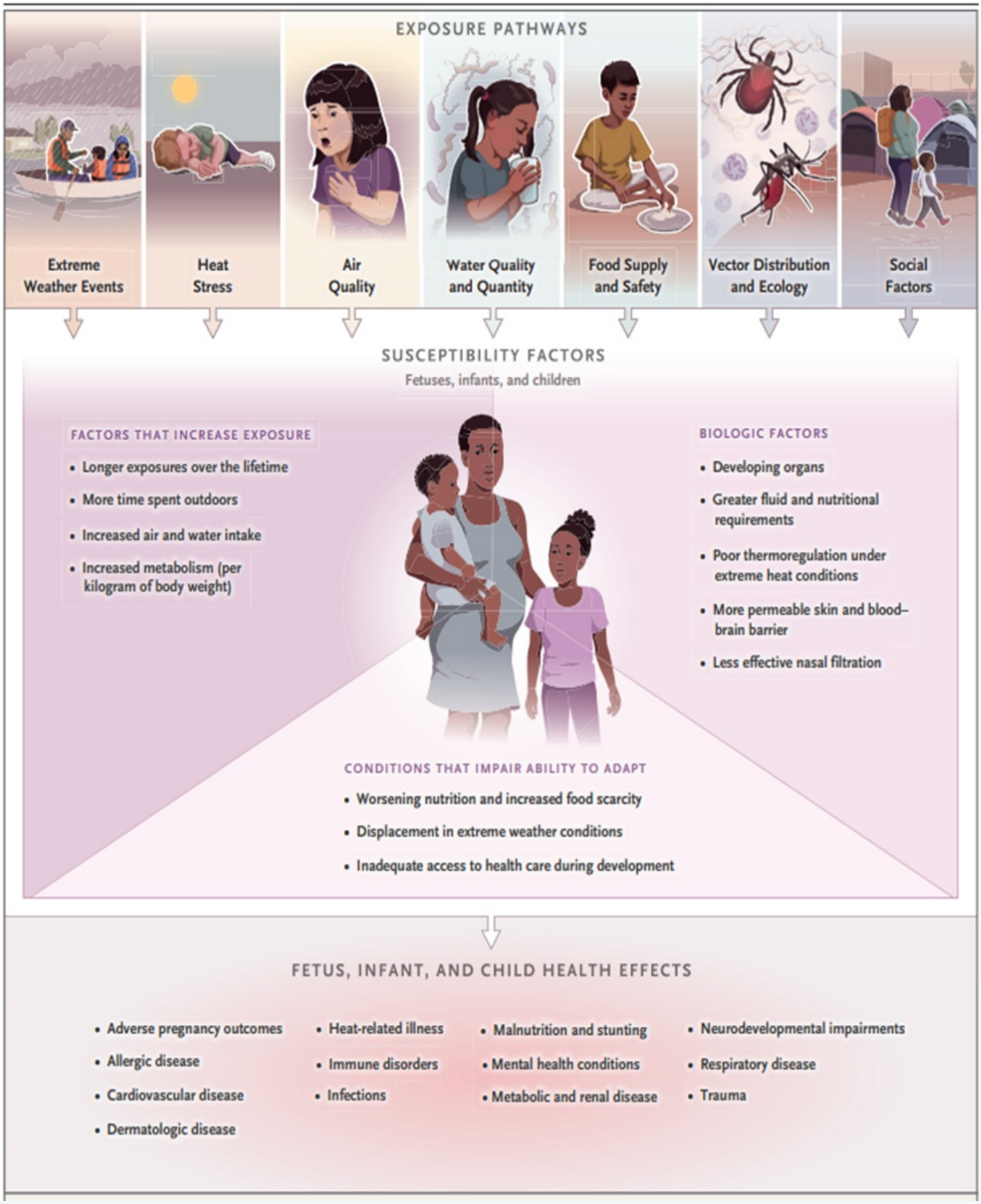

Figure 3. Susceptibilities in Fetuses, Infants, and Children Associated with Climate Change and Exposures. *Adapted from Haines and Ebi (2019), the illustration provides instances of potential exposure pathways, susceptibilities, and likely health outcomes that establish the connection between climate change and the health of children. The term PTSD signifies post-traumatic stress disorder.*

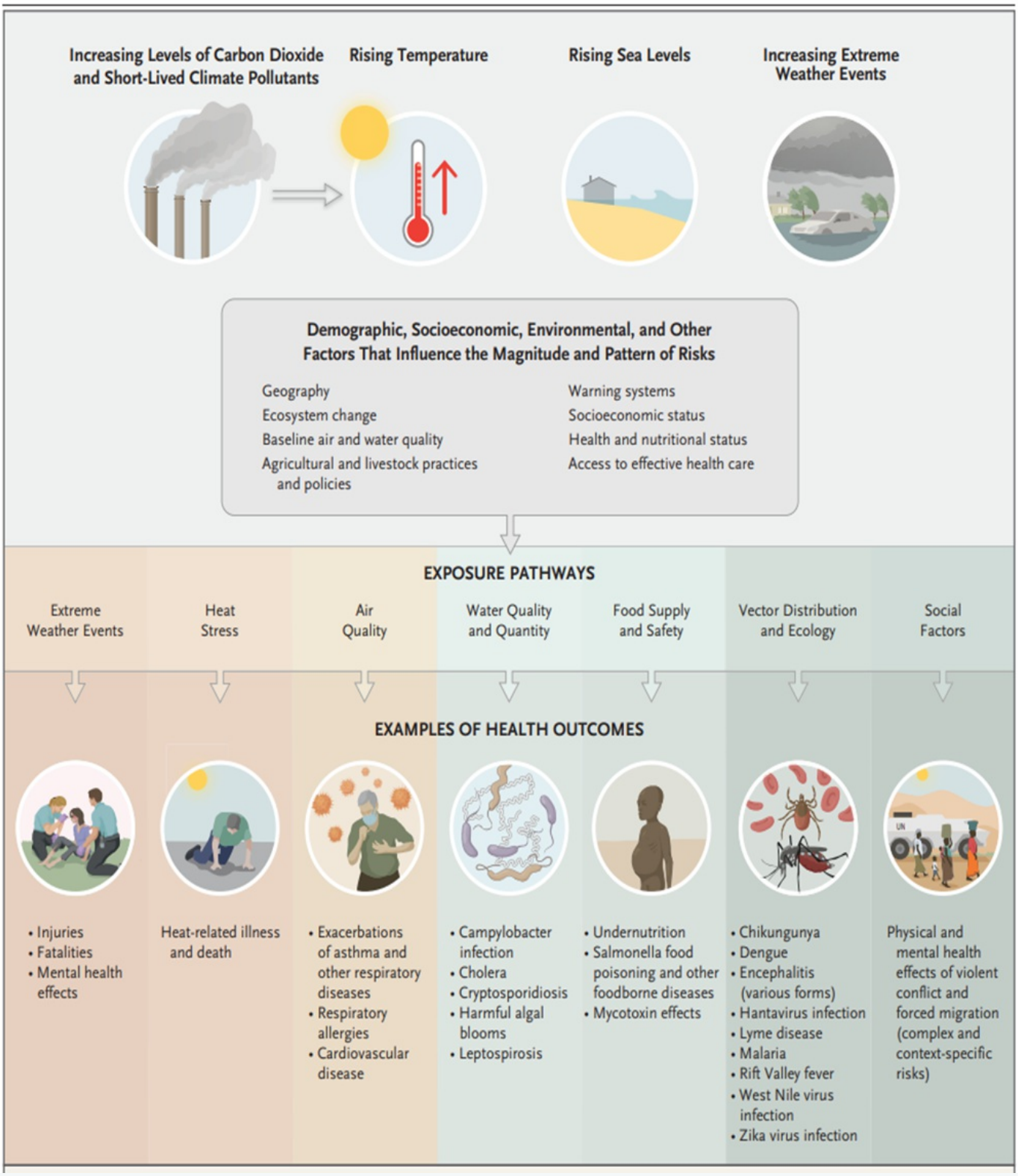

Figure 4. Major Health Risks Associated with Climate Change.

Illustrated are instances of potential health outcomes and exposure pathways that establish the connection between climate change and human health, accompanied by factors influencing the extent and nature of associated risks. This figure draws from various sources, such as Ebi et al. (2018), Smith et al. (2014), the World Health Organization (2014), Hallegatte et al. (2015), and Missirian and Schlenker (2017), and is not intended to provide a comprehensive overview.

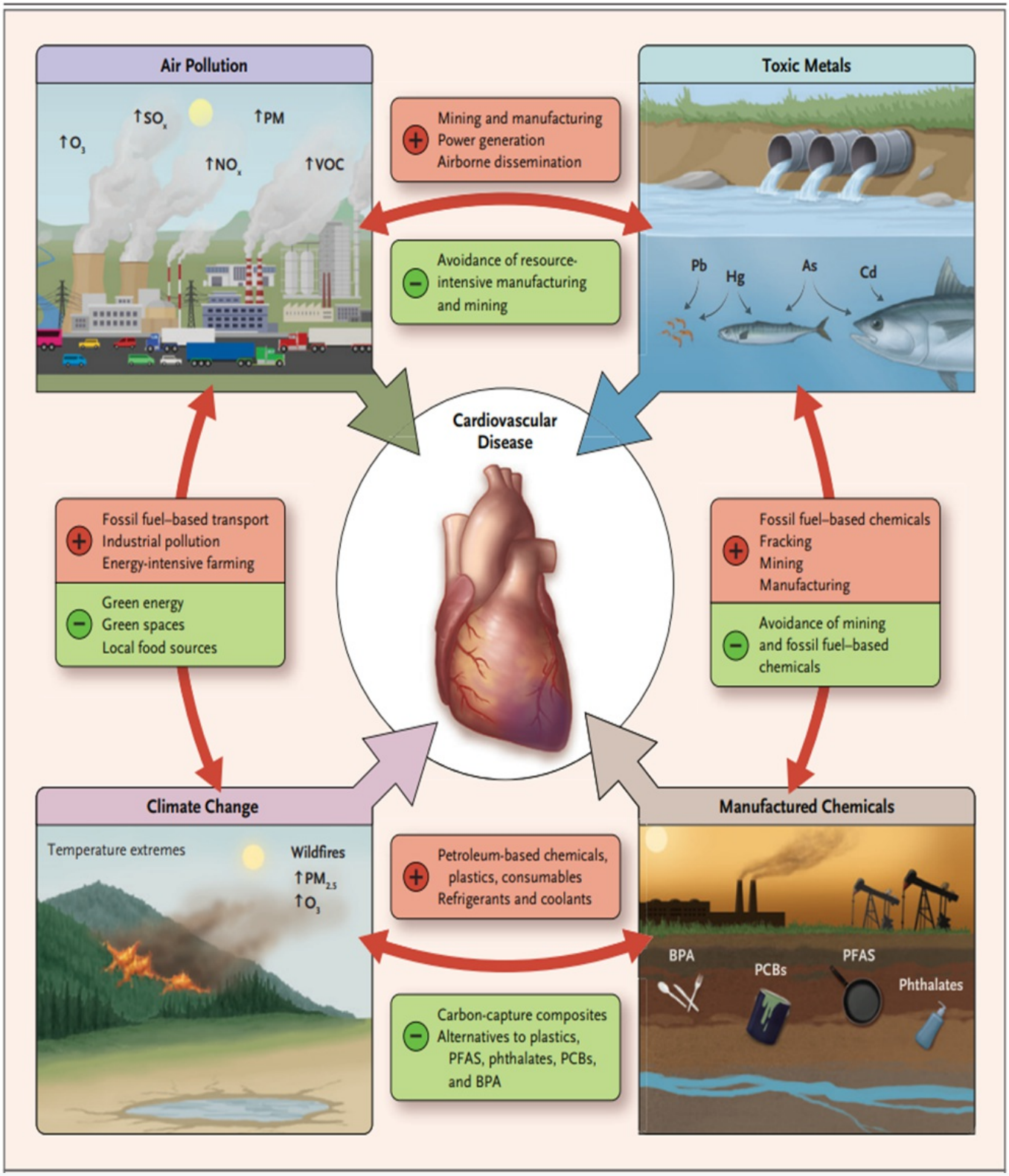

Figure 5. Pollution, Climate Change, and Cardiovascular Disease.

Positive and negative signs signify factors that amplify or alleviate pollution, respectively. The shorthand notations include As for arsenic, BPA for bisphenol A, Cd for cadmium, Hg for mercury, NOx for oxides of nitrogen, O_3 for ozone, Pb for lead, PCBs for polychlorinated biphenyls, PFAS for perfluoroalkyl substances, PM for particulate matter, $PM_{2.5}$ for particulate matter with an aerodynamic mass median diameter less than 2.5μm, SOx for oxides of sulfur, and VOC for volatile organic compounds.

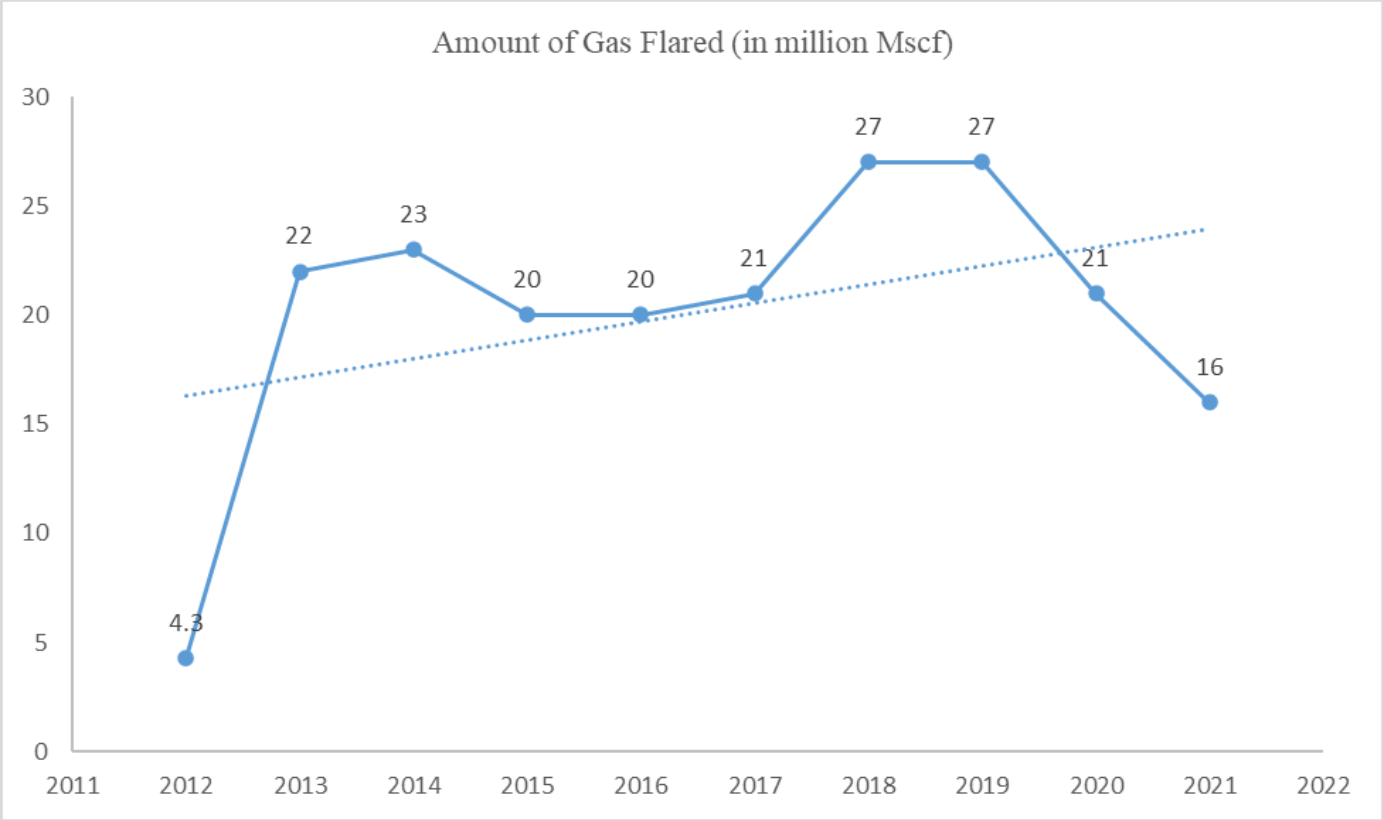

Figure 6. Amount of Gas flared

Source: Adapted from https://tribuneonlineng.com/how-gas-flaring-harms-health-climate-and-environment-in-niger-delta-community/

Meanwhile, scientists have regarded pollution as the largest environmental cause of premature death on the planet. It was estimated to have killed 8.3 million people in 2019. In 2018, it was reported that air pollution caused by PM led to the death of about 11,200 persons, the highest number in West Africa for that year (Croitoru et al, 2020). It was further reported that the highest number of casualties (about 60%) were children under five years of age mainly because of lower respiratory infections (Croitoru et al, 2020). For 2019, UNICEF reported that this figure had risen to 78% (UNICEF, 2021). The adverse effects of pollution are felt globally not just in terms of premature deaths, but also the impacts on health and ability to enjoy a normal life (see figure 3, 4 & 5 above). The DALY (Disability-Adjusted Life Year) metric can be used to assess and quantify the health impacts of pollution, as exposure to environmental pollution can contribute to disease burden and disability. Pollution, especially air pollution, has been linked to a wide range of health effects, including respiratory diseases, cardiovascular diseases, cancers, and other adverse health outcomes that can result in years of life lost and years lived with disability, which can be captured by the DALY metric. On the other hand, the burden of disease caused by pollution can also contribute to the overall disease burden of a population, affecting the DALYs. For example, a study conducted by the Global Burden of Disease (GBD) project estimated that ambient particulate matter pollution was responsible for 4.1 million premature deaths and 103 million DALYs globally in 2019 (Cohen et al., 2020). Another similar study estimated that household air pollution from cooking with solid fuels was responsible for 2.6 million premature deaths and 74.9 million DALYs globally in 2019 (Dandona et al., 2018). These studies highlight the significant health burden associated with pollution and its impact on DALYs. Furthermore, pollution and its associated health impacts can also have overwhelming social and economic implications, potentially exacerbating existing inequalities and affecting vulnerable

populations disproportionately. For example, populations living in low-income communities or in areas with high levels of pollution may experience higher exposure to pollutants and suffer from increased health impacts, leading to a higher burden of disease and disability, as well as reduced quality of life, which can be captured by the DALY metric (Hogben et al., 2020).

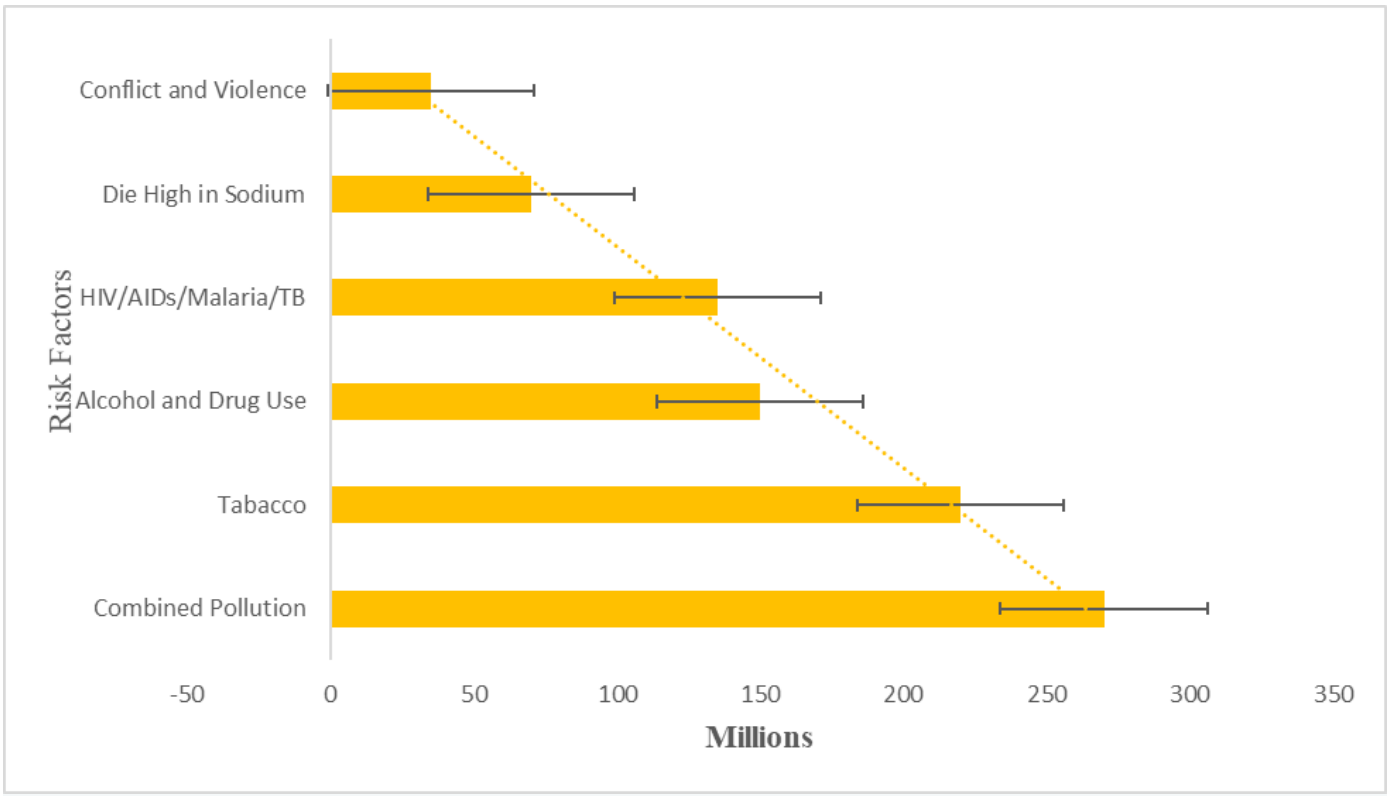

Figure 7. Factors affecting Disability Adjusted Life Year Global Alliance on Health and Population (2019).

Having a comprehensive understanding about pollution within a developing nation's context is key to addressing global pollution control and global environmental sustainability. Pollution especially in developing climes is attributed to lots of factors. Industries relied heavily on fossil fuels for their operational activities but end up generating tremendous volumes of industrial effluents, plastic fumes, burnt organic materials from byproducts of manufactured goods all of which either taints the air or degrade nearby water bodies (Raimi et al., 2019; Afolabi and Raimi, 2021; Raimi et al., 2022a; Raimi and Sawyerr, 2022). Outrageous numbers of cars and trucks in developing nations won't even pass emission tests, lots of these vehicles are very obsolete and in bad shape which undeniably releases noxious oil vapors, fumes, noise, radiation and heat, all of which are detrimental to the environment. In many instances, commuters held by traffic gridlock especially in the cities directly inhaled these poisonous substances. In many low income populations, indoor air pollution, largely caused by poor ventilation and smoke from cook stoves and heating fires, and water pollution from unsafe sanitation is rampant. Addressing the pollution issues in developing nations may be quite difficult and more so, with the huge deficit in environmental awareness, waste disposal infrastructure coupled with the increasing population and high demand for industrialization, hence, it is even more complicated.

It is easy to understand that combating the current tragic ecological trend necessitates new ecological solutions, multilateral strategies, and careful navigation. This is because the devastating COVID 19 pandemic has added to the already overwhelming burden of global environmental pollution (Raimi and Raimi, 2020; Samson et al., 2020; Raimi et al., 2020; Omoyajowo et al., 2021), particularly through increased single use of health & safety products such as masks and gloves. Individuals, communities, and enterprises must consciously alter our modes of production, distribution, and consumption if we are to leave behind a clean planet for future generations. Hence, only through environmental education, which informs the populace of how their actions affect the environment, could this attempt be made realistic. The OECD (2018) has offered quite a few suggestions and doable actions to reduce the pollution threat on a worldwide scale. These comprise performing a thorough examination of nitrogen transfer channels while utilizing a risk approach that is geographically targeted. Reducing the dangers associated with water, soil, and air pollution as well as the threats to connected ecosystems is the aim. Other recommendations center on using a global risk approach to manage the ongoing rise in nitrous oxide concentrations in the atmosphere. A precautionary approach must also be used to anticipate the sometimes-significant long-term implications and the uncertainties surrounding the cascading effects.

The saying "If you are not part of the solution, you are going to be part of the problem," as famously said by Leroy Eldridge Cleaver, can be related to environmental responsibility in the sense that it emphasizes the importance of taking an active role in solving environmental issues rather than contributing to the problem through inaction or indifference. By merely inspiring and educating others to actively participate in discovering answers, storytelling, humor, and celebrities' influence could help individuals or communities be part of the solution rather than being part of the pollution. These initiatives could inspire people to collaborate and pique their sincere interest to actively participate in efforts to protect and sustainably manage natural resources, reduce pollution, and mitigate the impacts of climate change. There are many connections between people and the environment. The environment determines human behavior because humans are at the mercy of the environment (environmental determinism), but it also acknowledges that humans can shape and control the environment (environmental possibilism). This is a complete synthesis of environmental determinism and environmentalism. Therefore, human activities have a significant impact on the environment, and those effects have a negative impact on human health and quality of life (Amiolemen and Omoyajowo, 2016).

Materials and Method

This paper employed a synthesis of pertinent information related to the subject matter, utilizing a diverse set of suitable keywords (such as Pollution + Storytelling + Environment; Humor + Pollution; Celebrities + Pollution, Civil Society Actors + Environmental Actions, etc.). The search process involved filtering through relevant peer-reviewed journals, books accessed via scholarly search engines, including but not limited to EBSCO Discovery Service (EDS), Google Scholar, Google Books, Microsoft Academic, ResearchGate, WorldWideScience, as well as personal blogs, online newspapers, and internet reports. To analyze the content, a systematic process of content analysis was employed, focusing on the subjective interpretation of data within the text. This method aimed to capture and observe trends regarding the impact of storytelling, humor, and celebrities' influence in achieving a society with reduced pollution. Additionally, discourse analysis

was applied to investigate text linguistics, encompassing tone, phonology, syntax, style, and organization, specifically in academic research papers. By deconstructing texts, implicit or concealed content in academic research papers was brought to light through reasoning and analytical thinking, facilitating the extraction of reliable information aligned with research objectives.

Results and Discussion

a. How could storytelling entrench pro-environmental behaviors?

Storytelling has long received great momentum as a tool of positive impact enabling civil society to execute their humanitarian obligation specially to raise awareness, sensitize, educate, mobilize, and inform the communities about a reasonable course of action. One thing is to communicate, another thing is to effectively communicate and draw the attention of the audience (Rasplus, 2017). Storytelling has that power to connect the critical essence of a message, awareness program or campaign to the audience. The reality is that more than just awareness, or sensitization on environmental discourse is needed to reinforce pro-environmental behaviors. Constant environmental education, advocacies and mentoring would be required to make a big impact on this learned course. More so, specific details about environmental events need to be consciously conveyed through storytelling to attract attention. The question “Who are storytellers? ensures. Storytellers are literally individuals that bring to existence strong seductive and convincing power that very often involves the vivid description of ideas, beliefs, personal experiences and life lessons to people or organizations (Simmons, 2001; Serrat, 2008; Weedon, 2018). Storytelling is therefore an interactive art that consists of using words and/or actions to reveal the elements and images of one or more stories while encouraging the imagination of its audience in the sense of convincing, seducing, or impacting them of something-capturing their attention, stimulating their desire for change, and winning their conviction using reasoned arguments (Denning, 2007; NSN, 2021). These stories, which can be simple anecdotes, narratives, or entire speeches, can also serve to convey complex [or latent] messages more effectively and powerfully, based on the principle that "emotion makes one more receptive" (Durand, 2011). Imagine the great outcome of communicating an environmental crisis or the impact of people’s action towards environmental degradation through storytelling. Flurry of articles have pinpointed how storytelling could help reduce air pollution in vulnerable regions, populous cities, and severely polluted regions (Baden, 2020; NCAS, 2022). For instance, when air pollution hit alarming levels in India, a few years back, Tamseel Hussain and a group of mobile storytelling and social media experts built the platform “Let me breathe” taken to the streets to tell pollution stories, connecting their stories to the global narrative on sustainability and climate emergency. Baden (2020) opined that increasing awareness, news and fiction stories with positive role models which focus on the positive outcomes of solutions are more likely to inspire actions to solve it. A recent study explored how people respond to stories that frame environmental issues in different ways. Respondents were made to read two short stories that had a solution focus with a positive tone and two with a negative tone and catastrophic focus (order counterbalanced). They were asked how each story made them feel directly after reading it. Result of findings revealed that positive stories inspire greater action and interactions to change behavior and more positive emotions for most people (Baden, 2020). Indeed, it has become a global necessity for all

human societies to acculturate eco-friendly behaviors across the spheres and strata of such society. Hence, in an age where people are more present on social media platforms than physical workshops, where tweets have more distant reach than television announcements and where there is a new language of interest and passion, storytelling presents a more effective tool for communicating the findings of research. Unlike traditional strategies for research communication, the potentials of storytelling cut across age, culture, and religion.

In recent times, storytelling has evolved in dynamic dimensions. The contemporary forms of storytelling include the use of cartoons, animated movies, creative artworks such as paintings, short film skits, live comedy performances, etc. Beyond the reach of folklore, these recently emerged channels of storytelling present more effective tools of communication and dissemination of ideas. Hence, there has never been a more ideal time to explore and strategically harness the potentials of these channels of storytelling as a medium by which the pro-environmental behaviors are effectively communicated. For instance, Disney movies have established its reach in hundreds of millions of homes across the globe for over two decades. In assessing its influence on its audience, usually teens and adolescents, it has been argued that Disney movies have changed the way the world is seen (Gray, 2019). In late 2022, the New York Times published a story of how a four-year-old boy learnt about climate change and global warming through the Netflix cartoon that he watched. The creative manner by which the effect of global warming was staged through animation had a long lasting impact on the mind of the preschooler. (Davenport, 2022). In fact, these animated films portend an effective way of infusing basic teachings on eco-friendly behaviors into the academic curricula at the elementary and high school levels. More importantly, the animated movies truly present the effective medium by which pro-environmental behaviors are graphically demonstrated and psychologically imprinted on the minds of teens and adolescents. In 2016, one of the most-watched trending videos on the internet was a short video skit that tells the story of how humanity can, through concerted efforts, achieve the lofty goals of environmental sustainability. The story was told by a young girl, who had grown into the future, to narrate how the world would be in 2090, if humanity begins to pay attention to the issues of climate change and how to develop patterns of behaviors that help sustain the world. The '*one minute- thirty seconds*' length video skit titled "The Future starts today: Earth Hour 2016" dramatically imprints the necessity and urgency of eco-friendly behaviors in the minds of the audience and attracted thousands of views on YouTube. (Melkonian, 2016). Hence, the traction of engagements and views generated by storytelling using short video skits, in recent years, clearly demonstrate the adoption of storytelling strategy, using internet video tools, as a contemporary medium for effective communication of research outcomes on eco-related issues. Flowing from the above, there have been a few short-video skits on the internet through which the stories are told of how humanity can tackle pollution and set the pace for environmental sustainability. For instance, Michael Pollan, in a YouTube video titled "Soil Solution to Climate Problem" narrated the illuminating story of the effects of environmental pollution on the soil. In his story, he described the loss of carbon from the soil, the movement of the carbon into the air, the effects on the greenhouse and concluded on how the planting of trees can help to reabsorb carbon from the atmosphere back into the soil. Similarly, the Conservation International produced a very sensitizing two-minutes video where the voices of popular celebrity narrators were used to portray the voices of various elements of nature: ocean, rainforest, water, etc. In this video titled "Nature is Speaking", the influences of these known story celebrity narrators were harnessed to propel environmental stewardship (Melkonian, 2016).

Yet again, creative artists use their paintings or drawings to narrate stories that often have strong imaginative impacts on the minds of people. Throughout history, creative arts are a medium by which historical events or culture are preserved or an idea is critiqued. In recent years, the creative art industry, especially in Europe and America, has shown profound commitment to the broad-based collaborative efforts to promote environmental sustainability. Hence, some notable artists have used the power of creative arts to tell the story of how human activities have decimated the earth (Serota, 2018). One of those renowned artists who has committed his arts into promoting the environment and telling the story of the effects of climate change is Olafur Eliasson. Eliasson's artworks titled "*Earth Perspective*" described the inclusion of plants, animals, and other natural elements as part of humanity that needs to be protected (Lee, 2020). During the 2019 United Nations Climate Action Summit, Eliasson made a powerful art presentation which is described as "*art's ability to provoke emotional, visceral responses to climate change – something that data points and statistics often struggle to do*" (Lee, 2020). Eventually, he was appointed as a *Goodwill Ambassador* for Climate Action by the United Nations Development Program. In the same vein, the artworks of Mary Mattingly, John Akomfrah, Agnes Denes, Tomas Saraceno are also recognized for eco-promoting creative arts which has demonstrated strong influence on people's perspective about global warming, climate change, etc. The global concerted efforts geared towards environmental sustainability must be strategically complemented with the adoption of unconventional mechanisms of communicating research on environmental issues. One of these potent methods is storytelling.

b. How could Celebrities help to influence an eco-friendlier world?

The entertainment industry across the globe has, in recent times, experienced a wave of sensitization on environmental issues such as global warming, climate change, pollution, etc. Thus, there has been some developing focus on the actors within the entertainment industry and their potential influence in promoting an eco-friendly society. Celebrities in various parts of the world have used their platforms and influence to drive awareness about environmental pollution and encourage individuals and organizations to take actions to combat it. In 2020, Billie Eilish, an American young artiste, announced that she would be voyaging on a '*Green Tour*'. Being one of the country's most popular teens, as at then, her announcement went viral and received wide social media attention, especially with respect for her eco-activism (Campbell, 2020). In her statement, she said: "*there will be no plastic straws allowed, the fans are going to bring their own water bottles. There's going to be recycled cans everywhere, because it's like, if something's recyclable - it doesn't matter unless there's a recycle bin*" (Campbell, 2020). Indeed, this presents a classic example of how celebrities can strongly promote eco-friendly behaviors, considering their influence on millions of people across the globe. Similarly, in the year 2020, one of the popular UK-based pop rock bands – The 1975 announced that its next performance concert would be powered by Hydrotreated Vegetable Oil (HVO), which is a eco-friendly renewable diesel fuel with almost 90% carbon reduction. (Campbell, 2020). This posture sends a very strong message to their fans as to the need to cultivate activities that are eco-friendly. Moreover, it provides clearer understanding to their fans on what behavioral patterns should be adopted or otherwise reduced in order to promote environmental responsibility. In practical terms, the involvement of celebrities in promoting sustainability helps in the wider spread of environmentalism into spaces where convention campaigns do not reach. Consequently, eco-activism is sweeping through Europe's creative entertainment industry. In the United Kingdom and Ireland, many eco-promoting initiatives by several non-governmental organizations have been

established within the industry to galvanize awareness among the fans about eco-friendly responsibilities (Campbell, 2020).

Some of the ways in which these celebrities have helped include:

- **Raising Awareness**: Some celebrities have used their social media accounts to share information about environmental issues and encourage their followers to act. They have also used their fame to bring attention to environmental issues that may not be well-known or receiving enough media coverage. For instance, the renowned actor and environmental activist, Leonardo DiCaprio, has been using his social media platforms on Instagram, Twitter, and Facebook to share information about environmental issues, climate change, and wildlife conservation (DiCaprio,2020).
- **Participating in campaigns and events**: Some celebrities have participated in environmental campaigns and events, such as tree-planting, beach clean-up, and conservation awareness campaigns. DiCaprio has also promoted environmental documentaries and campaigns, such as the documentary "Before the Flood" and the Global Citizen campaign for climate action (DiCaprio,2020)
- **Advocating for policy change**: Some celebrities are using their influence to advocate for stricter regulations and enforcement of environmental laws. Some have also used their platform to call for the protection of endangered species, and the reduction of carbon emissions. For instance, the actor and environmental activist, Mark Ruffalo, uses his social media platforms to raise awareness on climate change, renewable energy, and anti-fracking campaigns and has also used his social media presence to advocate for policy changes and promote environmental initiatives (Ruffalo,2021).
- **Supporting environmental organizations**: Some celebrities are using their financial resources to support environmental courses and organizations. They have also used their platform to promote environmental organizations and encourage their followers to donate or volunteer. The supermodel and environmental activist, Gisele Bündchen, uses her social media accounts to raise awareness about environmental issues, sustainability, and conservation and to educate her followers about the impacts of deforestation, climate change, and other environmental challenges. Bündchen also uses her social media presence to advocate for sustainable lifestyle choices and support environmental organizations (Bündchen, 2019).
- **Using their art to raise awareness**: Some celebrities are using their arts e.g.; music, acting, and writing, to raise awareness about environmental issues.

For example, In the United States, celebrities such as Leonardo DiCaprio, Al Gore, Mark Ruffalo and Cameron Diaz have used their fame to bring attention to issues such as climate change, deforestation, and conservation. In China and Nigeria, celebrities like Jackie Chan, Li Bingbing, Yao Ming, David Adedeji Adeleke (Davido), Olufela Olusegun Oludotun Ransome Kuti (Fela Anikulapo Kuti), Innocent Ujah Idibia (2Baba), Tiwatope Savage (Tiwa Savage), Olawale Ibrahim Ashimi (Brymo), Ayodeji Ibrahim Balogun (Wizkid), Inetimi Timaya Odon (Timaya), Damini Ebunoluwa Ogulu (Burna Boy) and Adeolu Akinsanya have used their influence to promote environmental causes such as wildlife conservation and pollution control. In India and other parts of the world, actors and musicians like Dia Mirza, Aamir Khan, John Abraham, Celine Marie Claudette Dion and Michael Joseph Jackson have been actively working on creating awareness about

environment and sustainability.

Recent communications are mindful of the role of celebrities in the fight against environmental degradation. Celebrities are literally those who gained fame through their art of creativity, those famous humorists, storytellers, boxers, sports celebrities, prolific writers, cartoonists, journalists, cartoonists, songwriters, film writers and performing artists, TV/Radio presenters etc. Celebrities are known for their strong social influence on people through their talents or acts of creativity on virtual platforms such as Facebook, Instagram, Tiktok, Twitter, Youtube. Prominent personalities use their fame as a platform to influence others on issues or topics of interest (Brown & Tiggemann, 2021). One of the many attributes of celebrities is their gigantic audience, they have millions of followers, mentees and proud supporters who are active listeners of their messages. Yoo (2015) argues that because people often chose celebrities as role models, hence, the influence they promote ostensibly impacts population and/or societal culture in either a positive or negative way. Hence, it is easier for them to get the message on the crusade against pollution easily across to their gigantic audience through various channels (Penz, 2021; De Andrade Júnior, 2018; Arnold, 2018). Of course, some celebrities, the likes of Leonardo Dicaprio, Shailene Woodley, Robert Redford, James Cromwell have started this movement (Finn, 2020). With the rise of digital, internet and social networks especially Facebook, Instagram, Tiktok, Twitter, Youtube and with the presence of social actors on these virtual platforms and their gigantic audiences of millions and millions of people, their messages circulate very quickly in the audiences opening more than half of the world's population. Out of 7.83 billion of the world population, 5.22 billion or 66.6% are mobile users; 4.66 billion or 59.5% are internet users spending on an average of 6 hours and 54 minutes on the internet; 4.32 billion use the internet from a mobile; while 4.2 billion or 53.6% are active users of social networks (Patard, 2021). Imagine if great environmental stewardship messages are spearheaded by the likes of Justin Bieber, Michael Jordan, Will Smith, Shakira, Kim Kardashian, Raimi Morufu Olalekan, Lebron James, Kanye West, Anthony Joshua (to mention a few), what would the outcome look like? Definitely great! It means with their billions of followers; great messages of this course may possibly influence and change the way people live their lives such that people can be great stewards of the earth. The media (internet, radio, billboards, newspaper etc.) is overwhelmingly saturated with names, performances of these celebrities. With these celebrities, it is easier to get peoples' attention, opinions and contribution on any subject of interest, course of action or event. Through them, a strong environmental communication can be engaged in the sense to push towards a reduced pollution society. These social actors can greatly advocate for a healthy environment for existential reasons due to their gigantic and powerful audiences. Their messages and lifestyle would therefore awaken genuine interest in environmentalism, more people will be aware, sensitized, educated, and even be mobilized to take serious steps towards saving the planet from further environmental degradation. In other words, through their great commitment and increased influence, they can quickly give weight to collective ecological actions and positively increase the trend of wanting green economies via them. Society can quickly change its ecological behavior both in production and distribution and in consumption. By having not only a word at the marketing point of various production and distribution industries, but also influence on consumption and lifestyle, these social actors have strong potential to push both towards green industries and ecological households thus to the production units and populations respectful of the new environmental deals, which should most likely lead towards a reduced pollution society.

Table 1. Contributory Impact of Some Celebrities & Activists towards Environmental Sustainability

Celebrities	Profile	Impact	Country of Residence	Reference(s)
Leonardo Dicaprio	Philanthropist, Founder of Leonardo DiCaprio Foundation	Big supporter of Environmental Education	US	Reed (2015)
Mark Ruffalo	Environmental Activist	Big influencer of renewable energy	US	Melchionne, 2022
Al Gore	Politician, Former US Vice President	Authored books and produced documentaries to raise awareness about Climate change and other environmental issues	US	Magdy, 2022
Morufu Raimi	Environmental Activist	Authored several publications of environmental interest. He has volunteered in various nation-wide projects and environmental campaigns including cancer free society	Nigeria	Raimi et al., 2021; 2022
Julia Louis Droyfus	Actress, Comedian & Producer	Advocate for Renewable energy & Clean energy investment	US	Melchionne, 2022
Emma Thompson	Actress & Activist	Climate change awareness campaign and carbon footprint mitigation	UK	Melchionne, 2022
Chris Packham	Naturalist, Photographer & Broadcaster	Vocal critic of chemical pollution and plastic waste	UK	Cockburn, 2021
Emma Watson	Actress, Model and feminist advocate	Pollution, climate change, and renewable energy	UK	Melchionne, 2022
Trevor Noah	Comedian, TV host	Pollution, climate change and sustainable living	South Africa	Horton, 2022
Yvonne Chaka Chaka	Singer and Songwriter	Pollution control and Biodiversity conservation	South Africa	Horton, 2022
Damini Ebunoluwa Ogulu " Burna Boy"	Singer and Songwriter	Advocate for environmental sustainability. He described Niger- Delta pollution in his song "Whiskey"	Nigeria	Venkat et al. (2022)

How could humor entrench pro-environmental behaviors?

Environmental scientists have recently been interested in the use of comedy as a caring way to impart knowledge and perspective on a specialist issue. It could be used, for example, to assist in providing adequate information on urgent environmental issues or in communicating community risks in a way that allows individuals to unwind while simultaneously learning the significance of that communication. In one interesting article, the author exclaimed "*In the olden days of kings who ruled with absolute power, only the court jester could safely tell the king the truth, mediated through humor. Anyone else who attempted to tell the emperor he had no clothes was in danger of losing his head!"* (Tabares, 2009). Therefore, some people believe that since humor eliminates fear, it can easily be used to influence people's behavior depending on how it is channeled since humor is one language that everyone can understand. With humor, great hurdles and anxiety are dealt with and hence, making your audience feel relaxed and comfortable. Humorist refers to an author whose intellectual, written, or visual production contains and manifests humor, that is, causes amusement or laughter (McGhee, 1979; McGhee and Goldstein, 1983; Carlson, 2011). Humorists may largely embody the playwrights, writers, cartoonists, journalists, cartoonists, songwriters, film writers and performing artists. A recent report described humor as viable means

of communicating with diplomacy and tact to ameliorate awkward situations and assuage tense ones and more so, to help initiate and perpetuate a cycle of individual and social-level positive affect (UC, 2022). Humor events are defined as "discrete social behaviors that a producer (humorist) intentionally creates for an audience that influences audience positive affect." Such positive effects can be transmitted to others through emotional contagion, or the idea that emotional states are contagious; to illustrate, consider how you feel when you are around someone who is depressed, versus someone who is happy and uplifting (UC, 2022). We believe humor events especially when tailored within the “environmental responsibility context” may exert influence on individual and group feelings (affect) and build a foundation for additional behavioral change. The incongruity theory asserts that humor "results from the experience of incongruity and its appreciation or resolution." For example, stand-alone jokes work because they simultaneously evoke two seemingly unrelated systems of expectation. The "punch line" bridges these systems to resolve the incongruity. It can generally get your point across with less effort and verbiage. The Wheel Model of Humor argues that individual humor events between just two people are important for a few reasons. From the first standpoint, they create positive feelings (positive affect) in the other person and in the other part, this positive affect can be shared with others, influencing a group or the two-person dynamic (UC, 2022). Humor events easily break down barriers between people regardless of the situation, race, color, gender, religion etc. People believe that If you can share a laugh with someone, you have connected with that person. The defenses come down, and there’s a desire to continue the dialog. Shared amusement and laughter help assure that both participants in the conversation will remember the good feeling they had long after the content is forgotten.

People with a great sense of humor when adequately sensitized on environmental issues, they would be able to create humor events that may shape environmental attitudes and further influence societal norms and values. For instance, laughter has some unique properties of its own. Humor will make you laugh, and the sound of hearing people laugh will make others laugh, physiologically. Humor is central around the world pressing environmental issues (e.g., climate change which is a real and undeniable threat to our entire civilization. The effects are already visible and will be catastrophic unless we act now) will awaken genuine concerns for environmental responsibility (see figure 8 below). Through education, innovation and adherence to our climate commitments, we can make the necessary changes to protect the planet. These changes also provide huge opportunities to modernize our infrastructure which will create new jobs and promote greater prosperity across the globe.

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This is because people who are lost in the middle of a humor event are most likely to ask their colleagues, or counterparts on the jokes that have been said. In other words, humor can be important to developing a sense of identity, learning and community responsibility. Therefore, a comedic message against environmental damage will echo in a listener's mind, unconsciously reminding themselves of the issues at hand. Eventually, this constant reminder will develop a mere exposure effect towards sustainability, connecting themselves with the topic. This humor effect towards environmental protection will further stimulate a determination to contribute to this movement. For instance, many hotels ask guests to make a general contribution to eco-friendly action, such as turning off lights when leaving or reusing towels. Without further motivation, consumers act in the same way they always do. However, customers are more inclined to participate and take eco-friendly action when hotels give a "Friend of the Earth" lapel pin to those who are more devoted (UK Essays, 2018). Humor eases tension, which further fosters civil discourse to propagate sustainable ideology and encourages more individuals to mention environmentally good practices. In similar circumstances, encouragement increases people's self-esteem and fosters a positive attitude toward the challenging sustainability issues.

Conclusion

Recognition of pollution as a major health risk factor that is often overlooked in practice opens up multiple opportunities for prevention and control. The pervasive threats to health posed by pollution demand decisive actions from professionals and governments to protect the health of current and future generations. Preventing and controlling pollution not only has the potential to improve public health and the environment, but it can also create economic benefits by reducing healthcare costs, promoting sustainable development, and supporting the growth of clean energy industries. Understanding the role of storytelling, social media, humor, and celebrities in pollution reduction can help guide anticipatory guidance efforts to promote environmental conservation. This paper underscored the import of storytelling, humor and celebrities' influence in promoting, creating awareness and awakening genuine concern for environmental sustainability. Storytelling can be a powerful tool for raising awareness about environmental issues and inspiring people to take action. By sharing stories of people affected by pollution, or stories of successful environmental conservation efforts, individuals and organizations can help to promote a culture of environmental responsibility and encourage others to get involved. Social media platforms such as Twitter, Facebook, and Instagram can also be effective tools for promoting environmental conservation and pollution reduction. By leveraging social media to share information, raise awareness, and promote positive behaviors, individuals and organizations can help to drive change and build momentum for environmental action. Humor can also be a powerful tool for engaging people and promoting positive behaviors. By using humor to highlight the absurdity of pollution-related behaviors or to make environmental conservation more approachable and relatable, individuals and organizations can help to break down barriers and encourage people to take action. Incorporating these strategies into anticipatory guidance efforts, as well as into broader public health and environmental initiatives, can help to promote behavior change and encourage individuals and organizations to take action to protect the environment and reduce pollution-related health risks.

Policy Implications

The findings presented above underscore the urgent need for comprehensive and effective policies to address the environmental consequences of industrialization in Nigeria. The government's current lack of statutory capability and financial provisions, coupled with the prevailing belief that pollution is an inevitable byproduct of industrialization, demands a strategic and immediate policy response. Here are key policy implications:

Strengthening Regulatory Frameworks:

- There is an immediate need to fortify regulatory frameworks that govern industrial activities, particularly those related to petroleum exploration and gas flaring. Stringent regulations should be put in place to ensure industries adhere to environmental standards, and penalties for non-compliance should be enforced rigorously.

Investing in Monitoring and Surveillance Systems:

- The establishment of a robust and technologically advanced monitoring and surveillance system is crucial for early detection and rapid response to environmental incidents, such as oil spills and gas flaring. This involves investing in cutting-edge technology for real-time tracking of industrial activities and environmental parameters.

Financial Allocation for Environmental Conservation:

- The government should allocate specific funds dedicated to environmental conservation and mitigation efforts. Financial provisions should be made to address the aftermath of industrial activities, including the restoration of contaminated farmland, water bodies, and ecosystems affected by oil spills and gas flaring.

Public Awareness and Stakeholder Engagement:

- Engaging the public and relevant stakeholders is essential for building awareness and garnering support for environmental conservation initiatives. A comprehensive communication strategy should be developed to inform local communities about the environmental impact of industrial activities, empowering them to advocate for their rights and demand responsible practices from industries.

Encouraging Sustainable Industrial Practices:

- Encouraging and incentivizing industries to adopt sustainable practices is imperative. The government should introduce policies that promote eco-friendly technologies, waste management practices, and alternative energy sources to reduce the environmental footprint of industrial operations.

International Collaboration and Partnerships:

- Collaborating with international organizations and leveraging global partnerships is essential for addressing the transboundary nature of environmental issues. This includes seeking expertise, sharing best practices, and accessing funding opportunities to implement large-scale environmental conservation projects.

Capacity Building and Research:

- Investing in capacity building for regulatory agencies, environmental scientists, and policymakers is crucial. Additionally, supporting research initiatives focused on understanding the specific environmental challenges posed by industrialization in Nigeria will provide the necessary insights for evidence-based policymaking.

Periodic Environmental Impact Assessments:

- Requiring industries to conduct periodic Environmental Impact Assessments (EIAs) is essential to evaluate and mitigate potential environmental risks. Strict adherence to EIA protocols should be enforced, and the results should guide decision-making regarding the approval and continuation of industrial projects.

These policy implications are foundational steps toward creating a sustainable and environmentally conscious approach in Nigeria. A proactive and holistic policy framework will not only safeguard the environment but also contribute to the long-term socio-economic well-being of the nation and its communities.

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Conflict of Interest

The authors declare that there is not any conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/ or falsification, double publication and/or submission, and redundancy has been completely observed by the authors.

Contributions

All authors contributed equally to the conceptualization, materials and method, results, discussion, conclusion, supervision and writing of the article.

Life Science Reporting

No life science threat was practiced in this research.

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