

Cancer Association of South Africa (CANSA)



Research • Educate • Support

Fact Sheet on Solar Radiation and Skin Cancer

Introduction

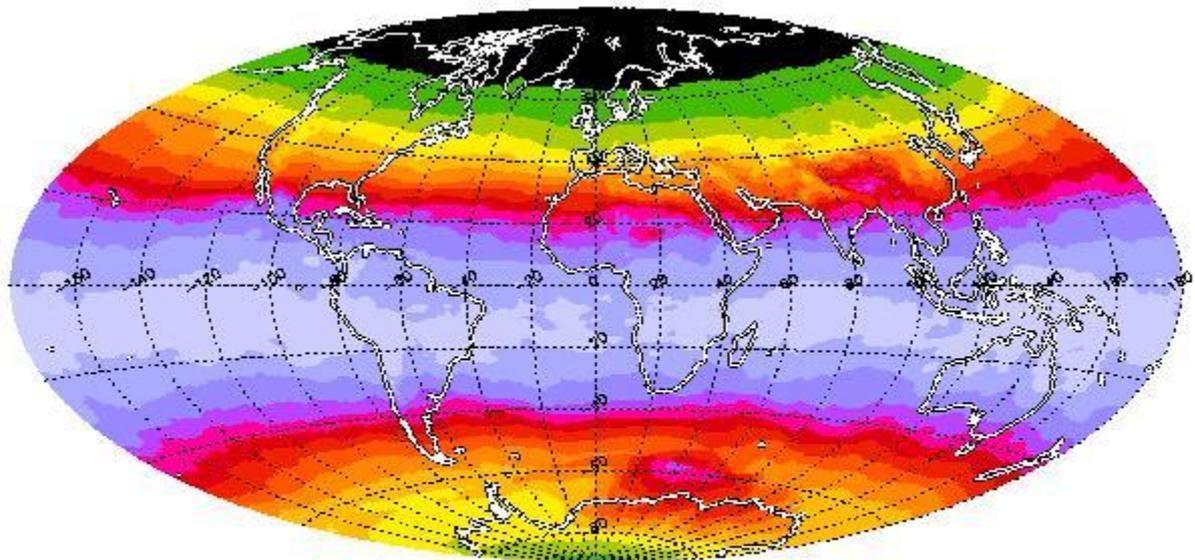
Solar radiation is more than the light and heat that we perceive from the sun. The sun is a star and it produces energy in many forms, from perceptible heat, visible and invisible spectrums of light, radiation, and more. Life on earth would be impossible without the sun, but our atmosphere also protects us from the more dangerous aspects of solar radiation.

Humans tend to have a love-hate relationship with the sun. On the one hand, sunlight keeps us warm, creates food and shelter for us via plant life, and gives us light. On the other hand, as greenhouse gases trap more heat and the ozone layer allows more dangerous ultraviolet (UV) light through, the sun's rays can be distinctly dangerous (American Cancer Society). UV rays cause skin cancer in humans and animals, but can contrastingly improve other skin conditions like psoriasis (Psoriasis-Aid.Com). Humans need the sun biologically, as well, as it causes our bodies to produce vital Vitamin D (About.Com).

World Ultraviolet Radiation Map

[Picture credit – World UVR Map]

—



0 0.5 1.5 2.5 3.5 4.5 5.5 6.5 7.5 8.5 9.5 10.5 12.5 14.5 UVI

Daily maximum of UV Index clear sky, 28.10.04 00:00 UTC period= +12 h

The Sun is the centre of our galaxy both literally and figuratively. The sun is approximately 149 million kilometres away, sending its energy to the Earth in about 8 minutes. This energy is a combination of both light and UV rays. Known as a yellow dwarf star in the astronomy world, the sun is busy converting hydrogen to helium at its core by way of nuclear fusion. The result of this action is energy (Suntan.Com).

Solar radiation and sunlight make it possible for the earth to house life (NASA). The negative aspects of our relationship with the sun are primarily the result of human irresponsibility: we develop skin cancer when we ignore our bodies' signals to avoid sunlight, while we rather struggle with global warming because we have ignored the environmental concerns of our actions. When we do not give solar radiation the respect it deserves, we are literally playing with fire (Solarradiation.Net).

Solar Radiation

Solar radiation is thermal radiation emitted from the surface of the sun, which is powered by nuclear fusion. It is radiant energy emitted by the sun which comprises mostly of electromagnetic energy. About half of the radiation is in the visible short-wave part of the electromagnetic spectrum. This is the part of light that can be seen by the human eye. The other half of solar radiation is mostly in the near-infrared part, with some in the ultraviolet (UV) part of the spectrum (WordIQ.Com).

Classification of Electromagnetic Energy

The electromagnetic spectrum is divided into several parts:

- *Electric Power* – electric power covers the low-frequency, long-wavelength end of the spectrum. It is usually ducted along 2-wire and 3-wire transmission lines and is what we use to power up items in our homes.
- *Radio Waves* – radio waves are generally utilised by antennas of reasonable size, so their wavelengths range from hundreds of metres to about one millimeter. The different parts of the radio spectrum are called bands. Television (TV), mobile phones, wireless networking and amateur radio all use Radio Waves.
- *Microwaves* – microwaves are waves which are typically short. It is produced with Klystrom and Magnetron tubes. Microwaves are absorbed by molecules that have a dipole moment in liquids. In a microwave oven, this effect is used to heat food. Low-intensity microwave radiation is used in Wi-Fi. An average microwave oven in active condition is, in close range, powerful enough to cause interference with poorly shielded electromagnetic fields such as those found in mobile medical devices and cheap consumer electronics.
- *Infrared Radiation* – the infrared part of the electromagnetic spectrum covers three main parts:
 - Far-infrared
 - Mid-infrared
 - Near-infrared

- *Visible Radiation (Light)* - after infrared comes visible light. This is the range in which the sun and stars, similar to it, emit most of their radiation. The different colours that the human eye can see all have a different wavelength.
- *Ultraviolet (UV) Light* – this is radiation of which the wavelength is shorter than the violet end of the visible spectrum. Being very energetic, UV can break chemical bonds, make molecules unusually reactive or ionize them, in general changing their mutual behaviour. Sunburn, for example, is caused by the disruptive effects of UV radiation on skin cells, which can cause skin cancer by damaging the complex DNA molecules in the skin cells. The sun emits a large amount of UV radiation, which could quickly turn earth into a dead desert, but most of it is absorbed by the atmosphere's ozone layer before reaching the surface of the earth.
- *X-Rays* – hard X-rays (highest energy X-rays) are of shorter wavelength than soft X-rays (low energy X-rays). X-rays make it possible for us to 'see' through some things and not others, as well as for high-energy physics and astronomy. Black holes and neutrons emit x-rays, which enable us to study them.
- *Gamma Rays* – these are the most energetic photons, having no lower limit to their wavelength. They are useful to astronomers in the study of high-energy objects or regions and find a use with physicists thanks to their penetrative ability and their production from radio-isotopes (WordIQ.Com).

Health Effects of Ultraviolet Radiation

Small amounts of UV are beneficial for people and essential in the production of vitamin D. UV radiation is also used to treat several diseases, including rickets, psoriasis, eczema and jaundice. This takes place under medical supervision and the benefits of treatment versus the risks of UV radiation exposure are a matter of clinical judgement.

Prolonged human exposure to solar UV radiation may result in acute and chronic health effects on the skin, eye and immune system. Sunburn (erythema) is the best-known acute effect of excessive UV radiation exposure. Over the longer term, UV radiation induces degenerative changes in cells of the skin, fibrous tissue and blood vessels leading to premature skin aging, photodermatoses and actinic keratoses. Another long-term effect is an inflammatory reaction of the eye. In the most serious cases, skin cancer and cataracts can occur.

Between 2 and 3 million non-melanoma skin cancers, e.g. basal cell carcinomas and squamous cell carcinomas, are diagnosed each year, but are rarely fatal and can be surgically removed. Approximately 130,000 malignant melanomas occur globally each year, substantially contributing to mortality rates in fair-skinned populations. An estimated 66,000 deaths occur annually from melanoma and other skin cancers.

Worldwide some 12 to 15 million people become blind from cataracts annually, of which up to 20% may be caused or enhanced by sun exposure according to WHO estimates. Furthermore, a growing body of evidence suggests that environmental levels of UV radiation may suppress cell-mediated immunity and thereby enhance the risk of infectious diseases and limit the efficacy of vaccinations. Both of these act against the health of poor and vulnerable groups, especially children of the developing world. Many developing countries are located close to the equator and hence, people are exposed to the very high levels of UV radiation that occur in these regions.

It is a popular misconception that only fair-skinned people need to be concerned about overexposure to the sun. Darker skin has more protective melanin pigment, and the incidence of skin cancer is lower in dark-skinned people. Nevertheless, skin cancers do occur with this group and unfortunately they are often detected at a later, more dangerous stage. The risk of UV radiation-related health effects on the eye and immune system is independent of skin type.

Global Burden of Disease from Solar Ultraviolet Radiation

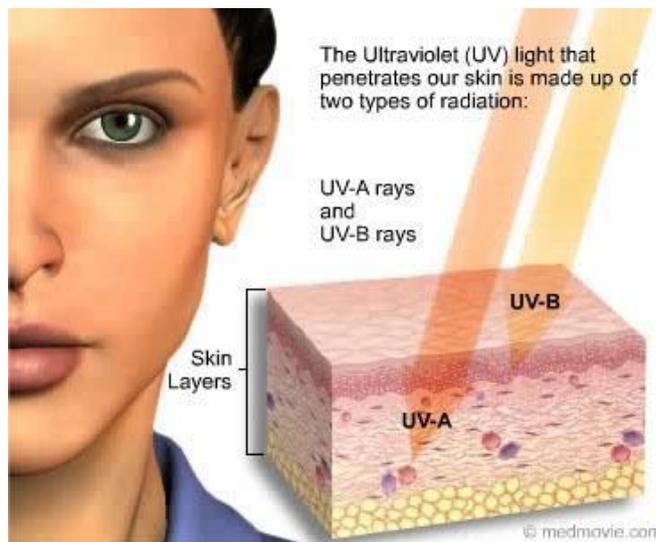
WHO has recently published a report entitled "Global burden of disease from solar ultraviolet radiation" that provides detailed estimates of UV-associated disease burden worldwide. Using established methodology and best available estimates on UV-related mortality and morbidity, this report estimates that annually around 1.5 mill DALYs (Disability-adjusted life years) are lost through excessive UV exposure. The report gives region, age and sex-specific estimates and includes detailed methodological considerations. A counterfactual zero population exposure to UV would generate a substantial burden of disease through diseases of vitamin D deficiency. This, however, is only a theoretical possibility since the large majority of people is casually exposed to UV radiation such that extremely low Vitamin D levels are rarely found (World Health Organization).

Incidence of Skin Cancer in South Africa

According to the National Cancer Registry (2011) the following cases of skin cancer were histologically diagnosed in South Africa during 2011:

Group 2011	Type of Skin Cancer	Actual Number of Cases	Estimated Lifetime Risk	Total of All Cancers
All Males	Basal Cell Carcinoma	8 000	1:17	24,87%
All Females		5 627	1:36	17,71%
All Males	Squamous Cell Carcinoma	3 386	1:40	10,55%
All Females		2 129	1:101	6,74%
All Males	Melanoma	672	1:213	2,09%
All Females		613	1:341	1,95%

Please refer to the different Fact Sheets for information on the various skin cancers. They can be viewed at www.cansa.org.za.



[Picture credit – UVA & UVB Rays]

Ultraviolet (UV) radiation is electromagnetic radiation of a wavelength shorter than that of the visible region (that which the human eye can see) of the electromagnetic spectrum. The name means 'beyond violet', violet being the colour of the shortest wavelengths of visible light.

The sun emits UV radiation in the UVA, UVB, and UVC bands, but because of absorption in the atmosphere's ozone

layer most of the ultraviolet radiation that reaches the earth's surface is UVA (WordIQ.Com). In general, UVA contributes to the ageing of skin, DNA damage and possibly even skin cancer (Suntan.Com). It penetrates deeply and does not cause sunburn.

While ultraviolet B (UVB) rays, the main cause of sunburn, are the strongest in the summer, ultraviolet A (UVA) rays remain constant throughout the year. UVA rays account for up to 95 percent of the UV radiation reaching the Earth's surface. Although they are less intense than UVB, UVA rays are 30 to 50 times more prevalent, and go through glass, making sun protection necessary indoors as well as out.

A new study in 2010 by researchers at NYU School of Medicine found that UVA radiation damages the DNA in human melanocyte cells, causing mutations that can lead to melanoma. Melanocytes, which contain a substance called melanin that darkens the skin to protect it from the ultraviolet rays of the sun, are more vulnerable to UVA radiation than normal skin cells because they are unable to repair themselves efficiently (ScienceDaily).

UVB radiation has been linked to skin cancers including melanoma. Researchers at The University of Texas M. D. Anderson Cancer Center have found that the risk of developing melanoma, the most deadly form of skin cancer, is only partially associated with exposure to ultraviolet B (UVB) radiation, the rays in sunlight that increase in summer and cause sunburn (ScienceDaily). The radiation ionises DNA molecules in skin cells and, thereby, damaging the DNA.

UVB radiation is also responsible for the formation of Vitamin D within the epidermis of the skin from pro-vitamin D3 (Meinhardt-Wollweber & Krebs).

South Africa has the second highest incidence of skin cancer in the world after Australia as far as Caucasians are concerned. The good news is that skin cancer can be prevented by respecting the sun. The three most common types of skin cancers are basal cell carcinoma (BCC), squamous cell carcinoma (SCC) and malignant melanoma (IOLNews).

Skin Cancer

There are three (3) most common types of skin cancers:

Basal Cell Carcinoma - Basal cell carcinoma, or basal cell skin cancer, is the most common form of cancer. Most skin cancers are basal cell cancer.

Basal cell carcinoma starts in the top layer of the skin called the epidermis. Most basal cell cancers occur on skin that is regularly exposed to sunlight or other ultraviolet radiation. This includes the top of your head, or scalp.

Basal cell skin cancer is most common in people over age 40. However, it occurs in younger people, too.

[Picture Credit: Basal Cell Carcinoma]

One is more likely to get basal cell skin cancer if one has:

- Light-coloured or freckled skin
- Blue, green, or grey eyes
- Blond or red hair



- Overexposure to x-rays or other forms of radiation
- Many moles
- Close relatives who have or had skin cancer
- Many severe sunburns early in life
- Long-term daily sun exposure (such as the sun exposure people who work outside receive).

(MedLinePlus).

Squamous Cell Carcinoma - Squamous cell carcinoma (SCC) is the second most common type of skin cancer. It begins in the squamous cells, which are found in the upper layer of the epidermis (skin). Fortunately, SCC is curable in 95% of cases if detected early.



[Picture Credit: Squamous Cell Carcinoma]

SCC primarily develops in fair-skinned, middle-aged and elderly people who have had long-term sun exposure. SCCs may also occur where skin has suffered certain kinds of injury: burns, scars, long-standing sores, sites previously exposed to X-rays or certain chemicals (such as arsenic and petroleum by-products). In addition, chronic skin inflammation or medical conditions that suppress the immune system over an extended period of time may encourage development of the disease. Finally, those who have been diagnosed with skin cancer previously are at a greater risk of recurrence. There are numerous less common risk factors for SCC as well (About.Com).

Malignant Melanoma - Malignant melanoma currently accounts for approximately 1% of all cancer deaths. However, the worldwide incidence of melanoma is increasing at a faster rate than any other neoplasm, with the exception of lung cancer in women.



[Picture credit – Melanoma]

South Africa has one of the highest incidences, if not the highest, of malignant melanoma in the world as far as Caucasians are concerned (at least similar to that of Australia). To date, we do not have accurate statistics, but the 2009 figure for the Cape is 69 new cases per year per population of 100 000 Caucasians, compared to 65 per 100 000 for Australia. This translates to one in 1 429 people developing a malignant melanoma. From 1990 to 1995, this figure was 22,2 per 100 000 for females and 27,5 per 100 000 for males.

In the period 2000 – 2003, this rose to 33,5 per 100 000 for females and 36,9 per 100 000 for males (South African Melanoma Advisory Board).

Melanoma can affect all ethnic and racial groups; however, the typical melanoma patient has a fair complexion and a tendency to sunburn rather than tan, even after a brief exposure to sunlight. Although there is no conclusive evidence that exposure to sunlight is causally related to the development of melanoma, lesions are most commonly found on sun-exposed areas of the body. Other epidemiologic risk factors include the occurrence of a previous melanoma and an afflicted first-degree relative (parent or sibling) (Cancer News).

There is a definite link between the occurrence of breast cancer and melanoma. A link has recently also been established between certain prostate cancers and melanoma.

Spot the Spot

Check your skin carefully every month by doing a mole check - ask a family member or friend to examine your back and the top of your head. If you notice any of the warning signs, see a doctor or dermatologist immediately.

Warning Signs

The following A B C D E warning signs apply:

A-symmetry - a mole or mark with one half unlike the other - common moles are round and symmetrical

B-order irregularities - scalloped or poorly defined edges - common moles have smooth and even borders

C-colour variations and inconsistency – tan, brown, black, red, white and blue - common moles are usually a single shade of brown or black

D-iameter - larger than 6 mm

E-volving – changes in shape, colour or border of a mole



[Picture Credit: ABCDE Warning Signs]

High Risk Exposure

Everyone is at risk of getting skin cancer, although people with darker skins are less susceptible because their skin contains more natural melanin that protects against sun damage. People with fair skin, especially those with red hair, moles or skin spots as well as people with a personal or family history of skin cancer, or who play sport outdoors, work in the sun or spend a lot of time driving, are considered high-risk.

Researched and Prepared by Prof Michael C Herbst

[D Litt et Phil (Health Studies); D N Ed; M Art et Scien; B A Cur; Dip Occupational Health]

Approved by Ms Elize Joubert, Chief Executive Officer [BA Social Work (cum laude); MA Social Work]

November 2016

At least 80% of sun-induced skin damage occurs before the age of 18 and only manifests later in life. Therefore, it is imperative to take special care of children in the sun, whether it is at the pool, on the beach, at play or at school. Babies younger than one year should never be exposed to direct sunlight. When it comes to protecting the young ones, mothers of babies and toddlers; educators and caregivers can play an important role.

Skin Types

People of skin of colour comprise the majority of the world's population and Asian subjects comprise more than half of the total population of the earth.

The most obvious ethnic skin difference relates to skin colour which is dominated by the presence of melanin. The photoprotection derived from this polymer influences the rate of the skin aging changes between the different racial groups. However, all racial groups are eventually subjected to the photoaging process.

Generally Caucasians have an earlier onset and greater skin wrinkling and sagging signs than other skin types and in general increased pigmentary problems are seen in skin of colour although one large study reported that East Asians living in the U.S.A. had the least pigment spots.

Changes in skin biophysical properties with age demonstrate that the more darkly pigmented subjects retaining younger skin properties compared with the more lightly pigmented groups. However, despite having a more compact stratum corneum (SC) there are conflicting reports on barrier function in these subjects. Upon a chemical or mechanical challenge the SC barrier function is reported to be stronger in subjects with darker skin despite having the reported lowest ceramide levels. Barrier function relates to the total architecture of the SC and not just its lipid levels.

Asian skin is reported to possess a similar basal transepidermal water loss (TEWL) to Caucasian skin and similar ceramide levels but upon mechanical challenge it has the weakest barrier function.

Differences in intercellular cohesion are obviously apparent. In contrast reduced SC natural moisturising factor levels have been reported compared with Caucasian and African American skin. These differences contribute to differences in desquamation but few data are available.

One recent study has shown reduced epidermal Cathepsin L2 levels in darker skin types which if also occurs in the SC could contribute to the known skin ashing problems these subjects experience.

The frequency of skin sensitivity is quite similar across different racial groups but the stimuli for its induction shows subtle differences. Nevertheless, several studies indicate that Asian skin may be more sensitive to exogenous chemicals probably due to a thinner SC and higher eccrine gland density. There is still more to learn and especially about the inherent underlying biological differences in ethnic skin types (Rawlings).

The most commonly used scheme to classify a person's skin type by their response to sun exposure in terms of the degree of burning and tanning was developed by Thomas B. Fitzpatrick*, MD, PhD (Fitzpatrick).

One can use the following skin-type charts for self-assessment of one's skin type by adding up the score for each of the questions that have been answered. At the end there is a scale providing a range for each of the six skin-type categories. Following the scale is an explanation of each of the skin types. One can quickly and easily determine which skin type one has.

Genetic Disposition of Skin

Score	0	1	2	3	4
What is the colour of your eyes?	Light blue, Grey, Green	Blue, Grey, Green	Blue	Dark Brown	Brownish Black
What is the natural colour of your hair?	Sandy Red	Blond	Chestnut / Dark Blond	Dark Brown	Black
What is the colour of your skin (non-exposed areas)?	Reddish	Very Pale	Pale with Beige tint	Light Brown	Dark Brown
Do you have freckles on unexposed areas of your skin?	Many	Several	Few	Incidental	None

Total Score for Genetic Disposition of Skin: _____

Reaction of Skin to Sun Exposure

Score	0	1	2	3	4
What happens when you stay in the sun too long?	Painful redness, blistering, peeling	Blistering followed by peeling	Burns sometimes followed by peeling	Rare burns	Never had burns
To what degree do you turn brown?	Hardly or not at all	Light colour tan	Reasonable tan	Tan very easy	Turn dark brown quickly
Do you turn brown within several hours after sun exposure?	Never	Seldom	Sometimes	Often	Always
How does your face react to the sun?	Very sensitive	Sensitive	Normal	Very resistant	Never had a problem

Total Score for Skin Reaction to Sun Exposure: _____

Tanning Habits

Score	0	1	2	3	4
When did you last expose your body to sun (or artificial sunlamp / tanning cream)?	More than 3 months ago	2-3 months ago	1-2 months ago	Less than a month ago	Less than 2 weeks ago
Did you expose the area to be treated to the sun?	Never	Hardly ever	Sometimes	Often	Always

Total Score for Tanning Habits: _____

Add up the total scores of the three (3) sections to determine your Skin Type Score.

Skin Type Score – Fitzpatrick Skin Type

Score	Skin Type
0 - 7	I
8 - 16	II
17 - 25	III
25 - 30	IV
Over 30	V - VI

The Six Fitzpatrick Skin Types

Below is a description of the six (6) Skin Types according to the Fitzpatrick Skin Type Scale:

Skin Type I:

Highly sensitive, always burns, never tans. Example: Red hair with freckles

Skin Type II:

Very sun sensitive, burns easily, tans minimally. Example: Fair skinned, fair haired Caucasians

Skin Type III:

Sun sensitive skin, sometimes burns, slowly tans to light brown. Example: Darker Caucasians.

Skin Type IV:

Minimally sun sensitive, burns minimally, always tans to moderate brown. Example: Mediterranean type Caucasians, some Hispanics.

Skin Type V:

Sun insensitive skin, rarely burns, tans well. Example: Some Hispanics, some Blacks

Skin Type VI:

Sun insensitive, never burns, deeply pigmented. Example: Darker Blacks (Fitzpatrick Skin)

Pictures of Skin Types According to the Fitzpatrick Skin Type Scale



[Picture Credit – Fitzpatrick Skin Types]

Reducing the Risk for Skin Cancer – The CANSA SunSmart Message

To prevent skin cancer, CANSA advocates the following:

- Avoid direct sunlight between 10:00 and 15:00 when the sun's rays are most dangerous. Stay in the shade or under an umbrella as much as possible
- UV rays reflect off cement, water, sand, glass and grass and can therefore cause sunburn in the shade. UV rays are not the same as heat. You can get overexposed even in cool weather - so take care on windy or overcast days
- Cover up by wearing thickly-woven hats with wide brims and loose-fitting clothes, made of tightly-woven, fabric that is cool, but will block out harmful UV rays. Look out for UV protective swimsuits and beach wear as UV radiation can penetrate fabric. Swimwear and umbrellas bearing the CANSA Seal of Recognition should also be part of your protection kit
- Always apply a sunscreen, preferably with a Sun Protection Factor (SPF) between 20 and 50 – preferably SPF 30 to 50 for fair to very fair skin. Apply the sunscreen generously to all exposed skin areas. It is preferable to always use a sunscreen bearing the CANSA Seal of Recognition (CSOR). Always apply sunscreen 20 minutes before going outside into the sun. Re-apply regularly (at least every two hours), after towel-drying, perspiring or swimming. Apply it liberally to all exposed skin; including the back of the neck, tips of ears, arms, feet and hands. The use of sunscreen lotion is not a license to 'bare all' in the sun. Go under cover whenever possible, to ensure that you are SunSmart while out in the sun
- Protect the eyes by wearing sunglasses with a UV protection rating of UV400
- Look out for the manufacture or expiry date on the sunscreen package. Sunscreen usually expires two (2) years after date of manufacture
- Once opened, sunscreen should NOT be used for longer than one (1) year
- Avoid sunlamps and tanning beds
- Take special care to protect children - babies younger than one year should never be exposed to direct sunlight
- Check your skin regularly for changes, unusual marks or moles. An annual medical examination should include a skin check. Ask a friend to check your back, top of your head and the back of your legs for spots or changes you may not notice yourself



CANSA's SunSmart campaign takes place during the summer months (November to February) and includes talks and exhibitions as well as visits to schools, holiday resorts and beaches in South Africa.

Researched and Prepared by Prof Michael C Herbst

[D Litt et Phil (Health Studies); D N Ed; M Art et Scien; B A Cur; Dip Occupational Health]

Approved by Ms Elize Joubert, Chief Executive Officer [BA Social Work (cum laude); MA Social Work]

November 2016

Sun Beds and Tanning Booths are not Safe

It has been proven through recent research findings that there is a relationship between the use of sun beds and malignant melanoma as well as other non-melanoma skin cancers. Sun beds predominantly emit UVA and UVB both which can cause damage in the DNA of skin cells (Cancer Research UK).

The mutagenic properties of UVA in humans have been confirmed in several studies. The possibility that indirect DNA damage induced by UVA could play a major role in melanoma occurrence is underlined by reports of multiple cutaneous melanomas developing in patients genetically highly susceptible to oxidative agents (IARC, 2005).

Sun beds and tanning booths deliver concentrated UVA radiation to unprotected skin and should be avoided at all costs, as it ages skin more rapidly while putting you at risk of developing skin cancer. According to Professor Werner Sinclair, a dermatologist associated with the University of the Free State: "In general, one can state that the use of an artificial tanning booth will double the melanoma risk of any particular individual."

An IARC Working Group has classified UV-emitting tanning devices as "carcinogenic to humans" (Group 1) (IARC).

The Meaning of a Sun Protection Factor (SPF)

The SPF 'Sun Protection Factor' listed on a container of sunscreen is a measure of how well the product protects one's skin from the sun's shorter-wave ultraviolet B (UVB) radiation. Technically, it is the ratio of how long one could spend in the sun before burning when one is protected by sunscreen, compared to when one does not have that protection. A common mistake is applying too little sunscreen, which can drastically reduce the effectiveness of the product. About 30g (a palm full) of sunscreen is recommended to cover the entire body, and it should be applied half an hour before sun exposure. One should reapply every two hours if staying outdoors for a long period of time. Applying sunscreen properly is one of the essential recommendations to lower one's risk of developing skin cancer (About.Com).

Here is how SPF – or Sun Protection Factor – works. If it takes five (5) to ten (10) minutes for your unprotected skin to start turning red, using an SPF 20 sunscreen theoretically prevents reddening twenty (20) times longer – about one hour and forty minutes to three hours twenty minutes (two hours on average). Most sunscreens with an SPF of 20 or higher do an excellent job of protecting against UVB.

All sunscreens bearing the CANSA Seal of Recognition (CSOR) have broad spectrum protection abilities, meaning they protect against ultraviolet A rays (UVA) and ultraviolet B rays (UVB). The CSOR is a guarantee that the manufacturers of these UV protective products have complied with the strict set of criteria developed by CANSA.

What 'Broad-Spectrum' Means with Reference to Sunscreens

Broad-spectrum sunscreens protect the skin from both UVA and UVB rays. The current South African Standard makes provision for protection against UVA and UVB radiation in a ratio of 0.4/1. Recent research, however, has found an increased correlation between UVA exposure and the onset of malignant melanoma, as well as non-optimal UVA protection provided by existing sunscreens in terms of the total UVA radiation spectrum and the photo

stability of many critical sunscreen chemicals leading to a worldwide demand for sunscreen with improved UVA protection properties.

About Clinical Trials

Clinical trials are research studies that involve people. These studies test new ways to prevent, detect, diagnose, or treat diseases. People who take part in cancer clinical trials have an opportunity to contribute to scientists' knowledge about cancer and to help in the development of improved cancer treatments. They also receive state-of-the-art care from cancer experts.

Types of Clinical Trials

Cancer clinical trials differ according to their primary purpose. They include the following types:

Treatment - these trials test the effectiveness of new treatments or new ways of using current treatments in people who have cancer. The treatments tested may include new drugs or new combinations of currently used drugs, new surgery or radiation therapy techniques, and vaccines or other treatments that stimulate a person's immune system to fight cancer. Combinations of different treatment types may also be tested in these trials.

Prevention - these trials test new interventions that may lower the risk of developing certain types of cancer. Most cancer prevention trials involve healthy people who have not had cancer; however, they often only include people who have a higher than average risk of developing a specific type of cancer. Some cancer prevention trials involve people who have had cancer in the past; these trials test interventions that may help prevent the return (recurrence) of the original cancer or reduce the chance of developing a new type of cancer

Screening - these trials test new ways of finding cancer early. When cancer is found early, it may be easier to treat and there may be a better chance of long-term survival. Cancer screening trials usually involve people who do not have any signs or symptoms of cancer. However, participation in these trials is often limited to people who have a higher than average risk of developing a certain type of cancer because they have a family history of that type of cancer or they have a history of exposure to cancer-causing substances (e.g., cigarette smoke).

Diagnostic - these trials study new tests or procedures that may help identify, or diagnose, cancer more accurately. Diagnostic trials usually involve people who have some signs or symptoms of cancer.

Quality of life or supportive care - these trials focus on the comfort and quality of life of cancer patients and cancer survivors. New ways to decrease the number or severity of side effects of cancer or its treatment are often studied in these trials. How a specific type of cancer or its treatment affects a person's everyday life may also be studied.

Where Clinical Trials are Conducted

Cancer clinical trials take place in cities and towns in doctors' offices, cancer centres and other medical centres, community hospitals and clinics. A single trial may take place at one or two specialised medical centres only or at hundreds of offices, hospitals, and centres.

Each clinical trial is managed by a research team that can include doctors, nurses, research assistants, data analysts, and other specialists. The research team works closely with other health professionals, including other doctors and nurses, laboratory technicians, pharmacists, dieticians, and social workers, to provide medical and supportive care to people who take part in a clinical trial.

Research Team

The research team closely monitors the health of people taking part in the clinical trial and gives them specific instructions when necessary. To ensure the reliability of the trial's results, it is important for the participants to follow the research team's instructions. The instructions may include keeping logs or answering questionnaires. The research team may also seek to contact the participants regularly after the trial ends to get updates on their health.

Clinical Trial Protocol

Every clinical trial has a protocol, or action plan, that describes what will be done in the trial, how the trial will be conducted, and why each part of the trial is necessary. The protocol also includes guidelines for who can and cannot participate in the trial. These guidelines, called eligibility criteria, describe the characteristics that all interested people must have before they can take part in the trial. Eligibility criteria can include age, sex, medical history, and current health status. Eligibility criteria for cancer treatment trials often include the type and stage of cancer, as well as the type(s) of cancer treatment already received.

Enrolling people who have similar characteristics helps ensure that the outcome of a trial is due to the intervention being tested and not to other factors. In this way, eligibility criteria help researchers obtain the most accurate and meaningful results possible.

National and International Regulations

National and international regulations and policies have been developed to help ensure that research involving people is conducted according to strict scientific and ethical principles. In these regulations and policies, people who participate in research are usually referred to as "human subjects."

Informed Consent

Informed consent is a process through which people learn the important facts about a clinical trial to help them decide whether or not to take part in it, and continue to learn new information about the trial that helps them decide whether or not to continue participating in it.

During the first part of the informed consent process, people are given detailed information about a trial, including information about the purpose of the trial, the tests and other procedures that will be required, and the possible benefits and harms of taking part in the trial. Besides talking with a doctor or nurse, potential trial participants are given a form, called an informed consent form, that provides information about the trial in writing. People who agree to take part in the trial are asked to sign the form. However, signing this form does not mean that a person must remain in the trial. Anyone can choose to leave a trial at any time—either before it starts or at any time during the trial or during the follow-up period. It is important for people who decide to leave a trial to get information from the research team about how to leave the trial safely.

The informed consent process continues throughout a trial. If new benefits, risks, or side effects are discovered during the course of a trial, the researchers must inform the participants so they can decide whether or not they want to continue to take part in the trial. In some cases, participants who want to continue to take part in a trial may be asked to sign a new informed consent form.

New interventions are often studied in a stepwise fashion, with each step representing a different “phase” in the clinical research process. The following phases are used for cancer treatment trials:

Phases of a Clinical Trial

Phase 0. These trials represent the earliest step in testing new treatments in humans. In a phase 0 trial, a very small dose of a chemical or biologic agent is given to a small number of people (approximately 10-15) to gather preliminary information about how the agent is processed by the body (pharmacokinetics) and how the agent affects the body (pharmacodynamics). Because the agents are given in such small amounts, no information is obtained about their safety or effectiveness in treating cancer. Phase 0 trials are also called micro-dosing studies, exploratory Investigational New Drug (IND) trials, or early phase I trials. The people who take part in these trials usually have advanced disease, and no known, effective treatment options are available to them.

Phase I (also called phase 1). These trials are conducted mainly to evaluate the safety of chemical or biologic agents or other types of interventions (e.g., a new radiation therapy technique). They help determine the maximum dose that can be given safely (also known as the maximum tolerated dose) and whether an intervention causes harmful side effects. Phase I trials enrol small numbers of people (20 or more) who have advanced cancer that cannot be treated effectively with standard (usual) treatments or for which no standard treatment exists. Although evaluating the effectiveness of interventions is not a primary goal of these trials, doctors do look for evidence that the interventions might be useful as treatments.

Phase II (also called phase 2). These trials test the effectiveness of interventions in people who have a specific type of cancer or related cancers. They also continue to look at the safety of interventions. Phase II trials usually enrol fewer than 100 people but may include as many as 300. The people who participate in phase II trials may or may not have been treated previously with standard therapy for their type of cancer. If a person has been treated previously, their eligibility to participate in a specific trial may depend on the type and amount of prior treatment they received. Although phase II trials can give some indication of whether or not an intervention works, they are almost never designed to show whether an intervention is better than standard therapy.

Phase III (also called phase 3). These trials compare the effectiveness of a new intervention, or new use of an existing intervention, with the current standard of care (usual treatment) for a particular type of cancer. Phase III trials also examine how the side effects of the new intervention compare with those of the usual treatment. If the new intervention is more effective than the usual treatment and/or is easier to tolerate, it may become the new standard of care.

Phase III trials usually involve large groups of people (100 to several thousand), who are randomly assigned to one of two treatment groups, or “trial arms”: (1) a control group, in which everyone in the group receives usual treatment for their type of cancer, or 2) an investigational or experimental group, in which everyone in the group receives the new intervention or new use of an existing intervention. The trial participants are assigned to their individual groups by random assignment, or randomisation. Randomisation helps ensure that the groups have similar characteristics. This balance is necessary so the researchers can have confidence that any differences they observe in how the two groups respond to the treatments they receive are due to the treatments and not to other differences between the groups.

Randomisation is usually done by a computer program to ensure that human choices do not influence the assignment to groups. The trial participants cannot request to be in a particular group, and the researchers cannot influence how people are assigned to the groups. Usually, neither the participants nor their doctors know what treatment the participants are receiving.

People who participate in phase III trials may or may not have been treated previously. If they have been treated previously, their eligibility to participate in a specific trial may depend on the type and the amount of prior treatment they received. In most cases, an intervention will move into phase III testing only after it has shown promise in phase I and phase II trials.

Phase IV (also called phase 4). These trials further evaluate the effectiveness and long-term safety of drugs or other interventions. They usually take place after a drug or intervention has been approved by the medicine regulatory office for standard use. Several hundred to several thousand people may take part in a phase IV trial. These trials are also known as post-marketing surveillance trials. They are generally sponsored by drug companies.

Sometimes clinical trial phases may be combined (e.g., phase I/II or phase II/III trials) to minimize the risks to participants and/or to allow faster development of a new intervention.

Although treatment trials are always assigned a phase, other clinical trials (e.g., screening, prevention, diagnostic, and quality-of-life trials) may not be labelled this way.

Use of Placebos

The use of placebos as comparison or “control” interventions in cancer treatment trials is rare. If a placebo is used by itself, it is because no standard treatment exists. In this case, a trial would compare the effects of a new treatment with the effects of a placebo. More often, however, placebos are given along with a standard treatment. For example, a trial might compare the effects of a standard treatment plus a new treatment with the effects of the same standard treatment plus a placebo.

Possible benefits of taking part in a clinical trial

The benefits of participating in a clinical trial include the following:

- Trial participants have access to promising new interventions that are generally not available outside of a clinical trial.
- The intervention being studied may be more effective than standard therapy. If it is more effective, trial participants may be the first to benefit from it.

- Trial participants receive regular and careful medical attention from a research team that includes doctors, nurses, and other health professionals.
- The results of the trial may help other people who need cancer treatment in the future.
- Trial participants are helping scientists learn more about cancer (e.g., how it grows, how it acts, and what influences its growth and spread).

Potential harms associated with taking part in a clinical trial

The potential harms of participating in a clinical trial include the following:

- The new intervention being studied may not be better than standard therapy, or it may have harmful side effects that doctors do not expect or that are worse than those associated with standard therapy.
- Trial participants may be required to make more visits to the doctor than they would if they were not in a clinical trial and/or may need to travel farther for those visits.

Correlative research studies, and how they are related to clinical trials

In addition to answering questions about the effectiveness of new interventions, clinical trials provide the opportunity for additional research. These additional research studies, called correlative or ancillary studies, may use blood, tumour, or other tissue specimens (also known as 'biospecimens') obtained from trial participants before, during, or after treatment. For example, the molecular characteristics of tumour specimens collected during a trial might be analysed to see if there is a relationship between the presence of a certain gene mutation or the amount of a specific protein and how trial participants responded to the treatment they received. Information obtained from these types of studies could lead to more accurate predictions about how individual patients will respond to certain cancer treatments, improved ways of finding cancer earlier, new methods of identifying people who have an increased risk of cancer, and new approaches to try to prevent cancer.

Clinical trial participants must give their permission before biospecimens obtained from them can be used for research purposes.

When a clinical trial is over

After a clinical trial is completed, the researchers look carefully at the data collected during the trial to understand the meaning of the findings and to plan further research. After a phase I or phase II trial, the researchers decide whether or not to move on to the next phase or stop testing the intervention because it was not safe or effective. When a phase III trial is completed, the researchers analyse the data to determine whether the results have medical importance and, if so, whether the tested intervention could become the new standard of care.

The results of clinical trials are often published in peer-reviewed scientific journals. Peer review is a process by which cancer research experts not associated with a trial review the study report before it is published to make sure that the data are sound, the data analysis was performed correctly, and the conclusions are appropriate. If the results are particularly important, they may be reported by the media and discussed at a scientific meeting and by patient advocacy groups before they are published in a journal. Once a new intervention has proven safe and effective in a clinical trial, it may become a new standard of care.

(National Cancer Institute).

Medical Disclaimer

This Fact Sheet is intended to provide general information only and, as such, should not be considered as a substitute for advice, medically or otherwise, covering any specific situation. Users should seek appropriate advice before taking or refraining from taking any action in reliance on any information contained in this Fact Sheet. So far as permissible by law, the Cancer Association of South Africa (CANSA) does not accept any liability to any person (or his/her dependants/estate/heirs) relating to the use of any information contained in this Fact Sheet.

Whilst the Cancer Association of South Africa (CANSA) has taken every precaution in compiling this Fact Sheet, neither it, nor any contributor(s) to this Fact Sheet can be held responsible for any action (or the lack thereof) taken by any person or organisation wherever they shall be based, as a result, direct or otherwise, of information contained in, or accessed through, this Fact Sheet.

References and Consulted Sources

ABCDE Warning Signs

<http://www.parkercenter.net/could-this-be-skin-cancer>

About.Com

<http://nutrition.about.com/od/askyournutritionist/f/sunlight.htm>
<http://skincancer.about.com/od/skincancerbasics/a/Squamous.htm>
http://skincancer.about.com/od/glossary/g/SPF_sunscreen.htm

American Cancer Society

<http://www.cancer.org/Cancer/CancerCauses/SunandUVExposure/skin-cancer-facts>

Basal Cell Carcinoma

<http://www.bing.com/images/search?q=free+illustration+basal+cell+carcinoma&view=detail&id=80F2FD8D34B1DA89638FF0A0B82981ECAFDE15&first=91&FORM=IDFRIR>

Bureau of Air Quality, Department of Environmental Protection

<http://maine.gov/dep/air/ozone/uvrad.htm>

Canadian Centre for Occupational Health and Safety

http://ccohs.ca/oshanswers/phys_agents/ultravioletradiation.html
http://www.ccohs.ca/oshanswers/diseases/skin_cancer.html

Cancer News

<http://www.cancernews.com/articles/melanomas.htm>

Cancer Research UK

<http://info.cancerresearchuk.org/cancerstats/types/skin/sunbeds/>

Centers for Disease Control and Prevention

<http://www.cdc.gov/niosh/topics/uvradiation/>

Department of Health and Mental Hygiene, Maryland

<http://fha.maryland.gov/cancer/cancerplan/>

Department of Health and Ageing, Australia

<http://www.skincancer.gov.au/internet/skincancer/publishing.nsf/Content/fact-uv>

Earth Observatory, NASA

<http://earthobservatory.nasa.gov/Features/UVB/>

Elmets, C.A. 2011.

<http://dermatology.jwatch.org/cgi/content/full/2011/1104/1>

Fitzpatrick Skin Types

https://www.google.co.za/search?q=pics+skin+types&hl=en&rlz=1G1LENN_ENZA491&prmd=imvns&tbm=isch&tbo=u&source=univ&sa=X&ei=poNNUNnEN-i30QXe2YH4Bg&ved=0CCAQsAQ&biw=1366&bih=613

Fitzpatrick, T.B. 1988 The validity and practicality of sun reactive skin types I through VI. Arch Dermatol 124; 869-871.

Fitzpatrick Skin.

http://www.hollywoodtansatlanta.com/The_Fitzpatrick_Skin.pdf

Health Physics Society

<http://hps.org/hpspublications/articles/uv.html> (Accessed on 2011-11-09).

IARC – International Agency for Research on Cancer

<http://www.iarc.fr/en/publications/pdfs-online/wrk/wrk1/ArtificialUVRad&SkinCancer.pdf>

http://www.iarc.fr/en/media-centre/iarcnews/2009/sunbeds_uvradiation.php

IOLNews

<http://www.iol.co.za/news/south-africa/skin-cancer-rises-among-black-south-africans-1.389849>

(Accessed on 2011-11-24).

Irish Cancer Society

<http://www.cancer.ie/sunsmart/ultraviolet.php>

<http://www.cancer.ie/sunsmart/detection.php>

<http://www.cancer.ie/sunsmart/sunbed.php>

Ley, R. & Reeve, V.E. 1997. Chemoprevention of ultraviolet radiation-induced skin cancer. *Environ Health Perspect.* 105(Suppl 4): 981-984, June.

MedlinePlus

<http://www.nlm.nih.gov/medlineplus/ency/article/000824.htm>

Meinhardt-Wollweber, M. & Krebs, R. 2012. A computational model for previtamin D3 production in skin. *Photochemical & Photobiological Sciences*, 11: 731-737.

Melanoma

<http://www.bing.com/images/search?q=free+images+melanoma&view=detail&id=9BDD5B8602500694B50252FDCB2891F7BF4B986C&qpv=free+images+melanoma&FORM=IDFRIR>

Melanoma.Com

http://melanoma.com/uv_radiation.html

NASA Goddard Space Flight Center

http://imagine.gsfc.nasa.gov/docs/science/known_11/emspectrum.html

National Institutes of Health

<http://www.nih.gov/researchmatters/february2011/02072011melanoma.htm>

<http://www.cancer.gov/clinicaltrials/learningabout/what-are-clinical-trials>

<http://www.cancer.gov/about-cancer/treatment/clinical-trials/what-are-trials>

National Aeronautic and Space Administration (NASA)

http://missionscience.nasa.gov/ems/10_ultravioletwaves.html

<http://www-istp.gsfc.nasa.gov/stargaze/Sun1lite.htm>

Navy Environmental Health Center. 1992. Ultraviolet Radiation Guide.

<http://www-nehc.med.navy.mil/downloads/ih/UVDOC.pdf>

OncoLink

<http://www.oncolink.org/experts/article.cfm?c=3&s=28&ss=125&id=2342>

Researched and Prepared by Prof Michael C Herbst

[D Litt et Phil (Health Studies); D N Ed; M Art et Scien; B A Cur; Dip Occupational Health]

Approved by Ms Elize Joubert, Chief Executive Officer [BA Social Work (cum laude); MA Social Work]

November 2016

Psoriasis-Aid.Com

http://www.psoriasis-aid.com/psoriasis/sun_exposure_and_psoriasis.html

Queensland Health, Queensland Government, Australia

http://access.health.qld.gov.au/hid/SkinHealth/SunSafety/ultravioletRadiation_ap.asp

Rawlings, A.V. 2006. Int J Cosmet Sci. 2006 Apr;28(2):79-93. doi: 10.1111/j.1467-2494.2006.00302.x.

ScienceDaily

<http://www.sciencedaily.com/releases/2005/12/051224100902.htm>

<http://www.sciencedaily.com/releases/2010/07/100701103415.htm>

Solarradiation.Net

<http://www.solarradiation.net/>

South African Melanoma Advisory Board

http://www.melanoma.co.za/D_doccnr_MFS.asp

Squamous Cell Carcinoma

<http://www.bing.com/images/search?q=free+images+squamous+cell+carcinoma&view=detail&id=BC45F8372B4F9BB72A61397D9EE2BD757FF1E986&qv=free+images+squamous+cell+carcinoma&FORM=IDFRIR>

SunSmart Australia

http://www.sunsmart.com.au/ultraviolet_radiation

http://www.sunsmart.com.au/ultraviolet_radiation/the_health_risks

Suntan.Com

<http://www.suntan.com/?factssun>

United States Nuclear Regulatory Commission

<http://www.nrc.gov/about-nrc/radiation/around-us/uses-radiation.html>

University of Washington, Environmental Health and Safety

<http://www.ehs.washington.edu/rsononion/uvlight.shtm>

US Environmental Protection Agency

<http://www.epa.gov/sunwise/doc/uvradiation.html>

<http://www.epa.gov/sunwise/uvandhealth.html>

US Food and Drug Administration

[http://www.fda.gov/Radiation-](http://www.fda.gov/Radiation-EmittingProducts/RadiationEmittingProductsandProcedures/Tanning/ucm116425.htm)

[EmittingProducts/RadiationEmittingProductsandProcedures/Tanning/ucm116425.htm](http://www.fda.gov/Radiation-EmittingProducts/RadiationEmittingProductsandProcedures/Tanning/ucm116425.htm)

UVA & UVB Rays

[http://www.google.co.za/imgres?hl=en&sa=X&rlz=1T4LENN_enZA490ZA490&biw=1366&bih=613&tbm=isch&prmd=imvns&tbid=sFIMGHRCoaVOrM:&imgrefurl=http://www.fda.gov/Radiation-](http://www.google.co.za/imgres?hl=en&sa=X&rlz=1T4LENN_enZA490ZA490&biw=1366&bih=613&tbm=isch&prmd=imvns&tbid=sFIMGHRCoaVOrM:&imgrefurl=http://www.fda.gov/Radiation-EmittingProducts/RadiationEmittingProductsandProcedures/Tanning/ucm116425.htm&imgurl=http://www.fda.gov/ucm/groups/fdagov-public/documents/image/ucm116427.jpg&w=369&h=304&ei=wPxGUL-MMMG3hQeeioDoAw&zoom=1&iact=hc&vpx=267&vpy=140&dur=2922&hovh=204&hovw=2)

[EmittingProducts/RadiationEmittingProductsandProcedures/Tanning/ucm116425.htm&imgurl=http://www.fda.gov/ucm/groups/fdagov-](http://www.fda.gov/Radiation-EmittingProducts/RadiationEmittingProductsandProcedures/Tanning/ucm116425.htm&imgurl=http://www.fda.gov/ucm/groups/fdagov-public/documents/image/ucm116427.jpg&w=369&h=304&ei=wPxGUL-MMMG3hQeeioDoAw&zoom=1&iact=hc&vpx=267&vpy=140&dur=2922&hovh=204&hovw=2)

[public/documents/image/ucm116427.jpg&w=369&h=304&ei=wPxGUL-](http://www.fda.gov/ucm/groups/fdagov-public/documents/image/ucm116427.jpg&w=369&h=304&ei=wPxGUL-MMMG3hQeeioDoAw&zoom=1&iact=hc&vpx=267&vpy=140&dur=2922&hovh=204&hovw=2)

[MMMG3hQeeioDoAw&zoom=1&iact=hc&vpx=267&vpy=140&dur=2922&hovh=204&hovw=2](http://www.fda.gov/ucm/groups/fdagov-public/documents/image/ucm116427.jpg&w=369&h=304&ei=wPxGUL-MMMG3hQeeioDoAw&zoom=1&iact=hc&vpx=267&vpy=140&dur=2922&hovh=204&hovw=2)

Researched and Prepared by Prof Michael C Herbst

[D Litt et Phil (Health Studies); D N Ed; M Art et Scien; B A Cur; Dip Occupational Health]

Approved by Ms Elize Joubert, Chief Executive Officer [BA Social Work (cum laude); MA Social Work]

November 2016

47&tx=155&ty=113&sig=107310304455409594391&page=1&tbnh=130&tbnw=166&start=0
&ndsp=21&ved=1t:429,r:1,s:0,i:75].

Wordiq.Com

<http://www.wordiq.com/definition/Visible>
http://www.wordiq.com/definition/Solar_radiation
http://www.wordiq.com/definition/Electromagnetic_spectrum
<http://www.wordiq.com/definition/Infrared>
<http://www.wordiq.com/definition/Ultraviolet>
<http://www.wordiq.com/definition/Suntan>
<http://www.wordiq.com/definition/Sunburn>
<http://www.wordiq.com/definition/Sunlight>
http://www.wordiq.com/definition/Thermal_radiation
<http://www.wordiq.com/definition/Pyranometer>
<http://www.wordiq.com/definition/Actinometer>

World Health Organization

<http://www.who.int/uv/faq/uvhealthfac/en/index.html>
<http://www.who.int/uv/en/>
<http://www.who.int/uv/health/en/>
http://www.who.int/uv/sun_protection/en/
<http://www.who.int/uv/intersunprogramme/en/>
<http://www.who.int/uv/faq/uvhealthfac/en/index1.html>
http://www.who.int/uv/uv_and_health/en

World Health Organization

<http://www.who.int/uv/health/en/>

World UV Map

http://www.gse-promote.org/gallery/UV/dwd_forecast.htm