Global Climate Change and Toxic Exposures

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Human health is affected by the state of the physical environment even the children are more susceptible to adverse health effects caused by environmental hazards, especially since their physical, physiological and cognitive development has not yet been completed. The United Nations' The Intergovernmental Panel on Climate Change (IPCC) published "Climate Change 2021: A Physical Science Basis" report documenting the changes in the Earth's climate including predictions on how continued changes would impact us in very near future. The report summarizes and forecast that some thresholds with high-risk "abrupt or irreversible changes" that can entirely alter the Earth's climate system. As the climate changes, it can be said that their environmental dangers will change and even intensify, general health will be affected by cases such as an increase in infectious and vector-borne diseases, negative effects on growth, development and education, and posttraumatic stress syndromes after possible disasters. Changes in temperature, humidity, and the hydrologic cycle will affect chemicals used in food production and other pest control, which directly changes the chemical exposure patterns. Global surface temperatures, wind patterns, global ice volume said to be play important role in persistent organic pollutants while climate change is expected to result change in global distribution and more toxic exposures. Reasonable public health strategies are needed that address future health problems while building adaptive capacity to respond to worsening future impacts from climate change.

Introduction

The climate system is a complex and interactive system that encompasses the atmosphere, land surfaces, snow and ice, oceans, and other bodies of water, and living things. This system changes gradually over time, under the influence of its own internal dynamics or due to changes in external factors.

Climate change is defined as changes in the average state and/or variability of the climate over decades or more, regardless of the cause. Throughout the history of our world to date, there have been many changes in the climate system over a period of about 4.5 billion years, with natural factors and processes on all time scales, from millions of years to decades. Climate changes in geological epochs, especially through glacial movements and changes in sea level, have not only changed the geography of the world, but also brought about permanent changes in ecological systems (1-3).

Today, the mentioned global climate change refers to the increase in the average surface temperatures of the Earth and the changes in the climate as a result of the rapid increase in greenhouse gas accumulations released into the atmosphere by human activities such as the burning of fossil fuels, land use changes, deforestation and industrial processes, which reinforces the natural greenhouse effect (1).

The heat energy held on Earth and in the atmosphere is distributed across the earth by atmospheric and ocean circulation and returned to the atmosphere as long-wave ground radiation. Some of this is absorbed by clouds and greenhouse gases that regulate the greenhouse effect in the atmosphere and released back from the atmosphere. In this way, the Earth's surface, and the lower atmosphere heat up. This process, which makes the earth warm more than expected and regulates the heat balance, is called the natural greenhouse effect. The increase in the density of greenhouse gases in the composition of the atmosphere is considered dangerous (2).

The burning of fossil and biomass fuels is the largest source of human-caused greenhouse gas emissions. Land-use changes also significantly affect the climate system. Opening up land for agricultural use increases the amount of dark surface, and as a result, the incoming solar radiation is absorbed rather than reflected. Land opening also means that due to the destruction of forests, there is a decrease in trees and plants that hold and store carbon dioxide. Desertification can have an effect that slows down global warming by reducing the energy coming from the sun to the Earth's surface due to the increase in the amount of dust passing into the atmosphere. Urbanization leads to the formation of urban heat islands, that is, warmer areas in cities than in their surroundings (3).

Impacts of climate change

The impact of climate change is not just an increase in temperatures. It damages natural life with factors such as drought, floods, increase in the frequency and impact of extreme weather events such as floods, severe hurricanes, rise in ocean and sea water levels, increase in acidity rates of the oceans, melting of glaciers; disasters become everyday event (4).

While the scientific world states that the increase in average temperatures should be limited to a maximum of 2 ° C in order to minimize the destructive effects of climate change; they are preparing time- and emissions-dependent climate change scenarios for what situations will be encountered in the future. The most important questions raised are: What will be the total potential health impact caused by climate change (nowadays to 2050)? How much of this could be avoided by reducing the risk factor (i.e., stabilizing greenhouse gas (GHG) emissions)? With current policies and practices, this rate is expected to continue to increase (5). While it is said that the increase in average temperatures will reach 4°C in 2060 at the current rate of increase in carbon dioxide emissions, it states that the effects of this increase will be also on human health (6,7).

It’s undeniable that temperatures are getting hotter, with the rate of warming having continued to accelerate over the past 30 years. Every year, that year recorded hottest year on record. Climate change may entail changes in variance of temperature, as well as changes in mean temperature, both shifting to much more hot weather and more record hot weather. All this means, heat waves are expected to become more intense, more frequent, and longer lasting (8). As waters warm in the top layer of the ocean, they provide more convection energy to fuel more powerful storms. Hurricanes increases in both intensity and duration; highly destructive hurricanes have been directly linked to rising sea surface temperatures (9).

As global temperature rises, global water cycle also accelerates, and water vapor rise in the atmosphere. The result is more intense downpours, even when total precipitation remains unchanged, which increases the risk of great floods all over the world (10).

In reverse spectrum, the climate models predict that the proportion of the world's land surface affected by extreme drought could increase from 1 percent currently to as much as 30 percent by the end of this century; many people will have lack access to safe drinking water, adequate sanitation, and adequate habitation (11). People will struggle for control of increasingly scarce resources like water and arable land while climate change could create as many as 150 million environmental refugees by 2050 (12).

Direct health impacts are on will be on public health as climate changes such as increase in air pollution related illness, increase in injury, death and illness from extreme weather events, increase in water-borne and food-borne diseases, increase in vector-borne illness, both increase in heat and cold related deaths all over the world (13).

Climate Change and Chemical Exposures

Climate change is altering human exposure to chemicals. extreme storms and floods decrease water quality by increasing chemical waste into surface waters; drought decreases water quality by concentration of non-volatile chemicals and toxic metals; while increased temperatures increase volatile chemicals to disperse more quickly in the air (14).

Global warming threatens to increase levels not only of man-made air pollutants, but of natural air pollutants as well. Pollen levels during spring and summer are rising, pollen season starts earlier and last longer, spring events like leaf unfolding and flowering have been advancing while autumn events have to seemed to be been delayed (15, 16). Rising CO2 concentrations increase in total pollen production, and this is estimated to increase the allergenicity (17). One of the ways that the potential influence of rising atmospheric carbon dioxide on public health is clearly demonstrated with the pollen production of common ragweed as a test case. It has been shown that the pollen level produced is directly related to the increase in the amount of carbon dioxide level, and while there is about 4 grams of pollen production at 280 ppm carbon dioxide level, it has been shown that the pollen level exceeds 10 grams at the 400 ppm carbon dioxide level measured nowadays (18).

Another factor that deteriorating the air quality is ozone pollution. Normally ozone is found at the highest levels in the atmosphere at stratosphere region, also known as ozone layer about 10-50 km above sea level). The ozone layer absorbs 97 to 99 percent of the Sun's medium-frequency ultraviolet light (from about 200 nm to 315 nm wavelength), which otherwise would potentially damage exposed life forms near the surface (19). However, low level ozone (or tropospheric ozone) is an atmospheric pollutant. Emissions from industrial facilities, gasoline vapors and chemical solvents are some of the major sources of nitrogen oxides and volatile organic compounds. Ground level ozone is not emitted directly by car engines or by industrial operations but formed by the reaction of sunlight on air containing these volatile hydrocarbons and nitrogen oxides that react to form ozone directly at the source of the pollution or many kilometers downwind (20). Environmental Health Protection Agency estimates that 1 degree Celsius would increase ozone concentrations by 5 percent while global warming would be the main contribution of expected high levels in cities near future (21).

Health levels of ground level ozone is associated with reduced lung function and lung tissue damage, increased risk of asthma attacks and aggravation of other chronic lung diseases (21). It is also known to affect the cardiovascular system and can increase the risk of heart arrhythmias and heart attack (22, 23). The inflammation of airways is direct responsible for cause of morbidity and mortality, while meta-analyses also showed the associated exposures with increased mortality in general population (24).

Not only ozone but mercury levels, particulate matter levels, oxides of nitrites, sulphates, volatile organic substances are all increasing with or prior to climate change because of global high levels of industrialization; all levels are also associated with increasing air pollution related illness such as respiratory infections, asthma attacks, higher infant mortalities, higher miscarriages, preterm and low birth weight births, higher developmental damages.

Conclusions

Human health is affected by the state of the physical environment. It is well defined that the short-term effect of air pollution is a risk factor for increased patient admissions to hospitals. Air pollutants such as pollens and other small particles, nitrogen oxides, sulfur oxides, ozone are increasing in all cities globally. In addition, the world's population is expected to reach 9 billion by 2050. Accordingly, the need for increased energy can be expected to cause more air pollution if it is reached by the use of more fossil fuels that would be a higher risk of negative consequences in the short term of climate change. It can be said that their environmental dangers will change and even intensify, and human health will be more affected by this climate change.

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