Keeping your sunny side up

How sunlight affects health and well-being

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The invariable mark of wisdom is to see the miraculous in the common.

—Ralph Waldo Emerson, *Nature*

Increasing evidence confirms that everyday sunshine is a determinant of health and has an important role in preventing or ameliorating many afflictions, including depression, cancer, and postoperative pain. Although sunshine has been used therapeutically throughout history, sun exposure has been discouraged lately with allegations that solar rays induce skin cancer. Recent studies, however, cast doubt on the wisdom of solar abstinence.

Mood disorder and sunlight

My friend, a Professor Emeritus of family medicine, is a cheerful man who laughs boisterously and has a pleasant, charismatic manner. At our regular lunch he charms the waitresses, young and old, as he enthusiastically discusses his endeavours. He suffers, however, from seasonal affective disorder; when the cold and dark of winter set in, he becomes increasingly depressed, his sleep pattern is disrupted, and he no longer enjoys his regular activities. He manages to survive the melancholy with the help of antidepressant medication. His perspective on everything noticeably improves, however, as the snow melts; it is delightful to again hear his hearty laugh when spring is in full force.

The World Health Organization has concluded that depression, the "common cold" of mental illness, will soon be the second-leading cause of disability worldwide,[1] surpassed only by ailments related to heart function. Between 1945 and 1994, admissions for depression to United States mental health facilities increased from about 1/10000 to 3/1000 yearly, and the World Health Organization recently estimated that depressive disorders cost the American economy about $44 billion annually, equal to the total cost of all cardiovascular diseases. Antidepressant medications are the top-selling group of pharmaceuticals in the world. In 2002, 28 million Americans, and by all indications a substantial number of Canadians, consumed these products, representing a 300% increase during the last decade alone.

Some interesting research explores the causes of mood disorders, including infectious agents[2] and toxicologic determinants.[3,4] A recent study,[5] however, begins to explain the astonishing recovery some people experience when the sun begins to shine. The study reports that levels of serotonin in the brains of participants increased in direct relationship to their exposure to sunlight. Catheters placed in the internal jugular veins of participants allowed assessments to be done as these people were exposed to varying degrees of sunlight. The study found that "the rate of production of serotonin by the brain was directly related to the prevailing duration of bright sunlight, and rose rapidly with increased luminosity."[5]

The implications of this research are interesting. Since sufficient levels of serotonin facilitate well-being, sunshine might well be considered nature's oldest remedy for adverse moods. If people feel better, they will naturally be more active, sleep better, and have more positive outlooks—outcomes that promote health and wellness and make patients less likely to develop other afflictions. Intrigued by the findings of this study, I explored what the medical literature says about sunlight's effect on other health matters; the search proved fascinating.

Sunlight and health

Through the centuries, long before the discovery and isolation of serotonin, many health practitioners recognized that patients who spent time in the sun felt better. As a result, sunbaths and hothouses have long been used to restore health. Around 400 BC, Hippocrates, the father of medicine, routinely prescribed sunbaths as part of his management of a variety of maladies. In his health facility on the island of Cos, he had a large solarium that exposed patients to maximal amounts of sunlight as part of their therapy. The Roman philosopher Aulus Cornelius Celsus (25 BC to 50 AD) recommended that sufferers of melancholy live in spaces full of light. In 1863 Florence Nightingale appealed to hospital designers to include wards that were brightly lit by natural sunlight. Recent research also confirms that sunshine is not an incidental bystander; it is a major determinant of human health.

A brief search of the scientific literature confirms that diverse health conditions are affected by sunlight. For example, one study found that postoperative patients in sunny rooms experienced less stress and pain and used fewer analgesics than their counterparts in dimly lit rooms.[6] Various skin conditions, including psoriasis and pityriasis rosea, are improved by regular exposure to the sun.[7] Receiving the most attention, however, is the sun's effect on health through production of vitamin D.

The sun's ultraviolet rays penetrate the skin, and, through a local chemical reaction followed by systemic absorption and subsequent metabolism, a prohormone called 7-dehydrocholesterol in the skin is eventually

converted into circulating vitamin D. Recent epidemiologic data have identified hypovitaminosis D as a very common deficiency in first-world nations,[8-11] likely the result of indoor living. Although a detailed understanding of nutrients and vitamins is not a prominent part of most medical school curricula,[12,13] vitamin D deficiency was recently shown to have a substantial role in many diseases, including various cancers,[14-19] osteoporosis,[9] hormonal problems,[20] and certain autoimmune disorders.[14,21-23] But what about sun exposure as an etiological force in the oncogenesis of skin cancer?

Sunlight and skin cancer

Over the last 2 decades, a sun-phobia paradigm has evolved, where many in our culture avoid sun for fear of developing skin cancer. Many experts have attributed the increasing incidence of various types of skin lesions, particularly malignant melanoma, to sun exposure, warning patients to restrict time in direct sunlight and to cover exposed flesh with protective lotions. Extensive research has demonstrated that sun exposure can contribute to the formation of skin abnormalities, but some recent epidemiologic findings have complicated the simplistic "sun causes skin cancer" dogma.

Although skin cancer has increased markedly during the last century, this malignancy has proliferated at a time when people live and work indoors more than ever before and generally have less sun exposure. People are spending much more of their leisure time in front of television and computer screens than basking in the sun. In 1900 more than 75% of the population of North America worked outdoors compared with only 10% by 1970. Furthermore, a study of melanoma incidence among United States Navy personnel showed a substantially higher occurrence among those with indoor jobs, such as engine crews, than among outdoor staff working in direct sunlight.[24] In addition, while malignant melanoma was uncommon until about 50 years ago, it now appears to have become prevalent among office workers and professionals who spend most of their time indoors. Most melanoma lesions occur on areas of the body, such as the torso, that are least exposed to sunlight.

Various other factors just do not add up to the 1-dimensional notion that sun exposure, in the absence of sunburn, is a direct cause of skin cancer. High-quality sunblocks are known to be efficient in blocking the allegedly damaging ultraviolet rays of the sun. Recent evidence, however, has demonstrated no association between use of sunscreens and less risk of melanoma,[25] and one article noted that "countries where chemical sunscreens have been recommended and adopted have experienced the greatest rise in malignant melanoma."[26]

Although there appears to be good evidence that various types of skin cancers are related to damage from some types of sun exposure, such as sunburn, the complexities of this issue are far from resolved. Recent research reveals that, although sun exposure might in fact be a trigger for skin cancer, cancer generally appears in predisposed individuals who have become susceptible as a result of certain environmental or toxicologic exposures, dietary and lifestyle influences, or exposure to ionizing radiation and electromagnetic fields.[27,28]

Conclusion

Just as vegetation is dependent on the sun's rays for sustenance, sunlight is also a major determinant of human health with distinct benefits attributed to judicious sun exposure. With the average person in Canada spending more than 90% of his or her time indoors, it seems worthwhile to encourage patients to partake of moderate sunshine and proactively educate children to play outdoors. Furthermore, with many hospital patients confined to sun-deprived wards, a move to facilitate sun exposure for inpatients might facilitate the healing process.

While the new research on sunlight leaves many questions unanswered, my retired doctor friend who suffers from seasonal affective disorder now claims that next winter he is going to travel south to soak up some rays in a nudist colony. He wants to know if the cost is covered by his health insurance.

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References

1. Michaud CM, Murray CJ, Bloom BR. Burden of disease—implications for future research. *JAMA* 2001;285:535-9.
2. Bode L, Ludwig H. Borna disease virus infection, a human mental-health risk. *Clin Microbiol Rev* 2003;16:534-45.
3. Rapp DJ. *Our toxic world: a wake up call—chemicals damage your body, brain, behavior and sex.* Buffalo, NY: Environmental Medical Research Foundation; 2004.
4. Rogers SA. *Depression: cured at last!* Syracuse, NY: Prestige Publishing; 1997.
5. Lambert GW, Reid C, Kaye DM, Jennings GL, Esler MD. Effect of sunlight and season on serotonin turnover in the brain. *Lancet* 2002;360:1840-2.
6. Walch JM, Rabin BS, Day R, Williams JN, Choi K, Kang JD. The effect of sunlight on postoperative analgesic medication use: a prospective study of patients undergoing spinal surgery. *Psychosom Med* 2005;67:156-63.
7. Horio T. Skin disorders that improve by exposure to sunlight. *Clin Dermatol* 1998;16:59-65.
8. Gordon CM, DePeter KC, Feldman HA, Grace E, Emans SJ. Prevalence of vitamin D deficiency among healthy adolescents. *Arch Pediatr Adolesc Med* 2004;158:531-7.
9. Bettica P, Bevilacqua M, Vago T, Norbiato G. High prevalence of hypovitaminosis D among free-living postmenopausal women referred to an osteoporosis outpatient clinic in northern Italy for initial screening. *Osteoporos Int* 1999;9:226-9.
10. Holick MF. *The UV advantage.* Rocklin, Calif: Prima Publishing; 2003.
11. Lehtonen-Veromaa MK, Mottonen TT, Nuotio IO, Irjala KM, Leino AE, Viikari JS. Vitamin D and attainment of peak bone mass among peripubertal Finnish girls: a 3-y prospective study. *Am J Clin Nutr* 2002;76:1446-53.
12. Mihalynuk TV, Scott CS, Coombs JB. Self-reported nutrition proficiency is positively correlated with the perceived quality of nutrition training of family physicians in Washington State. *Am J Clin Nutr* 2003;77:1330-6.
13. Darer JD, Hwang W, Pham HH, Bass EB, Anderson G. More training needed in chronic care: a survey of US physicians. *Acad Med* 2004;79:541-8.
14. Holick MF. Sunlight and vitamin D for bone health and prevention of autoimmune diseases, cancers, and cardiovascular disease. *Am J Clin Nutr* 2004;80(6 Suppl):1678S-88S.
15. Kleibeuker JH, van der Meer R, de Vries EG. Calcium and vitamin D: possible protective agents against colorectal cancer? *Eur J Cancer* 1995;31A:1081-4.
16. Lefkowitz ES, Garland CF. Sunlight, vitamin D, and ovarian cancer mortality rates in US women. *Int J Epidemiol* 1994;23:1133-6.
17. Miller GJ. Vitamin D and prostate cancer: biologic interactions and clinical potentials. *Cancer Metastasis Rev* 1998-1999;17:353-60.
18. John EM, Schwartz GG, Dreon DM, Koo J. Vitamin D and breast cancer risk: the NHANES I epidemiologic follow-up study, 1971-1975 to 1992. National Health and Nutrition Examination Survey. *Cancer Epidemiol Biomarkers Prev* 1999;8:399-406.
19. Garland CF, Garland FC, Gorham ED. Calcium and vitamin D. Their potential roles in colon and breast cancer prevention. *Ann N Y Acad Sci* 1999;889:107-19.
20. Kinuta K, Tanaka H, Moriwake T, Aya K, Kato S, Seino Y. Vitamin D is an important factor in estrogen biosynthesis of both female and male gonads. *Endocrinology* 2000;141:1317-24.
21. Vogelsang H, Ferenci P, Woloszczuk W, Resch H, Herold C, Frotz S, et al. Bone disease in vitamin D-deficient patients with Crohn's disease. *Dig Dis Sci* 1989;34:1094-9.
22. Freedman DM, Dosemeci M, Alavanja MC. Mortality from multiple sclerosis and exposure to residential and occupational solar radiation: a case-control study based on death certificates. *Occup Environ Med* 2000;57:418-21.
23. Cantorna MT. Vitamin D and autoimmunity: is vitamin D status an environmental factor affecting autoimmune disease prevalence? *Proc Soc Exp Biol Med* 2000;223:230-3.
24. Garland FC, White MR, Garland CF, Shaw E, Gorham ED. Occupational sunlight exposure and melanoma in the U.S. Navy. *Arch Environ Health* 1990;45:261-7.
25. Dennis LK, Beane Freeman LE, VanBeek MJ. Sunscreen use and the risk for melanoma: a quantitative review. *Ann Intern Med* 2003;139:966-78.
26. Garland CF, Garland FC, Gorham ED. Could sunscreens increase melanoma risk? *Am J Public Health* 1990;82:614-5.
27. Levitt BB. *Electromagnetic fields.* Orlando, Fla: Harcourt, Brace & Company; 1995.
28. Grob JJ, Stern RS, MacKie RM, Weinstock WA, editors. *Epidemiology, causes and prevention of skin diseases.* Oxford, Engl: Blackwell Science; 1997.