

Sanjiv Grover, Rajeshwari¹

INTRODUCTION

Global warming is the increase in the average temperature of the earth's near-surface air and oceans in recent decades and its projected continuation. Climate models referenced by the Intergovernmental Panel on Climate Change project indicate that global surface temperatures are likely to increase by 1.1-6.4°C (2.0-11.5°F) between 1990 and 2100.^[1] Unfortunately, recent human activities are enhancing the natural greenhouse effect. The concentrations of certain greenhouse gases in the atmosphere are increasing; therefore, more of the infrared radiation emitted by the earth's surface is being trapped. The planet is losing less heat and, as a result, we are beginning to experience "Global warming." The major greenhouse gases are water vapor, carbon dioxide, methane, nitrous oxide, chlorofluorocarbons and ozone. Some of these occur naturally and some result only from human activity. Were it not for this natural greenhouse effect, the earth would be at least 30°C cooler.^[2]

EFFECTS OF GLOBAL WARMING

An increase in global temperatures can cause changes, including sea level rise, and changes in the amount and pattern of precipitation, resulting in floods and drought. Experts have also warned that the melting ice glaciers could release bacteria, fungi and viruses incorporated during the freezing process that have been lying dormant for thousands of years that people thought have been eradicated. Heat could make common viruses develop strains to which people have no resistance

Department of Dermatology, Command Hospital and AFMC, Pune, India and ¹Military Hospital, Tezpur, Assam, India

Address for correspondence:

Dr. Sanjiv Grover, Department of Dermatology, Command Hospital and AFMC, Pune, India. E-mail: sanjivgrover@rediffmail.com

DOI: 10.4103/0378-6323.53127 -

and increases in the ranges of disease vectors.^[1] Global warming can reportedly influence animal evolution, increased disease prevalence and disease progression and even animal extinctions.^[3]

The effects of global warming on India vary from steady sea-level rise, increased cyclonic activity, changes in ambient temperature and precipitation patterns, submergence of low-lying islands and coastal lands to the melting of glaciers in the Indian Himalayas and increased landslides and flooding, impacting millions of lives in addition to leading to environmental disasters.^[4]

ULTRAVIOLET LIGHT

The sun is responsible for the development and continued existence of life on earth. The UV region of the electromagnetic spectrum is subdivided into three bands, termed UVA, UVB and UVC. Environmental photobiologists normally define the wavelength regions as UVA, 400-320 nm; UVB, 320-290 nm; UVC, 290-200 nm. The quality and quantity of UV radiation (UVR) at the earth's surface depend on the energy output of the sun and the transmission properties of the atmosphere. From a biological viewpoint, UVB radiation is by far the most significant part of the terrestrial UV spectrum and the levels of radiation in this waveband reaching the surface of the earth are largely controlled by ozone. It has been proposed that behavior associated with climate change may be the largest determinant of sun exposure, with a consequent impact on skin cancer, in UK.^[5,6] It has been speculated that the long-term elevation of temperature by 2°C, as a consequence of climate change, may increase the carcinogenic effectiveness of solar UV by 10%.^[7]

EFFECTS OF SOLAR UVR ON THE NORMAL SKIN

The normal responses of the skin to UVR can be classified under two headings: Acute effects and chronic effects.^[5,8]

How to cite this article: Grover S, Rajeshwari. Global warming and its impact on skin disorders. Indian J Dermatol Venereol Leprol 2009;75:337-9.

Received: May, 2009. **Accepted:** May, 2009. **Source of Support:** Nil. **Conflict of Interest:** None declared.

Acute effects

Sunburn

Sunburn, or erythema, is an acute injury following excessive exposure to solar UVR. The redness of the skin that results is due to an increased blood content of the skin by dilatation of the superficial blood vessels in the dermis, mainly the subpapillary venules. High doses may result in edema, pain, blistering and, after a few days, peeling. Although it can be seen that UVA radiation is much less erythemogenic than UVB radiation, in the summertime, UVA radiation contributes about 15-20% to the sunburn reaction.

Tanning

A socially desirable consequence of exposure to unfiltered sunlight is the delayed pigmentation of the skin known as tanning, or melanin pigmentation. Melanin pigmentation of the skin is of two types: (i) constitutive – the color of the skin seen in different races and determined by genetic factors only and (ii) facultative – the reversible increase in tanning in response to solar UVR and other external stimuli.

Immediate pigment darkening

This is a transient darkening of the exposed skin that can be induced by UVA and visible radiation. Immediate tanning can become evident within 5–10 min of exposure to summer sun and normally fades within 1-2 h.

Delayed tanning

The more familiar delayed tanning becomes noticeable about 1-2 days after sun exposure, gradually increases for several days and may persist for weeks or months.

Chronic effects

Photoaging. The clinical signs of a photoaged skin are dryness, deep wrinkles, accentuated skin furrows, sagging, loss of elasticity, mottled pigmentation and telangiectasia.

Carcinogenesis

Nonmelanoma skin cancer (NMSC). Skin cancer is the most common human cancer. Each 1% loss of total ozone leads to a 3-5% increase in skin cancer cases.^[2] Chronic exposure to solar UVR is the most important cause of NMSCs. The two common types of NMSC are basal cell carcinoma (BCC) and squamous cell carcinoma. BCC accounts for about 80% of all NMSC.^[5]

Malignant melanoma. Changing patterns of sun exposure are believed to be an important factor in the

continuing rise in incidence of melanoma in certain countries like the USA.

EFFECT ON INFECTIOUS DISEASES

Most infectious diseases are transmitted by insects and vectors that are accustomed to certain climate conditions. Climatic factors influence the emergence of infectious diseases by shifting the geographic range of the insect vectors, lengthening the reproductive cycles of insects and by shortening the incubation period of pathogens. It has been reported that a 3°C warming in the United States could increase the range of some mosquito species that can carry the dengue and yellow fever viruses.^[9]

Staphylococcus, Streptococcus and enteric bacteria tend to colonize humans more readily in warmer climates and high temperatures and humidity reportedly increase the overall frequency of isolation of Gram-negative bacteria.^[10-12]

While human travel and migration are thought to cause the increasing incidence of tropical parasitic diseases in Europe and North America, global warming or climate tropicalization is implicated as one of the factors in the increase of human dermatophytes and mold infection.^[13,14]

NATURAL CALAMITIES AND DISEASES

While it remains controversial as to whether global warming was to blame for the tsunami that hit Indian Ocean nations in December 2004, it may be worthwhile to review the dermatologic conditions associated with this disaster. Many tsunami survivors with traumatic wounds were diagnosed to have skin and soft tissue infections with *Aeromonas* species; infections with uncommon pathogens such as *Burkholderia pseudomallei*, *Cladophialophora bantiana* and *Mycobacterium abscessus*; multidrug-resistant bacteria and polymicrobial infections, all as the result of exposure to contaminated freshwater due to flooding.^[15] In the aftermath of Hurricane Katrina, CDC reported wound infections with methicillin-resistant *Staphylococcus aureus*, *Vibrio vulnificus* and *Vibrio parahaemolyticus* in evacuees of Hurricane Katrina and tinea corporis, folliculitis, malaria and arthropod bites among rescue workers.^[16]

Diarrheal disease outbreaks can occur after drinking

water that has been contaminated, which have been reported after flooding and related displacement. A large (>16,000 cases) cholera epidemic (O1 Ogawa) in West Bengal in 1998 was attributed to preceding floods. Outbreaks of leptospirosis occurred in Mumbai, India, after flooding in 2000. Crowding is common in populations displaced by natural disasters and can facilitate the transmission of communicable diseases. Crowded living conditions facilitate measles transmission. Natural disasters, particularly meteorologic events such as cyclones, hurricanes and flooding, can affect vector-breeding sites and vector-borne disease transmission.^[17]

GLOBAL WARMING AND RISKS OF SEVERE ACNE

The human body maintains a temperature of around 98.2°F. Sebaceous glands and sweat glands are heat sensitive and rapidly produce their secretions. Thus, persistent rise in temperature results in an increased activity of the sebaceous glands and overproduction of sebum. Overproduction of sebum admixed with shed keratinocytes clogs the hair follicles, precipitating acne.^[18]

CONCLUSION

That global warming is a burning issue of our times is not in doubt as the consequences, whether environmental or medical, are enormous. The solution goes beyond mere scientific discussions and involves health education and awareness in one and all in order to make timely amends to stop the devastation that accompanies this radical phenomenon.^[19]

REFERENCES

1. Global Warming's Health Effects, eHealth Philippines. Available from: <http://www.ehealth.ph/index.php/latest-ehealth-news/43>.

2. Global Warming, the Ozone Layer and Acid Rain. Available from: <http://www.ecocentre.org.uk/global-warming.html>. [accessed on 2009 May 22].
3. Garg AD, Hippargi RV, Gadegone MM. Global warming and its impact: A story of adaptations, extinctions and diseases. In: Souvenir of National Seminar on Eco-Environmental Impact and Organism Response. Department of Chemistry, Kamla Nehru Mahavidyalaya, RTM Nagpur University, Nagpur (M.S.), India: 2007. p. 66-74.
4. Normile D. Some coral bouncing back from El Niño. *Science* 2000;288:941-2.
5. Diffey BL. Solar ultraviolet radiation effects on biological systems. *Rev Physics Med Biol* 1991;36:299-328.
6. Diffey BL. Climate change, ozone depletion and the impact of ultraviolet exposure on human skin. *Phys Med Biol* 2004;49:R1-11.
7. van der Leun JC, de Gruijl FR. Climate change and skin cancer. *Photochem Photobiol Biol Sci* 2002;1:324-6.
8. Giacomoni PU. Biophysical and Physiological Effects of Solar Radiation on Human Skin. Cambridge, UK: RSC Publishing; 2007.
9. Patz JA, Epstein PR, Burke TA, Balbus JM. Global climate change and emerging infectious diseases. *JAMA* 1996;275:217-23.
10. Taplin D, Lansdell L, Allen AM, Rodriguez R, Cortes A. Prevalence of streptococcal pyoderma in relation to climate and hygiene. *Lancet* 1973;1:501-3.
11. Yildirim A, Erdem H, Kilic S, Yetiser S, Pahsa A. Effect of climate on the bacteriology of chronic suppurative otitis media. *Ann Otol Rhinol Laryngol* 2005;114:652-5.
12. McBride ME, Duncan WC, Knox JM. Physiological and environmental control of Gram negative bacteria on skin. *Br J Dermatol* 1975;93:191-9.
13. Wilson ME, Chen LH. Dermatologic infectious diseases in international travelers. *Curr Infect Dis Rep* 2004;6:54-62.
14. Balato N, Patrino C, D'Errico FP, Balato A. Global warming and its effect on dermatology and plants. *Arch Dermatol* 2008;144:1016.
15. Thong HY, Maibach HI. Global warming and its dermatologic implications. *Int J Dermatol* 2008;47:522-4.
16. Centers for Disease Control and Prevention (CDC). Infectious disease and dermatologic conditions in evacuees and rescue workers after Hurricane Katrina - multiple states, August-September, 2005. *MMWR Morb Mortal Wkly Rep* 2005;54:961-4.
17. Watson JT, Gayer M, Connolly MA. Epidemics After Natural Disasters. *Medscape Dermatology*. Available from: <http://www.medscape.com/viewarticle/550435>. [accessed on 2009 May 22].
18. Global Warming and Risks of Severe Acne, SEO Press Release Distribution Newswire Service. Available from: <http://pressmediawire.com/article.cfm?articleID=4626>. [accessed on 2009 May 22].
19. Pandve H. Global warming: Need to sensitize general population. *Indian J Occup Environ Med* 2007;11:86-7.