Effects of global warming on respiratory diseases

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Review Article

ABSTRACT

Background: Global warming is a consequence of air pollution resulting in climate change due to trapping of excess greenhouse gases in the earth's atmosphere that affects biodiversity and constitutes a serious health hazard, especially tothe respiratory system. These greenhouse gases include carbon dioxide, water vapor, methane, ozone and nitrous oxide. They hold heat in the atmosphere thereby creating a greenhouse effect. Thesources of these gases include human activities like industrial air pollution, burning of human waste, wood and forests, tobacco, fossil fuels like oil, natural gas and coal, deforestation and the release of chlorofluorocarbons (CFCs). Climate change brought about by global warming results in storms, drought, and floods which can be of immediate threat to life, the respiratory system being particularly vulnerable because of the background air pollution. Effects of global warming on the respiratory system include potentially increased incidence (and/or worsening/exacerbations) of the following: bronchial asthma and other allergic diseases, infection (pneumonia and tuberculosis), parasitic lung diseases, chronic obstructive pulmonary disease, hypersensitivity pneumonitis, lung cancer and sudden death.

Aim: To create awareness and increase enlightenment about the very important subject of global warming and the lung.

Methods: A literature search on global warming and respiratory diseases was carried out through the internet (Google, Medline) and locally. Data synthesis was carried out and synchronized under the following headings: introduction, effects of global warming on respiratory diseases, respiratory diseases, and recommendations.

Conclusion: There is urgent need for control measures to be taken to mitigate the effects of global warming on the respiratory system.

Keywords: Global warming**,** respiratory diseases

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Effets du réchauffement global de maladies respiratoires

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Révision Article

RÉSUMÉ

Antécédents : Le réchauffementclimatiqueestuneconséquence de la pollution de l'airrésultant de changementsclimatiques en raison de piégeage des excès de serredansl'atmosphère de la terre qui affecte la diversitébiologique et constitue un grave danger pour la santé, en particulier pour le systèmerespiratoire. Cesgaz à effet de serresontnotamment le dioxyde de carbone, de la vapeurd'eau, le méthane, l'ozoneetl'oxydenitreux. Ilsmaintiennent la chaleurdansl'atmosphère, créantainsi un effet de serre. Uniquetout en maintenant cesgazinclure les activitéshumainescomme la pollution atmosphériqued'origineindustrielle, la combustion de déchetshumains, bois et forêts, le tabac, les combustibles fossilescomme le pétrole, le gaz naturel et le charbon, la déforestation et les émissions de chlorofluorocarbures (CFC). Changementclimatiqueprovoqué par le réchauffementplanétairerésultatsdans les tempêtes, les sécheresses et les inondations, qui peuventêtre de menace immédiate pour la vie, le systèmerespiratoiresontparticulièrementvulnérables en raison de l'arrière-plan de la pollution atmosphérique. Effets du réchauffement de la planètesur le systèmerespiratoireincluentpotentiellementune augmentation de l'incidence (et/oul'aggravation/exacerbations) des élémentssuivants :asthmebronchique et d'autres maladies allergiques, infection (la pneumonie et la tuberculose), parasitaires maladies pulmonaires, les maladies pulmonairesobstructiveschroniques, pneumopathied'hypersensibilité, le cancer du poumon et la mort subite.

Objectif: sensibiliseret augmenter l'illuminationsur le très important sujet du réchauffement de la planète et le poumon.

Méthodes: unerecherchedocumentairesur le réchauffement de la planèteet maladies respiratoires a étéréaliséeparl'intermédiaire de l'internet (Google, Medline) et localement. Synthèse des données a étéeffectuéeetsynchronisés sous les rubriquessuivantes: introduction, les effets du réchauffement de la planètesur maladies respiratoires, les maladies respiratoires, et des recommandations.

Conclusion: Il existe un besoin urgent de mesures de contrôledoiventêtreprises pour atténuer les effets du réchauffement de la planètesur le systèmerespiratoire .

Mots-clés: réchauffement de la planète, maladies respiratoires

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INTRODUCTION

What is global warming? Global warming is a term used to describe the phenomenon of an abnormal rise in temperatures on the surface of the earth due to increases in atmospheric trapping of radiated heat from the sun (1). The phenomenon has been attributed to the rise in concentrations of anthropogenicgreenhouse gases in the atmosphere. Examples of these greenhouse gases include carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O) andmembers of halocarbon and related families known as chlorofluorocarbons (CFCs).

The built up of these gases in the atmosphere is responsible for the atmospheric blanket and this has been increasing since the mid-18th century due to human activities (2). Carbon dioxide concentration is increased primarily through the burning of fossil fuel, coal mining, deforestation and burning of residues from grainfields, animal and domestic waste, coal mining, burning of biomass and gas flaring. The CFCs are wholly man-made and are used in refrigeration, automobile air-conditioning and as aerosol propellant. Increase in the concentrations of these anthropogenic greenhouse gases in the atmosphere leads to depletion of the ozone layer, which normally protects the earth surface from ultraviolet B (UV-B) radiation from the sun.

In the developed parts of the world, industrial development, continued use of fossil fuel engines, and destruction of forests have ledto an increase in the carbon dioxide concentration in the atmosphere from 280 parts per million by volume (ppbv) during the pre-industrial era to 358 ppmv;methane from 700parts per billion volume (ppbv) to 1720 ppbv;nitrous oxide from 275 ppbv to 312 ppbv; and CFCs from 0 to 268 ppbv (3). In the developing countries, there is also overwhelming evidence of increasing atmospheric pollution from industrial activities, burning of firewood for cooking (domestic pollution), vehicular combustion, and gas flaring (4-11) both in urban and rural areas. The overall long-term effect of all these human activities is to increase the anthropometric greenhouse gases in the atmosphere with the resultant decrease in the protective ozone layer, and subsequent rise in the temperature of the surface of the earth.

These changes have resulted in the atmospheric blanket which was so important for origin of life on earth, now actually threatening life as we know it today. Heat trapping by the atmosphere is necessary, to some extent, and without it the earth surface temperature would have been around 18^0C. However, excessive trapping of heat can be detrimental to human, plant and animal on the surface of the earth. A significant rise in the temperature of the surface of the earth (about 0.4 ^{0}C) has occurred in the past 25years, and the last decade of the 20th century witnessed 9 of the 11 hottest recorded years and it is being projected that at the current rate of temperature rise, the next century will witness a rise of between 1 to 3.5^0C (3). The changes are anticipated to be more marked at higher latitudes and altitudes, causing rain, droughts, and storms.

EFFECTS OF GLOBAL WARMING ON RESPIRATORY DISEASES

According to the European Respiratory Society (ERS), 1^{o}C increase in atmospheric temperature can double the risk of premature death in patients with respiratory diseases when compared with people without respiratory diseases (12). A 1^0C increase in temperature can produce a 1-3% increase in all - cause mortality in the general population, but 6% increase among people with respiratory illnesses. Thefactors relating to global warming that canaffect respiratory diseases in the short and long term include: extreme temperatures, increase in air pollution (gaseous and particulate), floods e.g Ibadan floods, damp housing, thunderstorms and cyclones e.g Hurricane Katrina and the Indonesian or Japanese tsunamis, the recent typhoon in the Philippines, changes in allergen deposition and consequent allergies, bush fires, dust storms, worsening ozone levels in urban areas, increased desertification, destruction

of crops and animals causing nutritional diseases, demographic displacements, and socio-economic deprivation(13-15).

RESPIRATORY DISEASES

Although limited research has been conducted on the direct consequences of global warming on respiratory diseases, it has been postulated that about 42 percent of respiratory illnesses in the developing countries are related to global warming, while the developed countries have much lower estimates even though the latter are responsible for most of the air pollution that has resulted in the global warming (16). Potentially increased incidence (and / or worsening/ exacerbations) of the following respiratory diseases can occur as a result of the above – mentioned factors:

1. Bronchial Asthma and other allergic diseases e.grhinosinusitis. The factors to consider include: increased temperatures are more conducive for allergen – producing flora eg pollens (17), psychological stress (9), increased atmospheric pollution from gases and particulate matter(13), increased ground – level ozone in urban areas(18).

2. Infections

a. Pneumonia (community – acquired especially Legionella, Plague). The factors to consider here will include: increased atmospheric pollutants from gases and particulate matter (13), malnutrition (due to low food productivity and economic deprivation) (9), and change in distribution of bacterial agents since some organisms like Legionnella thrive in hot weather conditions (19).

b. Tuberculosis The factors to consider include the following: increased atmospheric pollutants from gases and particulate matter (13), malnutrition (due to low food productivity and economic deprivation) (9), demographic displacements causing refugee-like overcrowding e.g. from flooding, and increase in HIV infection . Mycobacterium tuberculosis also multiplies faster with high environmental temperatures (14).

3. Parasitic lung diseases The factors to consider here include: distribution of many parasitic diseases is closely correlated with temperature and the fact that some vectors and parasites may become established in the temperate zones of the world, e**.g.** malaria, Loefflers syndrome (tropical pulmonary eosinophilia), shistosomiasis (9).

4. Chronic Obstructive Pulmonary Disease (COPD) The main factor to consider here is the increased atmospheric pollutants from gases and particulate matter (20). The increase in environmental temperature also predisposes COPD patients to frequent exacerbations and consequent increased mortality (12).

5. Hypersensitivity Pneumonitis (an environmental lung disease) The factors to consider are: increased temperatures are more conducive for allergen – producing flora (17), increased atmospheric pollutants from gases and particulate matter(13), and change in distribution of bacterial agents (19).

6. Lung Cancer The factors here will include: increased ground-level ozone in urban areas (18), metastasis e.g. from non-melanoma skin cancer (9), and the increased atmospheric pollutants from gases and particulate matter (13). An increased incidence of lung cancer has been recorded in China and the disease was recently reported in an eight-year old child (21). The most plausible explanation is the very high level of environmental air pollution in that country as a consequence of rapid industrial development. Air pollution has now been listed as a grade 1 carcinogen by the International Agency for Research on Cancer (IARC) of the World Health Organization (22).

7. Sudden death (especially among infants, the elderly, weak people and those with pre-existing respiratory morbidity) Factors to consider are: drowning from flooding, collapsed buildings, thunder striand heat stroke (9).

Generally, Climate Change (Global Warming) and war have similar destructive effects on mankind. They both cause death (sudden and delayed) i.e low life expectancy,

untold human suffering by way of diseases, socio-economic deprivations demographic dislocations (refugees) and total anarchy in human existence. Yet global warming is almost totally man-made. Humanity is reaping what it has been sowing since many centuries through industrialization, population explosion, transportation and civilization.

According to the Nigeria Emergency Management Agency, the 2012 flooding in Nigeria resulted in 2.6 trillion naira in total economic loss, several states were affected, 7 million people were affected, 2.3 million people were displaced, more than 363 people were killed, while 597,476 houses were damaged.

RECOMMENDATIONS

(i) Reduction and prevention of atmospheric pollution from industrial, domestic and vehicular sources must be pursued. This has already been advocated (4). If carefully implemented there will be a reduction in the anthropogenic greenhouse gases, and the attendant advantage of possible eventual reduction in the temperature of the earth surface. Alternative sources of energy e.g solar and wind energy should be vigorously exploited.

(ii) Each Ministry of Health should have a functional Air Pollution Control Unit to ensure the formulation, implementation, and enforcement of national policies on air pollution control.

(iii) There is the need for industrialized countries to ratify the United Nations Framework Convention on Climate Change signed in Rio de Janeiro in 1993 to limit atmospheric greenhouse gases (13). International co-operation is therefore essential, and it will also allow for the pursuit of the just International Economic Order. The importance of international co-operation cannot be over- emphasized when it is realized that storms have the ability to transport bacteria, viruses, particles and gases several hundred kilometers in a relatively: short period of time (3) with theattendant cross-border spread of diseases.

(iv) The use of only the items / equipment that are environment friendly i.e. those that will not emit substances or gases that can deplete the ozone layer should be encouraged. For example, asthmatics who are on sulbatamol inhalers should be encouraged to use those with ozone sparing propellants (OSP).

(v) Health educating the community on the causes and health effects of global warming must be carried out, so that the people's co-operation on preventive and control measures taken by government can be guaranteed. This will also correct the prevalent erroneous and superstitious beliefs concerning air pollution and global warming (23,24).

(vi) There is need for epidemiological surveillance of diseases in the developing countries so that any changes in disease distribution due to global warming can be detected early and appropriate prompt control measures taken.

(vii) Air pollution and global warming should be given the importance they deserve in health sector allocations.

(viii) To effectively tackle the health problems associated with global warming, a multi- disciplinary approach, both in and out of the medical profession, must be adopted. Physicians, epidemiologists, statisticians are needed in medicine while meteorologists, engineers, physicists, town planners, lawyers, accountants, geographers, biologists, politicians etc are needed outside medicine.

(ix) The World Health Organization should continue to be involved in the subject of global warming and its health effects. This will foster the necessary international co-operation and allow for continued multidisciplinary research into the subject (25).

(x) he young people, particularly students should be carried along in all activities concerning air pollution since they will eventually inherit all the problems associated with it. They should also be encouraged to take up carriers relating to air pollution.(23)

(xi) Minimizing gas flaring by oil companies must be enforced.

(xii) Carbon sequestration should be encouraged in oil companies and industries to separate and capture carbon dioxide.

(xiii) Dredging of waterways will allow for easy flow of water during the rainy season.

(xiv) Tree planting (re-forestation) to reduce soil erosion and discouraging deforestation are very important measures to take.

(xv) Changing agricultural practices is necessary in view of different weather patterns or lack of water to enhance food production.

(xvi) Anti-smoking campaigns need to be intensified because tobacco smoking is a very important cause of air pollution and respiratory disease.

(xvii) Solar energy can be harnessed for domestic use and other purposes while wind energy can be similarly employed.

(xviii) There is the need for more respiratory physicians and facilities.

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