British Journal of Applied Science & Technology

21(2): 1-15, 2017; Article no.BJAST.33276
ISSN: 2231-0843, NLM ID: 101664541

Climate Change and Its Impact on Nutritional Status and Health of Children

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Authors' contributions

This work was carried out in collaboration between all authors. Author IG designed the study, wrote the protocol and the manuscript. Author MZ managed the literature search and editing of the manuscript. Author RN also managed the literature search. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/BJAST/2017/33276
Editor(s):
(1) João Miguel Dias, Habilitation in Department of Physics, CESAM, University of Aveiro, Portugal.
Reviewers:
(1) Giovanni Ghirga, International Society of Doctors for the Environment (ISDE), Rome, Italy.
(2) Luiz Koodi Hotta, University of Campinas, Brazil.
(3) Claudia Choma Bettega Almeida, Universidade Federal do Paraná (UFPR), Curitiba, PR, Brazil.
Complete Peer review History: http://www.sciencedomain.org/review-history/19176

Review Article

Received 7th April 2017
Accepted 16th May 2017
Published 23rd May 2017

ABSTRACT

Climate change has been one of the most sought out and debated topic of this decade and is evident to have profound effect on human health, climatic conditions and biodiversity. Though changes in climatic conditions has been referred as natural process but scientific investigation has shown that the recent climatic variation has gone beyond the natural level suggesting the evolution of a process i.e. "global climate change". The disease burden of a population, and how that burden is distributed across different subpopulations (e.g. infants, women), are important pieces of information for defining strategies to improve population health. Disease burden estimates provide an indication of the health gains that could be achieved by targeted action against specific risk factors. The measures also allow us to prioritize actions and direct them to the population groups at highest risk. It has been noticed that one in three developing-country children under the age of five – 178 million children suffers stunting due to chronic under nutrition and poor quality diets. Chronic malnutrition during the first two years of life usually results in irreversible harm. Keeping in view the above conditions this review paper was prepared to pledge the proficiency and admonish the people

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i.e., our children from ill effects of climate change by making people aware how they can save their children with suggestions to overcome the severe and grievous effects of looming climate change, and most of all through various suitable government policies at national and international level.

Keywords: Climate change; children; environment; food security; disease.

1. INTRODUCTION

Under -nutrition remains one of the world's most serious but least addressed socioeconomic and health problems. The human and socioeconomic costs of under nutrition are enormous, falling hardest on the poorest, especially on women and children [1,2]. The scores of millions of world over, as have been the victims of under nutrition early, life face numerous challenges as they grow. They generally encounter an increased risk of illness and death when young, experience difficulties at school, and are mostly unable to make a full scale contribution viz-a-viz the social and economic development of their households, communities and nations during their adulthood [3]. Such children are more vulnerable to vector-borne diseases. They have been found to be very intimate companions. The physical dangers of extreme weather events–flooding, building collapses etc - all pose unique threats to young bodies and mind. The change worsens each of these risks with the children who are at the receiving end. Furthermore, children suffer these effects longer than adults. This critically makes them centre in firming up the climate change responses.

More than 2.5 billion people worldwide depend more or less directly on agriculture for their livelihood, the availability of resources is a matter of survival. Impacts on agricultural production and prices—triggered by either gradual changes in long-term climate trends or more frequent and severe natural disaster—affect poor people through food production impacts, higher food prices, and changes in rural incomes. Understanding and forecasting the agricultural production supply, quality and diversity, as well as where food loss is occurring across regions, will be significant factors in reducing human, environmental, economic and food security impacts [4]. As food prices increase, the risks of malnutrition and poverty increase. Additionally, seasonality, which is compounded by climate change, can have substantial effects on people's nutritional status. The women and children are particularly vulnerable to malnutrition induced by seasonality. Despite the substantial nutritional impacts of seasonality, policymakers and program implementers are at times unaware of these effects owing to inadequate data [5]. It is clear from observations across a range of indicators that many fundamental measures of climate are changing. These broad changes, known as "climate change," threaten the biological systems on which the life, health, and prosperity depend. On the basis of well-established evidence from the past 20 years, there is now a broad consensus among scientific organizations and approximately 97% of climatologists that human-generated greenhouse gas emissions are the main cause of climate change [6,7,8] and [9]. Although the effects of climate change are already being felt across the world, the magnitude of the effects of future changes depends on our ability to substantially reduce greenhouse gas emissions and implement adaptation strategies during the ensuing decades to protect children, families and communities from the worst potential effects of climate change [10].

2. EXISTING INEQUITIES IN CHILD HEALTH

There have been visible improvements in child survival and life expectancies over the half-century, attributable to technological and medical advances. The social factors have also contributed significantly in these achievements. For example, access to education encourages new family structures in which women and children are allocated greater priority in terms of care and allocation of food within the household [11]. Educated mothers also begin to move beyond a fatalistic acceptance of high childhood mortality amongst their offspring towards the implementation of simple health-promoting practices, such as keeping a clean home and boiling water before use [12]. However, as reported by UN, out of the 530 million children in flood-prone areas, nearly 100 million already lack access to safe drinking water and over 270 million already lack access to sanitation. Similarly approximately 130 million children in high drought zones do not have access to sanitation and/or safe water. During G20 meeting it was discussed that even a 2 degree rise in temperature will have serious consequences for

food security, economic stability and international security. Soit was accentuated by the UNICEF to include children in climate change adaptations and furthermore, if shocks are going to become more frequent in the future, it is imperative to build resilience and improve equitable outcomes for children today [13].

3. CLIMATE CHANGE MAY WORSEN THE EXISTING INEQUITIES

Climate change will not affect children and adults equally. Because of the risk associated with both of them, flood and drought zones often overlap with areas of high poverty and low access to essential services such as water and sanitation. This means that children and families who are already disadvantaged by poverty – those with the fewest resources for coping – are likely to face some of the most immediate dangers of climate change.

3.1 This Can Create a Vicious Cycle

A child living in poverty or deprived of adequate water and sanitation before a crisis will be more affected by a flood, drought or storm, less likely to recover quickly and at even greater risk in a subsequent crisis. While climate change poses universal threats, tackling it is also an imperative for equity. Unaddressed, climate change will harm the poorest and most vulnerable children first, hardest and longest. Climate change has begun to change our world in unprecedented ways.

3.2 Children will Suffer Disproportionately from Climate Change and Growing Environmental Risks

Children's vulnerability to vector-borne diseases such as dengue, malaria, and diseases associated with poor water quality, inadequate sanitation and poor hygiene practices, such as diarrheal diseases, is also far higher than adults [14]. In 2015, malaria is estimated to lead to 438,000 deaths, of which more than two-thirds are children under 5 years of age. Children are also more susceptible to under nutrition. Diarrheal diseases are a major cause of under-five mortality, and are estimated to result in 530,000 deaths in 2015 alone. Some of the most dense child population areas in the world are likely to suffer substantially from flooding, drought and water and heat stress. These include parts of South Asia, particularly coastal South Asia and south of the Himalayas; the Mekong Delta; the Nile river basin; the Pacific Islands and other Small Island Developing States (SIDS) across the world; Equatorial Africa; and the Pacific coast of Latin America. Due to several major global trends, including demographic and migration trends, more and more people are living in disaster- prone areas and exposed to weather extremes. Those with the highest exposure to climate risks are also likely to experience repetitive crises, which also make it more difficult for poor families and children to recover. Even without climate change, the challenges ahead would stand to be enormous; climate change will significantly compound these challenges [14].

3.3 Children, Particularly Young Children are Reliant on Adults for their Survival and Development

Whatever happens to adults often has a devastating impact on children too. Besides the direct risks of climate change, children are also affected when climate change hits their parents and other caregivers, such as loss of livelihoods and crop productivity. Moreover, when climate change sparks conflict over dwindling resources, children again pay the price for adults' actions. The impacts of climate change are only just beginning, and will likely continue to worsen over the lifetime of today's children, and future generations. Currently, over half a billion children are living in areas with extremely high levels of flood occurrence, and nearly 160 million live in areas of high or extremely high drought severity. Most of them live in some of the world's poorest countries with the least capacity to manage these environmental risks [14]. Strengthening the resilience of the poorest children and families do not only absorb these changes, but also adapt and transform, will be critical. It will also require, as part of these efforts, that we address the profound social and economic inequities that drive the ways in which many children will be so deeply impacted by the climate crisis. Climate change and development are inextricably linked. Action on climate change is essential to achieving the Sustainable Development Goals (SDGs), and requires integrated action across social, economic and environmental spheres [14].

4. CLIMATE CHANGE AND CHILD NUTRITION

Much less well understood, however, are the links between climate change and nutrition. A clearer picture of how climate change affects nutrition, and how nutrition in turn affects climate change, offers an opportunity to use policies and programs in ways that are mutually beneficial for climate adaptation and nutrition status. Since childhood is the most vulnerable phase in the life of human being, nutritional inadequacies will result in the hampering of the development of the body. If this nutritional inadequacy persists for a longer period of time it results in the growth faltering manifested in the form of low weight, small height, low IQ, etc. Future of the country is determined by the growing generation of the country. It is the health status of children of any country that represents the health status of people of that country. Since this growing generation is going to be the future productive citizens, they should be healthy enough to make use of the full potential of their productive age. Scientific evidence has shown that beyond the age of 2-3 years, the effects of chronic malnutrition are irreversible. Child malnutrition is the single biggest contributor to under-five mortality due to greater susceptibility to infections and slow recovery from illness. Misconception prevalent in the present time is attributed inter alia to the unavailability of the enough food. Between 6-18 months, young child requires only 200-300 kcal food to maintain normal growth and development; but because of insufficient knowledge of parents about feeding practices they don't provide enough food to their children leading to faltering of growth and consequently illness and death of child [15]. The world Bank estimates that India is one of the highest ranking countries in the world for the number of children suffering from malnutrition. The prevalence of underweight children in India is among the highest in the world and is nearly double that of Sub-Saharan Africa with dire consequences of morbidity, mortality, productivity and economic growth [4]. Furthermore, methods are depending on the stage of nutrients deficiency, time, cost, energy, and degree of research accurateness, and how many people will be evaluated.

4.1 The Impact of Climate Change as a Risk for Nutrition

Many poor people in rural areas are vulnerable to seasonal variations in food supply, disease, and time use, and these seasonal changes point to the potential effects of climate change on nutrition. Climate change affects the enabling environment for malnutrition reduction. Shifting and sometimes less predictable rainfall and temperature patterns affect political priorities, economic growth, and inequality because the poorest people are most vulnerable to the changes. A less favorable enabling environment for malnutrition reduction makes the underlying determinants of improved nutrition less effective. For example, unexpected and sometimes more severe weather changes disrupt the intermediate environments that are so important for good nutrition and climate change also affects people's food consumption by influencing local and global food availability (production, storage), quality (nutritional value and food safety), access (market policies and prices), and how the body utilizes food. Seasonal food scarcity and climate shocks (such as droughts) have long been shown to drive short-term malnutrition, morbidity, and, in Africa, mortality in vulnerable populations, especially women and girls. Global climate models suggest that by 2050 climate change will result in additional price increases of 5–25 percent for the most important agricultural crops—rice, wheat, maize, and soybeans—and that higher feed prices will result in higher meal prices [5]. This is because overall warming temperatures are expected to have a negative effect on global crop production, although this effect might be counteracted in part by the effects of CO_2 [16]. Without real efforts to adapt, people's production capacity and livelihoods are under serious threat. According to the Intergovernmental Panel on Climate Change (IPCC), climate change without adaptation will depress production of wheat, rice, and maize even under local temperature increases of 2° C. (high confidence). It is also estimated that food quality will be affected. For example, elevated CO_2 emissions representing likely levels in 2050 are associated with substantial declines in the zinc, iron, and protein content of wheat, rice, field peas, and soybeans [17]. In addition, food safety may be compromised by a changing climate. High temperatures and extreme weather events create a more favorable environment for food-borne pathogens such as campylobacter and salmonella [18], which reduce ability to absorb nutrients. It has also been observed by some of the researchers that the immediate causes of malnutrition are due to inadequate food intake (in terms of quantity or quality) and diseases. However, malnutrition is influenced by a host of underlying factors related to poverty, including food insecurity, poor water, sanitation and health

services, which find their roots in factors that can vary from conflict to climate change; from scarce natural resources to high and volatile food prices; from poor governance to demographic growth [19].

As per study conducted by [20] the health, environment, climate plays an important role in the transmission of many human parasitic, viral, and bacterial diseases (such as malaria, dengue, and cholera, respectively). With [21], who would carry the notion that rainfall and temperature determine the spatial and seasonal distributions of these diseases, influence year-to-year variability, including epidemics, and affect long-term trends observed warming in the East African highlands, which is clearly associated with global climate processes, may already be changing local malaria transmission dynamics.

5. CLIMATE CHANGE AND ENVIRONMENTAL HEALTH HAZARDS IN CHILDHOOD

Up to two-thirds of preventable illness and death from environmental hazards is experienced by children [22,23] and [24] and the burden is predominantly in those aged under 5 years [25]. Children have distinct physiologies and exposure profiles that mean climate-sensitive diseases place an undue burden on the youngest members of society. Compared to adults, children have much higher exposures to environmental hazards.

For example, children tend to spend more time outdoors, where they can be exposed to high temperatures and where disease vectors such as rodents, mosquitos and ticks are found. Children require more water (by weight) than adults, so their exposure to water-borne pathogens is much higher. Diarrheal diseases cause dehydration in children much faster than in adults, and children are more likely to develop severe infection and experience complications during recovery due to their small body size and their developing immune systems which provide little natural immunity or resistance [23,26]. Apart from this, there are distinct “windows of vulnerability” during gestation and early childhood, when critical biological systems such as the immune and central nervous system are developing. Maternal under-nutrition, infection and illness at these critical times can cause devastating and life-long damage, including physical stunting, neurological impairments and immune dysfunction [22,25].

6. PATHWAYS BETWEEN INEQUITIES IN CHILD HEALTH OUTCOMES AND THE IMPACTS OF CLIMATE CHANGE ON ENVIRONMENTAL HAZARDS

Inequities in child health outcomes may be exacerbated by climate-related changes in the frequency and severity of environmental hazards, especially heat stress, extreme weather events, vector-borne diseases and under-nutrition pathways between these particular environmental health hazards, climate change, and issues of inequity that lead to differential health outcomes for children are illustrated in Fig. 1.

6.1 Heat Stress

Infants and young children are at high risk of ill-health and death related to extreme heat exposure. Children tend to spend more time outside, with more vigorous activity, than adults, thus placing them at increased risk of dehydration, electrolyte imbalances, heat stroke and heat exhaustion [22,27] and [28]. It has also been observed that the health risks from a heat wave are strongly mediated by social advantage or disadvantage. During a period of extreme heat, a child from a high income family in a developed setting can retreat to insulated buildings, with electricity to run air conditioning and clean, cold water on tap. In contrast, a child living in an urban slum, with no running water or electricity and poorly made shelter, has no refuge from the heat and no way to artificially cool themselves [29]. Children in this setting are thus at much higher risk for heat-related illness and death [30,31].

6.2 Extreme Weather Events

Climate change is expected to bring more frequent and more severe extreme weather events, such as storms, cyclones, floods and droughts. Children are particularly vulnerable to these hazards as they are heavily dependent on their caregivers for safety and protection during such events. When the immediate threats to health and safety have subsided, there are invariably lingering effects related to material losses (including homes and possessions), infrastructure damage (such as loss of health services or access to relief supplies), the displacement of large numbers of people (which may be permanent), loss of livelihoods and slow economic recovery.

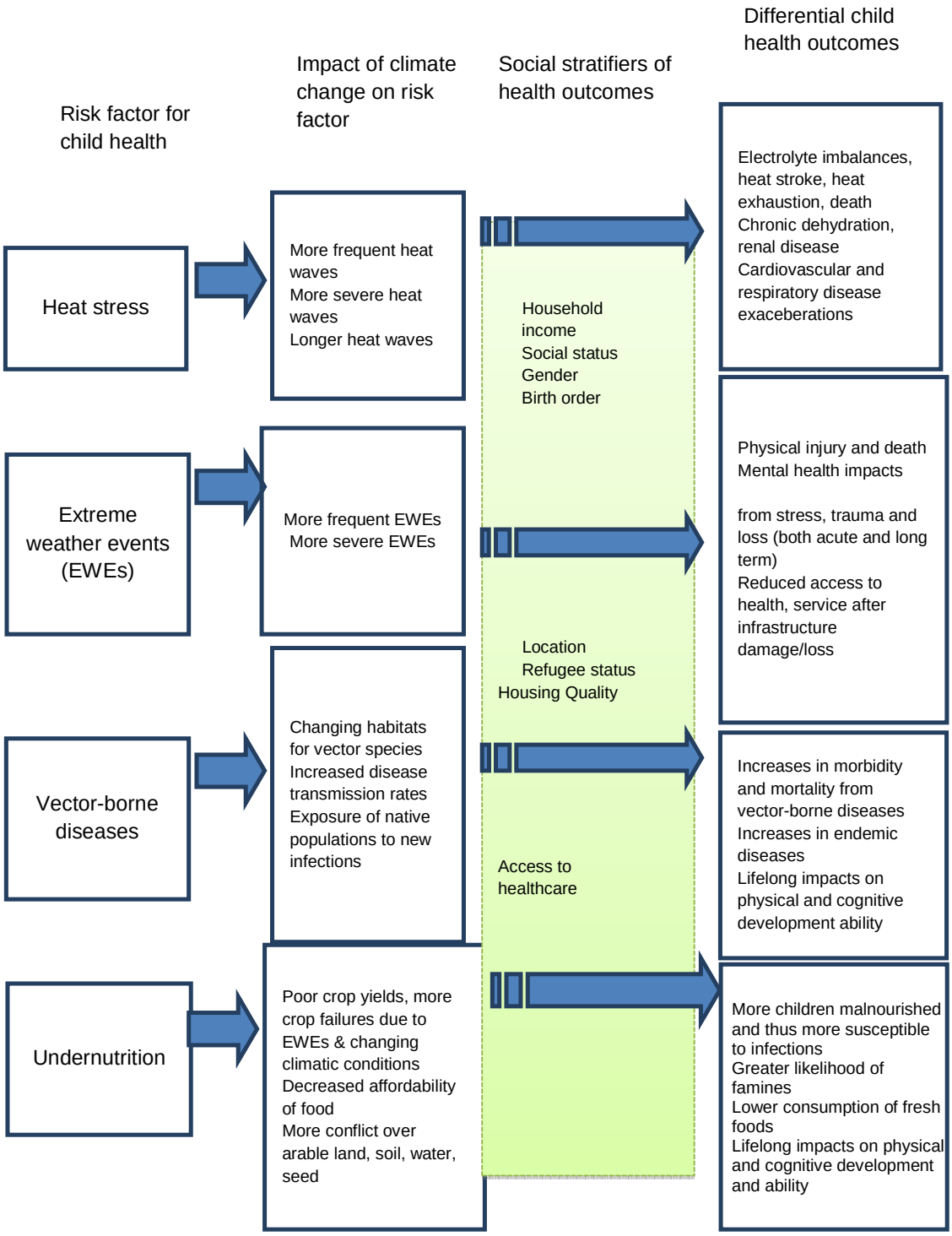

Fig. 1. Pathways between selected environmental hazards, climate change, and social conditions that lead to differential health outcomes for children

Disadvantaged communities have little ability to cope with disasters, especially a series of events in close succession. They also have little ability to recover and rebuild afterwards [32].

Many post-disaster emergency housing settlements are over-crowded, unsanitary and impoverished, and plagued by outbreaks of infectious diseases, episodes of violent conflict over scarce resources and persistent food insecurity. Basic life essentials (such as safe water and adequate shelter) are hard to obtain and livelihoods disappear. Many children become separated from their families and caregivers and are at greater risk of sexual assault, abuse and neglect [33]. In a climate-changed future with more frequent and more severe extreme weather events, and in a context of widening health inequities within and between countries, these unsafe and unhealthy environments will be where growing numbers of children may spend their formative years [23].

Mental and emotional distress is commonly reported in children and adolescents following natural disasters, including post-traumatic stress disorders, sleep disturbance, aggressive behavior, depression and anxiety, and substance abuse [27,34,35,36].

6.3 Vector-Borne Diseases

Climate change will alter the ecological context in which disease hosts, vectors and parasites breed, develop and transmit disease [37]. The distribution of many infectious disease vectors, including rodents, ticks and mosquitoes, is limited by the availability of suitable habitats and they are highly sensitive to changes in temperature, humidity and rainfall [27,38,39,40]. Poverty often coincides with regions of endemic infectious disease. Heavy burdens of endemic disease have significant impacts on productivity and health of the workforce, which leads to reduced household incomes and exacerbates economic disadvantage in those who can least afford it [41]. Moreover, it has been seen in United States, that mosquito season has grown in 76 percent of major cities since the 1980s due to increases in hot and humid weather conditions. Globally, the World Health Organization (WHO) reports that there are more than 1 billion cases and more than 1 million deaths from VBDs annually. VBDs including malaria, dengue, Lyme disease, schistosomiasis, leishmaniasis, Chagas disease, and yellow fever, account for more than 17 percent of all infectious diseases. VBDs overwhelmingly and disproportionately impact people living in tropical and subtropical developing countries, though warmer temperatures, migration, travel, and trade increases the risk of these diseases spreading to more temperate climates. According to the WHO, there are three key components that determine the occurrence of VBDs: vector and host abundance; local prevalence of disease-causing parasites and pathogens and human population behavior and disease resilience. Climate change affects these three key components through changes in temperature, precipitation, humidity, and other factors that influence the reproduction, development, behavior, and population dynamics of insects, pathogens, and people Insect vectors have several physical traits that help them take advantage of climate impacts like flooding, increased precipitation, and warmer weather.

The economic costs of a vector-borne disease epidemic are strongly mediated by socio-economic status. Epidemics in populations of low socio-economic status have substantial household costs, including foregone income from sick adults and those caring for sick children, the costs of healthcare and medicines, and missed schooling. Subsistence farmers and their families suffer disproportionately from the loss of income as well as loss of food from their land [42].

Childhood infections can therefore have major impacts on health and well-being in adult life, with survivors burdened with physical and cognitive deficits that lead to a less productive working life, whilst increasing the demands on caregivers, and thus affecting both the strength and the productivity of the future workforce [41].

6.4 Under Nutrition

The impact of climate change on agricultural yields and productivity is likely to have profound impacts on child health outcomes, especially in regions with heavy dependence on subsistence lifestyles and where under-nutrition and malnutrition is already prevalent. Children require more food per unit mass than adults [25], and most of the world's hungry are children. Malnutrition already kills more than 3 million children every year (mostly in southeast Asia and sub-Saharan Africa). Children are the most visible victims of under nutrition in the aggregate –including fetal growth restrictions stunting, wasting and deficiencies of vitamins-A, zinc along with sub-optimum breast feeding is a

cause of 3.1 million child deaths annually or 45 per cent child death in 2011 [43].

Globally 161 million under five years old were estimated to be stunted in 2013, furthermore 51 million under 5 year olds wasted and 17 million were wasted in 2013. In 2013, approximately 2/3 of all wasted children lived in Asia and 1/3 in Africa with similar propositions for severely wasted children [44].

Nutrient-deficient diets, under-nutrition and malnutrition weaken overall health, and are closely tied to unsanitary living conditions and socio-economic disadvantage [45,19]. Endemic disease and under-nutrition also fuel a vicious self-perpetuating cycle of disadvantage: the risk of infection (and complications from infection) is much higher if the child is malnourished, and the risk of malnourishment is greater if the child already has an infectious disease [22,23]. This cycle of poor health leads to permanent physical, cognitive and psychological impairments that will have profound impacts on the ability of that child to lead a healthy and productive adult life, including caring for children of their own [46,47].

7. FOOD INSECURITY AND CLIMATE CHANGE

The pivotal relationship between food and weather presents significant risk and security exposure for regions all over the globe. From production planning all the way through final consumption, there are numerous critical touch points in the food life cycle where weather and climate can have impacts on crop yields and consumption from minor to catastrophic levels.

In India, food security continues to be high on its list of development priorities because the country's relatively high rates of economic growth have not led to a reduction in hunger and under-nutrition. India's gross domestic product at factor cost and per capita income grew at seven percent and five percent per annum, respectively, from 1990-91 to 2013-14. However, the incidence of under-nutrition has dropped only marginally from 210.1 million in 1990 to 194.6 million in 2014, and India has failed to meet the Millennium Development Goal of halving the proportion of people who suffer from hunger. About 12 Indian states fall under the 'alarming' category of the Global Hunger Index. According to the National Family Health Survey 2015-16, the proportion of children under five years who are underweight is significantly high in states such as Bihar (43.9 percent), Madhya Pradesh (42.8 percent) and Andhra Pradesh (31.9 percent). While large sections of the Indian population suffer from acute under-nutrition, rising incomes and growing urbanization are rapidly changing the composition of the food basket—away from cereals to high-value agricultural commodities, such as fish and meat. As a result, the total demand for food grains is projected to be higher in the future due to an increase in population as well as a growing indirect demand from the feed. [48] has made long-term projections of India's food demand and supply up to 2026. According to her, the increase in total food demand is mainly due to growth in population and per capita income while production is likely to be severely constrained by low yield growth. In regions with high food insecurity and inequality, increased frequency of droughts and floods will affect children more, given their vulnerability. [48] conducted a survey of nine villages in the drought-prone Jalna district of Maharashtra and found that local crop yields and annual incomes of farmers dropped by about 60 percent in the drought of 2012-13. Such a large fall in income is likely to have a huge impact on child nutrition because poor households typically spend the bulk of their earnings on food. In another study based on 14 flooded and 18 non-flooded villages of Jagatsinghpur district in Orissa, [46] found that exposure to floods is associated with long-term malnutrition. According to their study, children exposed to floods during their first year of life presented higher levels of chronic malnutrition.

As reported by FAO [49], the agriculture sectors are also facing the enormous challenge of feeding the world’s growing population in the midst of climate change. The impacts of increased climate variability as well as more extreme and frequent weather events are jeopardizing agriculture, livelihoods and infrastructure. Farmers, pastoralists, fisher folk and community foresters depend on activities that are intimately and inextricably linked to climate. They are the ones who are affected the most by climate change yet are the least able to cope. A profound transformation in the global food and agriculture system is needed to ensure that the adaptive capacity of smallholders is enhanced and that countries transition toward low emission and climate resilient development. However, time is important. Action must be taken now in order to secure sustainable food and agriculture for the future.

With climate change, food will be produced under different climatic conditions in altered ecosystems, which will alter agricultural conditions and be compounded by adaptations to such change. Conditions may be further altered through initiatives from the food industry to mitigate against climate change. The food sector is a significant source of GHG emissions and food production, processing, transport, storage, preparation, purchase, and consumption that contributes 15–30% of global GHG emissions. Most GHG emissions arising from the food sector occur within agriculture (45%), food manufacture (12%), and transport (12%) [50]. GHG-mitigation initiatives might include introducing high-sugar grasses into the diet of cows, which reduces methane emissions [51], or altering the times of year when animal manures are spread onto land to reduce emissions of nitrous oxide (a GHG) [52]. These changes could have implications for nutritional quality and food safety.

Climate change may alter the seasonal patterns and abundance of pests and diseases, which may affect pesticide use, including herbicides and fungicides [53]. Responses will differ between crops and between geographical locations. For example, [54] estimated that pesticide use in the United States would increase under climate change overall. However, the projected effects varied by crop and location, such that pesticide use on wheat was predicted to increase by 14% in Kansas but decrease by 10% in Colorado; pesticide use in Illinois was predicted to increase by 18% on corn but only by 3% on soya beans. Elevated temperatures may also lead to the emergence and re-emergence of pathogens, vectors, or hosts [55], resulting in greater use of biocides and veterinary medicines in livestock management [56]. This could increase the prevalence of antibiotic-resistant pathogens in animal and human populations [57].

Climate change could affect existing pathogens or lead to the emergence of new pathogens in food [18], through effects on animal husbandry and animal-to-animal transmission, pathogen survival, and other mechanisms. Previous research has demonstrated that *Salmonella* infections in humans are positively associated with temperature [58]. This is biologically plausible because *Salmonella* bacteria will reproduce in food that is kept at ambient temperature. Therefore, under a warmer climate, elevated cases of salmonellosis are likely. However, for many other pathogens, although associations between human cases and weather exist (e.g., *Campylobacter* and temperature; [59], the biological mechanisms underpinning these associations are not fully understood, which makes it difficult to predict the effects of climate change. The pathogens most likely to be affected by climate change are those with low-infective doses (e.g., *Escherichia coli* strains and parasitic protozoa) where small changes in distribution or abundance could lead to many more human cases. Other pathogens likely to be affected are those with significant persistence in the environment (e.g. enteric viruses and parasitic protozoa) [60].

Climate-related Disaster Trends (to clear the confusion refer to the source FAO, 2016). This was added as per the comments of the reviewer)

Average climate-related disasters	Average economic damage of climate-related disasters*	In the last seven years on average
1980-1990 149/year 2004-2014 332/year	1980-1990 USD14B/year increased from USD100B/year 2004-2014	22.5 million people were displaced from their homes each year by climate-related disasters (mostly floods and storms) = 62 000 people every day
The impact of disasters between 2005 and 2015		
1.8 billion people were affected by natural disasters over the past decade in developing countries 1	94% were affected by climate-related disasters	64% of all damage due to natural disasters were climate-related

Damage and losses by type of hazard Share of climate related disasters' damage and losses absorbed by agriculture in developing countries (2003-2013) 84% Drought 18% Storms 14% Tsunami 4% Earthquakes 15% Floods Agriculture absorbed 84% of total damage and losses caused by drought in developing countries (2003-2013)				
Damage and losses by agricultural sub sector and type of hazard Share of total damage and losses in each subsector (2003-2013)				
Livestock 85%	Drought			
Fisheries 69%	Tsunami			
Crops 58%	Floods			
Forestry 89%	Storms			
Climate change worsens protracted crises and conflict				
500 M people are potentially affected by protracted crises	Hunger rates in protracted crisis situations are almost **3 times higher** than in other developing contexts	**40% more** protracted crises today than in 1990	Protracted crises absorb **80%** of humanitarian funds	87% of people affected by conflict do not flee their homes

Source: FAO 2016 [61]

8. GOVERNMENT POLICIES TO SUBJUGATE CLIMATE CHANGE

All over the world policies are being adopted that are desirable in their own right and are commendable, even if there were no threat of climate change. These policies would reduce greenhouse gas emissions, increase energy efficiency, reduce harms associated with global warming or increase the world's capabilities to deal with climate change-associated problems.

- Eliminate All Subsidies for Fuel Use. Subsidies for energy research and development, as well as the production, transportation, marketing and consumption of energy, encourage greater energy use and raise emissions levels.
- Reduce Regulatory Barriers to New Nuclear Power Plants. Regulatory delays add substantially to the cost of nuclear power, which is the only proven technology that can provide enough reliable emissions free energy to significantly reduce greenhouse gas emissions.
- Reduce Wildfires through Alternative Forest Management Institutions. Local and private forest management would reduce overcrowding and disease in poorly managed national forests, increasing the ability of the trees to absorb carbon and reducing wildfires, which release huge amounts of CO2 .
- Liberalize Approval of Biotechnology. Through biotechnology we are developing faster growing varieties of trees that can absorb and store large amounts of CO2 as well as drought-resistant crops that can thrive despite climate change.
- Repeal the National Flood Insurance Program. Subsidized flood insurance is responsible for much of the development in coastal areas and in flood plains. Eliminating this subsidy would make us less vulnerable to higher sea levels and increased rainfall.
- Increase Use of Toll Roads with Congestion Pricing. Toll lanes with rates that vary according to time of day can reduce traffic delays that increase energy use and emissions.
- Remove Older Cars from the Road. Subsidizing the replacement of older vehicles with newer ones would increase fuel efficiency and reduce emission

- Reform Air Traffic Control Systems. Allowing pilots to fly more direct routes and avoid lengthy holding patterns and runway delays would save fuel and reduce aircraft emissions. N
- Remove Regulatory Barriers to Innovation. Environmental regulations often increase the costs of replacing older, dirtier facilities with newer, cleaner ones.
- Encourage Breakthroughs in New Technology. An "X" prize-type competition would encourage the development of new transportation and electric power technologies that reduce CO2 emissions while meeting future energy demands [62].

Correspondingly India is also taking steps to tackle this problem through various national level programmes such as:

- Jawaharlal Nehru National Solar Mission to establish India as a global leader in solar energy, by creating the policy conditions for its diffusion across the country as quickly as possible.
- National Mission for Enhanced Energy Efficiency to achieve growth with ecological sustainability by devising cost effective and energy efficient strategies for end-use demand side management.
- National Mission on Sustainable Habitat to promote sustainability of habitats through improvements in energy efficiency in buildings, urban planning, improved management of solid and liquid waste including recycling and power generation, modal shift towards public transport and conservation.
- National Water Mission to conserve water, minimize wastage and ensure equitable distribution both across and within states through integrated water resources development and management.
- National Mission for Sustainable Agriculture to transform agriculture into an ecologically sustainable climate resilient production system while at the same time, exploiting its fullest potential and thereby ensuring food security, equitable access to food resources, enhancing livelihood opportunities and contributing to economic stability at the national level.
- National Mission for Sustaining the Himalayan Ecosystem to evolve management measures for sustaining and safeguarding the Himalayan glaciers and mountain ecosystem and attempt to address key issues namely impacts of climate change on the Himalayan glaciers, biodiversity, wildlife conservation and livelihood of traditional knowledge societies.
- National Mission for a Green India to use a combination of adaptation and mitigation measures in enhancing carbon sinks in sustainably managed forests and other ecosystems, adaptation of vulnerable species/ecosystems, and adaptation of forest-dependent communities.
- National Mission on Strategic Knowledge for Climate Change to identify the challenges and the responses to climate change through research and technology development and ensure funding of high quality and focused research into various aspects of climate change.

In addition to the National Action Plan on Climate Change, the Government of India has taken several other measures to promote sustainable development and address the threat of climate change. These initiatives operate at the national and sub national level and span domains that include climate change research, clean technology research and development, finance, and energy efficiency and renewable energy policy and deployment [63].

9. CONCLUSION

While submitting this status report it is pertinent to mention here that the future is replete with challenges, such that the mankind appears to be heading for an unprecedented adversity as can threaten the posterity with unprecedented consequences. We seem to have interfered with the nature mainly to satisfy our lust for more and more, and it looks mulling to strike back with vengeance unless we exhibit our will and skill to befriend it and endeavor to take sustentative measures in right earnest.

Even sans the climate change, the food security let alone the quality has remained a distant dream to the brute majority of the world populace. The hunger played a permanent partner to them with occasional intermissions for hide and seeks. The mankind knows the weather playing a spoilsport is known to the man kind for ages but the climate change is taking him by surprise and the impact assessment is presently beyond the comprehension many.

The children amongst the disadvantage are more venerable bound to suffer disproportionality from

the climate change and growing environmental risks. They are the easy praise and may get harm first, hardest and longest. The vicious cycle that the climate change can foster shall be the challenge that has the potential of threatening the posterity in a big measure. The impact in health, economic and social sectors shall be profound and any further delay in addressing the contributing melodies can prove very costly and even threaten the survival of both flora and fauna.

Given the worsening situation of climate and its catastrophic effects on health of children it is necessary to take some expeditious steps to safeguard our children. There are concrete steps that the world can take now to safeguard our children's future and their rights. Knowing this, and knowing how climate change can affect children, makes it morally wrong not to act promptly and decisively. The environmental hazards and natural calamities apart, children can be affected socially and economically through nutrition related problems like malnutrition, under-nutrition and other nutrition related problems indirectly associated with climate change. Climate change science indicates that because of past and ongoing greenhouse gas emissions, the world's climate is already changing. It is imperative that we prepare for the impacts that are inevitable. There is, nevertheless, an opportunity for action that can stave off some of the worst effects of climate change. What the world does now to cut greenhouse gas emissions can dramatically reduce the number of children threatened by the most severe impacts of climate change in the coming decades. The path that the world chooses now will indelibly mark our children's futures.

Climate change acts in conjunction with others factors, and thus is viewed as a threat multiplier. It is changing the patterns of climate-related hazards and it magnifies the risks of disasters. It exacerbates the risk of under-nutrition by an unprecedented scale through different pathways, respectively food, water, care & health-related. There is little doubt that climate change – both in terms of impacts and responses –will be further reshaping the humanitarian and development agendas and operations in the coming years; thus climate change should be considered seriously by humanitarian/development decision- and policy-makers and practitioners. Through proper understanding of climate change issue and its impending effects on health, timely initiation of preparedness activities with thorough participation of community, we can become successful in combating the health effects of climate change.

10. RECOMMENDATIONS

- The world is doing and must embark on low carbon development to reduce greenhouse gas emissions, and needs to adapt to the impacts of climate change that cannot be halted. The blueprint with focus on the following charter of objectives could be envisaged:
- Cutting greenhouse gas emissions so that the average rise in the global temperature is limited to a maximum of 2° Celsius, and ideally to 1.5°C.
- Prioritizing the needs of the most vulnerable in climate change adaptation efforts, particularly children – who will bear the brunt of climate, change far longer than adults.
- Reducing inequities among children now to promote their future resilience to climate change and other disasters or crisis.
- Listening to and acting on children's perspectives on climate change.
- Providing children and youth with climate change education, awareness raising and training.
- Aligning and coordinating work on climate change adaptation, preparedness and disaster risk reduction at national and sub-national levels.
- Protecting children and their families who are forced to move as a result of climate change.
- Investing in children as part of national climate plans on mitigation and adaptation.
- Scale-up proven approaches to address the changing needs of children.
- Higher priorities given to interventions that help households manage seasonal variations in consumption, income, and illness.
- There should be more food aid to drought stricken areas.
- The Government should look for responsive strategies and carry out research on how to reduce the impacts of climate change.
- Development and introduction of drought resistant crops.
- Make the needs of the most vulnerable, including children, central to climate change adaptation.

- Involvement of one and all in the campaign for the “continued and quality survival of all-today and tomorrow”.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/19176