Day/Part Two Background Information for Teaching

Statistics and numbers in the curriculum are taken from the American Cancer Society (ACS), American Academy of Dermatology (AAD), Centers for Disease Control (CDC), Surveillance Epidemiology and End Results (SEER), National Cancer Institute (NCI) and the Skin Cancer Foundation websites, unless otherwise noted.

Day/Part Two – Focus on Prevention/Protection

Review ABC's, Causes, and Risk Factor

One Day Course: Give the worksheet to the teacher -- they can use it for review, a follow-up quiz, or to maintain attention by having their students fill it in during the program lecture.

Two Day Course: Use this time period to ask the students what they remember from the first session. Start by saying you will be reviewing the ABC's of melanoma, the causes of skin cancer, and its associated risk factors. Pass out the Helpful Information about Skin Cancer handout and the SPOTS Worksheet -- have the students fill in the blanks as you read the questions and wait for their answers. Generate discussion by asking who can describe what asymmetry means, who can recite the two causes of skin cancer, etc. Ask how many of the risk factors they have. Make the review interactive, talkative, and personal. If class size is large, use the ABC game in the lecture for review. If class size is small, use the hands-on game cards.

Video - Teens with Melanoma/Demonstration of a Punch Biopsy

Explain to the students they will be viewing a video that includes two teens with melanoma telling their stories and a demonstration of a typical mole removal. When the video is finished, ask if there are any questions.

Interactive Lecture
Teaching with demonstrations

Protecting yourself from ultraviolet radiation (UVR) is the primary modifiable method of preventing skin cancer. Tell the students that on Day One you discussed the early detection of skin cancer – what it is, what causes it, how to identify it and associated risk factors. Today, you will be talking about how they can protect themselves from UVR. While you are introducing yourself, have one student or the teacher pass out the handouts.

Adolescence is a time of establishing independence, identity and social competence.[1] Keep this in mind as you are explaining the topics on the CD slides: stop intermittently and show the students *what* you are teaching them about (various sunscreens, hats, glasses, and clothing). **Make your teaching interactive**. Allow them to smell the sunscreen and have one or two students volunteer to try on different types of sunscreen so they can experience the difference in viscosity, coverage, and feel. Have a student read the label and tell you how many ounces are in that particular bottle of sunscreen. Then point out that a four ounce bottle is only four applications for one person. Next, ask how many of them use the same bottle all summer and how many more share the bottle with family or friends. Ask them what SPF stands for. When explaining the difference between chemical and physical sunscreens, have a student read the active ingredients on the label. Encourage them to ask and answer questions while you are teaching them, but maintain discipline by setting limits such as raising their hands. If you make a student wait until the end of your talk to ask a question, they will often either forget their question or lose interest. Allow them to ask questions as the come up.

Why Teach Teens?

Adolescents are an important group to educate about sun protection because this is the time when lifelong behaviors are developing,[2] early UVR exposure[3, 4] and damage from sunburns are critical,[5-11] and peer pressure is heavy. Additionally, indoor tanning begins and increases throughout the teen years,[12-13] vanity rules,[14] risk taking is high,[2, 15-16] and concern for sun protection is low.[17] Presently, there are few programs in existence in the U.S. for teens.[18-19] Teenagers tend to live in the here and now, weighing current benefits higher than future risks[2] so societal norms and adolescent perceptions of wanting the bronzed look need to be discussed.[20-21] Spend some time talking about the media's effect[22] on how the students *think* they should look. Around the age of 14-15 years, teens change from a low comprehension of understanding later consequences of current behaviors to a fuller comprehension[23] making this a critical time for educational interventions.

Instilling knowledge about skin cancer recognition and protective methods should be coupled with the realization that changing behaviors is a complex entity influenced by many issues. Adolescents are heavily affected by societal influences (having friends who tan, parents who condone and even pay for their tanning, other family members who tan),[14] vanity (they like the tanned look - makes them feel better, healthier, more attractive),[13] the tanning industry's marketing (ads in high school newspapers,[24] ads for free tanning, sponsoring high school events, false information that indoor tanning is safe), and unrealistic messages that they can ignore (stay out of the sun between 10-4 is all day to them).[25] Emphasizing positive alternatives and delineating the negative consequences of tanning on appearance are important techniques to use with teens. Asking questions and generating dialogue takes a bit of practice, so give yourself some credit and relax a little. It also allows you to receive immediate feedback on the students' translation of what you have taught. The idea is to have fun while instilling knowledge.

Lecture Sections

- ## Basic Protective Measures

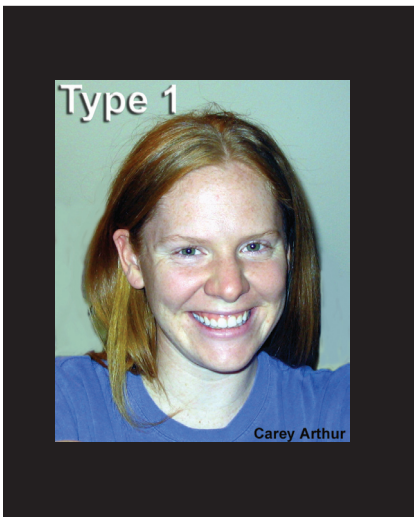
  - ### Know Your Skin Type

    The first thing you should know is your skin type. Skin types (Fitzpatrick Phototypes) are divided into six levels. Skin Type I is the least naturally resistant to sun damage and Skin Type VI is the most resistant. The skin types are based on natural skin color without a tan, natural hair color without dye, and natural eye color without contacts. The skin type table on the following page was developed by Fitzpatrick in the 1970's and adapted from Diffey, Citek, and the Skin Cancer Foundation.[26 -28]

    Two other issues to keep in mind when discussing skin types are: different body areas are more sensitive and prone to burning (face, neck and trunk are 2-4 times more erythemally sensitive than the arms and legs)[29] and horizontal body surfaces (such as the shoulders) receive up to 75% of the ambient UVR whereas vertical surfaces (upper arm) receive only about fifty percent.[26]

Skin Type	Skin Color (Natural -no tan/ makeup)	Hair Color (Natural - no dye)	Eye Color (Natural - no color contacts)	Tanning Ability
Type I	Very white, freckled	Blond, red	Blue, green	Always burns
Type II	White	Sandy blond, red, brown	Blue, hazel, brown	Usually burns, tans a little
Type III	Medium white	Dark blond to brown	Grey to brown	Sometimes burns, tans gradually
Type IV	Olive to light brown	Brown	Brown	Rarely burns, tans well
Type V	Dark brown	Dark Brown or black	Dark brown	Very rarely burns, tans darkly
Type VI	Dark brown to black	Black	Dark brown	Never burns, tans darkly

Table references [26-28]

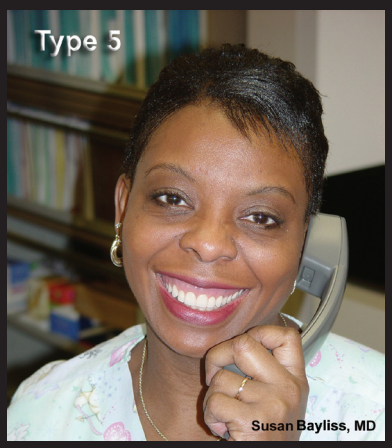


Skin Type I is a person who has natural white blond or red hair, blue or green eyes, and extremely fair white skin that freckles easily. Rather than producing eumelanin, which pigments the skin of most everyone else, they produce pheomelanin. In Greek, *pheo* means false. Because of this, they always burn, never tan, heavily freckle, and are more susceptible to skin cancer. Those of Norwegian or Celtic ancestry fall into this category.

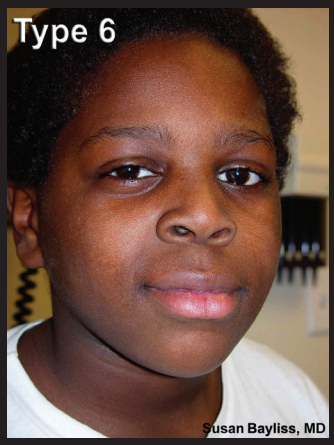
A person with Skin Type II has natural sandy blond to brown hair, green or brown eyes, and fair white skin that usually burns, but occasionally tans. Northern European and Scandanavian ancestry.

Skin Type III people have dark blond to brown hair, grey to brown eyes, and medium white skin that often tans, but sometimes burns. Average Caucasian, lighter Mediterranean, lighter Asian and lighter Hispanic descent.

Skin Type IV has dark brown hair, brown eyes, and olive to light brown skin that always tans, but rarely burns. Middle Eastern, darker Asian, darker Hispanic, and darker Mediterranean descent.



Skin Type V has dark brown-black hair, brown eyes, and dark brown skin that very rarely burns and tans well. American Indians, darker Middle Eastern, darker Latinos, lighter-skinned African Americans.



Skin Type VI has natural black hair, black eyes, and black-brown skin that never burns and tans darkly because it is so heavily pigmented. African American descent.

People with dark-colored skin are more naturally protected because they have larger, more evenly dispersed melanosomes that filter twice as much UVB as they do in Caucasians. The epidermis of darker-skinned persons also transmits 7.4% of UVB and 17.5% of UVA radiation compared with 24% and 55% in the epidermis of Caucasians.[30] To produce a minimally perceptible erythema, it has been estimated to require a dose of UVR 6-33 times higher in blacks than in whites.[30]

Note: Due to ethnic/racial intermarriage and variability within races it is often difficult to isolate one ethnic background or race into a particular skin type. The previous designations are listed as a generalized reference of skin phototypes.

Several studies have shown that when teenagers and college age students are allowed to choose their own skin type they consistently over estimate their level.[31] For example, people who are actually Types I or II will assess themselves as Types III or IV. Chan found that the lighter the skin color, the greater this discrepancy.[32]

Have the students look at their coloring and tell you what they think is their skin type. Remind them that skin types reflect the response of their skin to UVR in the absence of sunscreen or other protective measures. Some may claim that they are a Type III because they often tan and sometimes burn, but their response to sun exposure without sunscreen indicates they are a Type II.

o Know the Daily Ultraviolet (UV) Index

The daily UV index is an estimated measurement of UV radiation risk calculated using forecasted global ozone levels compared to incoming ground level radiation, forecasted cloud cover and local elevation.[33] Simply put, it is the estimated amount of UV radiation that reaches the earth's surface expressed as a risk scale from zero to 11 with zero being the least amount of UVR and 11 being the greatest.[34] Naturally, it follows that in the summer, the UV index is at its peak and in the winter, it is at its ebb. The UV index can be found online, in the newspaper or on the televised news during the weather section.[35]

Why is this important? If you know your skin type and the UV index, you will have a good idea of how much sun protection you will need on any given day. The higher the UV index, the more sun protection one needs. For example, in the summer months, a Skin Type III (average Caucasian) will burn within 20-30 minutes when outside without protection.[28]

UV Index	Description	Color	Recommended Protection
0-2	Low risk	Green	Minimal protection required for normal activity. Wear sunglasses and sunscreen if outside for 1 hour or more.*
3-5	Moderate risk	Yellow	As above, plus avoid mid-day sun; cover body with clothing and a hat; wear sunscreen if outside for 30 minutes or more.*
6-7	High risk	Orange	As above, plus reduce sun exposure from 11am-4pm
8-10	Very high risk	Red	As above, plus take extra care to avoid sun exposure between 11am and 4pm; unprotected skin burns quickly
11+	Extreme risk	Violet	As above, plus avoid any unnecessary sun exposure. Unprotected skin burns in minutes.

*Wearing sunscreen is recommended every day all year

Ultraviolet Index

o Wear Sunscreen Daily

For the purposes of this program, we will use the term "sunscreen" to apply to all sunscreens, including sunblocks. Tanning accelerators (lotions applied prior to indoor tanning) are not included in this definition as they rarely contain sunscreen. Sunscreen should be applied daily, all year long, to exposed skin surfaces. In the winter, when your clothing covers most of the exposed skin, make sure you coat your face, neck and hands with sunscreen. Keeping sunscreen near your toothpaste can remind you to apply it every morning. In the summer, sunscreen application is a bigger job.

• Three Types of Ultraviolet Radiation

Ultraviolet radiation is commonly divided into three wavelengths: UVA (320-400nm), UVB (280-320nm),[36] and UVC (100-280nm) radiation. Note: some literature lists the UVB range beginning at 290nm.[36]

o UVA

Ultraviolet A wavelengths are the longest at 320-400 nanometers (nm). A nanometer equals 0.000001 millimeter or one-millionth of a millimeter. UVA is further divided into: UVA I = 340-400 nm and UVA II = 320-340 nm. These waves penetrate deeper into the skin (dermis layer) than UVB rays, therefore greater numbers of cells may be affected.[37] Nearly 50% of UVA rays reach the dermis.[38] UVA rays can pass through glass (car windows) and

water (clouds, haze), and are responsible for aging skin (loss of elasticity, discolorations, wrinkling, sagging) and skin cancer. UVA is present all year in nearly equal percentages (annual UVA dose is 48% in the summer and 52% the rest of the year).[39]

Ultraviolet A waves are not blocked by the stratosphere so about 20 times the amount of UVA reaches the earth's surface as UVB radiation. Approximately 90-95% of the UV radiation that reaches the earth's surface is in the form of UVA.[40] Remember A for aging.

UVB

Ultraviolet B waves are mostly blocked by the stratosphere, have a wavelength range of 280-320 nm, penetrate only the top layer of skin (epidermis) and are responsible for sunburns, skin cancer, and signs of skin aging. UVB is present in greater quantities in the summer (annual UVB dose is 72% in the summer and 28% in the winter).[39] Approximately 5-10% of the UV radiation that reaches the earth's surface is in the form of UVB. Remember B for burn.

UVC

Ultraviolet C waves are blocked by the stratospheric ozone layer and currently don't reach the earth's surface.[41] This is important because the shorter UV wavelengths (UVC) are actually the most powerful of the UV waves; UVC range is 100-280/290nm.[42]

Type of UV radiation	Wavelength Range	Characteristics
UVA	320-400 nm	Not absorbed by ozone; penetrates deeply into skin; penetrates glass
UVB	280-320 nm	More energy than UVA; partially absorbed by ozone layer; mostly responsible for sunburn
UVC	100-280 nm	Absorbed by ozone layer

UV Rays and Cancer

Studies have shown epidemiological links between UVA and melanoma including multiple DNA aberrations, melanocyte proliferation, and gene expression modifications.[43-45] UVB studies have linked this wavelength to all forms of skin cancer. We have known for a long time of the photoaging and DNA damaging effects of UVB, but more studies are now demonstrating the link between UVA and skin cancer. Many of these studies involve the use of indoor tanning beds, [46] which use lamps that emit primarily UVA radiation.[45, 47]

• How to Choose and Use a Sunscreen

○ Check the SPF

▪ Calculating the SPF (UVB rating)

The Sun Protection Factor or SPF is a number on the outside of the sunscreen bottle that describes the percentage of protection provided from UVB radiation only. The SPF (Sun Protection Factor) number is meant to reflect how many minutes you can stay in the sun. The relationship between the SPF and the percentage of UVB radiation absorbed or blocked is given in the following formula:

%UVB absorbed or blocked = [(SPF – 1)/SPF] X 100

For example, for an SPF of 2: [(2-1)/2] x 100 = protection from 50% of the UV rays. Notice that there is not much difference in percentage of protection once you use an SPF of 30. Amount applied and reapplication of sunscreen are paramount.

SPF	Percentage of UVB absorbed or blocked
2	50%
15	93.3%
30	96.7%
45	97.7%
50	98%
70	98.5%

▪ Guideline Number

The SPF can also be used to determine how many minutes you can stay in the sun with that particular sunscreen before you will begin to burn. This relationship is given in the following formula:

Time to burn with sunscreen =
SPF x Time to burn without sunscreen

For example, if you burn in 10 minutes without sunscreen and you apply an SPF of 15, you should be able to multiply 15 (SPF) by 10 (number of minutes until you burn without sunscreen on) and stay in the sun for 150 minutes without burning.[48]

Unfortunately, this doesn't reflect the reality of the situation. For example, a person with skin type 1 can stay in the sun for about 10 minutes without sunscreen before they begin to burn. If that person applies a sunscreen with an SPF of 15, they should be able

to stay in the sun for 150 minutes without burning (10 x 15). However, this equation suggests that a Skin Type I (most susceptible to skin cancer: fair skin, blond/red hair, blue eyes) can stay in the sun for 150 min if using an SPF of 15. That's longer than the 1-2 hours in which sunscreen should be reapplied and greater than the longest lasting sunscreens.

The SPF number is also based on applying at least a full ounce to the average adult body (5'4", 150#, waist 32"),[49] which the rare person does. In addition, the SPF is calculated in labs under solar simulators that use mostly UVB light and little or no UVA light. About 20 times the amount of UVA light reaches the earth's surface as UVB, so natural sunlight has a lot more UVA compared to a laboratory solar simulator that uses mostly UVB light.[50-51] Additionally, solar simulators vary in their range of predicting accurate SPF values.[52] Another study showed there was a difference in the labeled SPF versus the actual SPF[53] which helps to explain why some higher SPF sunscreens often don't protect as well as those with lower sun protection factors.

Most people don't apply enough sunscreen to attain the SPF number on the label. Typical applications run about one-fourth the amount of sunscreen (0.5 mg/cm2) required to achieve the SPF.[54] Putting on one half the appropriate amount of sunscreen decreases the protection not by two-fold but by four-fold.[37] Thus, sunscreen protection does not decrease in a linear fashion.[55-56] Additionally, the different types of sunscreen adhere and apply in different amounts based on their viscosity and spreadability[53] (lotions cover best because they spread easily; sticks are best for small areas – lips, tip of nose, ears but spread poorly due to their wax matrix; gels spread easily and cover well but are full of alcohol and if used on the face burn the eyes so people often put on less; sprays/mists can have less coverage due to the fact that much of it may be lost on other surfaces). Therefore, the SPF is a guideline number, not a failsafe.

- **UVA Ratings of Sunscreen in the United States (U.S.)**

  In the U.S., most sunscreens contain both UVA and UVB protection. However, unlike Europe and Japan, there has been no U.S. rating for the amount of UVA protection on the label. Thus, the percentage of UVA protection can vary widely amongst sunscreens. In August 2007, the FDA proposed a new regulation for UVA labeling and testing.[57] Two tests are conducted. One is an in-vitro test to determine a sunscreen's ability to reduce the amount of UVA radiation that passes through it and the second test is an in-vivo test done on humans to determine a sunscreen's ability to prevent a darkening or tanning of the skin. UVA causes a pigment darkening to occur over several hours. An immediate pigment darkening (IPD) occurs first, followed by a persistent pigment darkening (PPD).

  The combined results of the two tests are then used to classify the UVA protection from "low to highest" using a four star system. One star equals low UVA protection, two stars equals medium, three stars equals high, and four stars equals the highest protection.[57] This UVA star rating will be placed on the label along with the SPF number (UVB rating) in 2008-2009.

- **UV Ratings Outside the US**

In Europe, Australia and South America, most sunscreens have both an SPF number for the UVB protection rating and an IPD (immediate pigment darkening) and PPD (persistent pigment darkening) number for the UVA protection rating. Of these two, the PPD is the better index of sun protection from UVA rays because the color darkening remains stable over time and is reproducible. There is also a method called PFA (Protection Factor A) to determine UVA protection in sunscreens. It is similar to the SPF method, but is for rating UVA rather than UVB.

Japan uses a PA (Protection grade of UVA) system for UVA rating.[56] PA+ offers some UVA protective effect correlating with a PPD of 2-4, PA++ offers moderate UVA protection correlating with a PPD of 4-8, and PA+++ offers good UVA protection correlating with a PPD of 8+.

Most of Europe and the United Kingdom uses the Boots PLC Star UVA/UVB radiation coefficient. This is a number ranging from 0 to 0.9+. It is a ratio of the mean UVA absorption to the mean UVB absorption. This coefficient number is then translated into a star rating system with 1 star equaling minimal UVA protection and 5 signifying UVA protection of at least 90% of the UVB protection.[58]

Boots (UK) UVA Rating System		
1 star	> 0.2	Minimal protection from UVA
2 stars	> 0.4	Moderate protection from UVA
3 stars	> 0.6	Good protection
4 stars	> 0.8	Superior protection
5 stars	> 0.9	Maximum protection

Table reference[167]

Check the Ingredients

Sun-protective lotions are commonly divided into two categories: chemical "sunscreens" and physical "sunblocks."

- **Chemical Sunscreens**

Sunscreens contain active ingredients like octyl salicylate, octyl methoxycinnamate, octyl dimethyl paba, octocrylene, oxybenzone, avobenzone (Parsol 1789), and others. These are all chemical sunscreens that work by absorbing the UV rays. They are clear in color and cosmetically attractive. However, they take 20-30 minutes to bind with the skin cells and therefore must be applied in advance before going outside or entering the water.

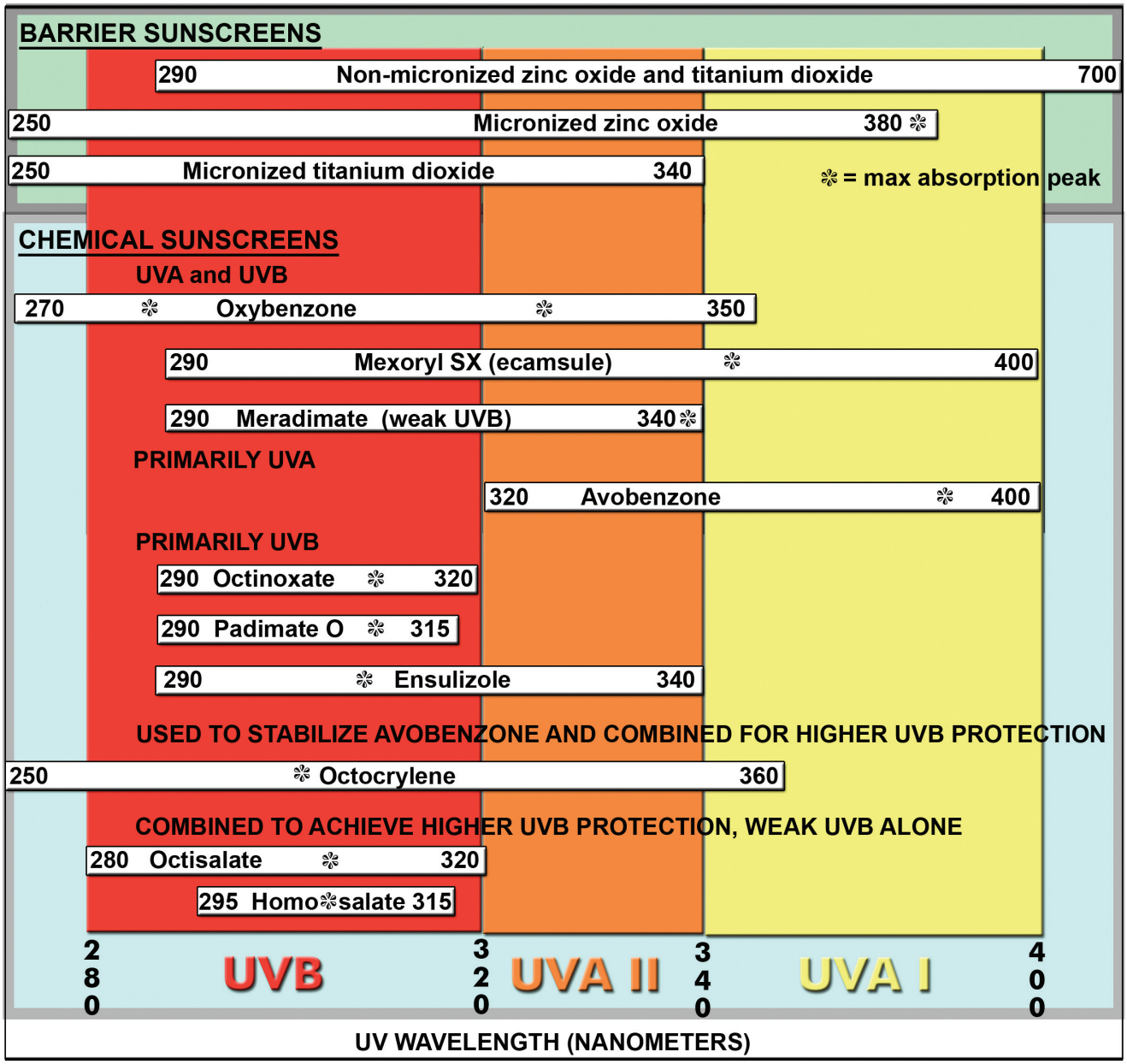


Table references [59-62]

- **Physical Sunscreens**

Zinc oxide and titanium dioxide are physical sunblocks that reflect/absorb sunlight by forming a physical barrier (block) to the skin. They are the heavier "white stuff" and thus may not be as cosmetically attractive when applied. However, most of the zinc oxides and titanium dioxides are now micronized, allowing them to blend into your skin color more naturally. The physical blocks cause less skin/allergic reactions and therefore are more suitable for children, sensitive skin, people on photosensitizing medications, patients with photodermatoses (polymorphous light eruption being the most common)[63] and patients post-cosmetic surgery (laser, chemical peels, and dermabrasion). Sunscreens that contain only physical sunblockers (zinc oxide, titanium dioxide)

are called sunblocks or barrier blocks by many dermatologists and plastic surgeons. Physical sunblocks can be applied while outdoors as their protection is immediate. Note, however, that most sunscreens are a combination of both chemical and physical sunscreens[64] so they should be applied 20-30 minutes before sun exposure. Finally, since no current sunscreen totally blocks all UVR, the use of the term "sunscreen" is preferred over "sunblock."

An Easy Way to Remember What Covers What		
Ultraviolet light	**Abbreviation**	**Chemical names**
UVA	"-zones"	Avobenzone, oxybenzone, mexoryl
UVB	"-ates"	Cinnamates, salicylates, padimate-O
UVA and UVB	"-xides"	Zinc oxide, titanium dioxide

- **Sensitive Skin**

  Some skin [very fair skin; sensitive skin; skin after facial treatments (laser treatments, chemical peels); skin on medications (ie: antibiotics)] may react to the chemicals in sunscreen either with or without exposure to ultraviolet radiation. If this happens, try a different sunscreen as the chemical combinations vary. For example, use a straight physical sunscreen with zinc oxide or titanium dioxide only or use a sunscreen without PABA and benzophenones. Additionally, you should check the expiration date as expired sunscreen may have degraded ingredients which can irritate the skin. Any sunscreen that smells rancid or has changed color should not be used.

- **Medications That React with UVR**

  After exposure to UVR, many common medications can cause a skin reaction (sunburn, rash, itching, scaling, swelling or irritation). The combination of UVR (especially from indoor tanning)[65] and these medications leads to a photoallergy or photosensitization that can be systemic or localized. Medications include antihistamines, coal tar derivatives (dandruff shampoos), birth control pills, hormone replacement therapy, non-steroidal anti-inflammatory drugs (ibuprofen), tranquilizers, sulfa drugs, oral medications for diabetics, antibiotics (cyclines), antidepressants, antiarrhythmics, antihypertensives, diuretics, antineoplastics, and acne treatments (isotretinoin, salicylic acid).[65] Skin areas covered by tattoos are more photosensitive due to the cadmium sulfide, so many tanning salons sell stick-on cover-ups.

- **UV Spectrum Coverage**

  The barrier blocks, zinc oxide and titanium dioxide, in non-micronized form cover the UVB, UVA, and part of the visible light spectrum. In micronized form (more cosmetically attractive, less visible) they cover the UVB and most of the UVA spectrum. The chemical sunscreens cover either the UVB spectrum (cinnamates, salicylates,

padimate-O, benzophenones), the UVA spectrum (photostabilized avobenzone), the UVA and part of the UVB spectrum (ecamsule), or the UVB and UVA II spectrum (octocrylene, phenylbenzimidazole). As a single sunscreen agent, zinc oxide provides the greatest protective coverage, the lowest allergic reactivity, and the highest safety record.

- **Photostabilization**

Photostabilized avobenzone and ecamsule (Mexoryl) are currently the best methods of UVA protection in *chemical* sunscreens in the U.S.[62] Avobenzone 2% is photostabilized in the U.S. by the addition of 1% octocrylene. Avobenzone's photoprotective capacity decreases by 50-60% after exposure to sunlight for one hour and increases the degradation of octyl methoxycinnamate.[61] Octinoxate or octyl methoxycinnamate (OMC) is also not photostable, but does not degrade as quickly as avobenzone and is often combined with zinc oxide. The addition of OMC to avobenzone, however, causes both to more rapidly deteriorate. This negative synergistic effect can cause some sunscreens with a higher SPF to allow more burning than those with a lower SPF. Polymorphous light eruption and solar uticaria are two common reactions to UVR, especially UVA, that can be decreased by use of a stabilized UVA sunscreen.[66]

- **Broad Spectrum**

In the U.S., the FDA has allowed a sunscreen to be labeled “broad spectrum” if it covers the UVB wavelength and part of the UVA wavelength spectrums.[67] In comparison, the Australian standard requires a UVA transmission of less than 10% in the 320-360 nm wavelengths (UVA II). Due to these differences, there are sunscreens that block more UVA being used in Europe, Australia, and Japan under the names Tinosorb, Uvinul, and Neo-Heliopan. There are also U.S. sunscreens that have minimal UVA protection being labeled as broad spectrum.

In August 2007, the FDA proposed an amendment to the final monograph governing sunscreen labeling. This amendment will have a specific rating for both UVB and UVA protection[67] rather than relying on the term "broad spectrum." In the U.S., combinations of UVA sunscreens are being developed that offer a higher level of protection by combining avobenzone (Helioplex is a combination of avobenzone and oxybenzone), benzophenones, mexoryl, zinc oxide and titanium dioxide with other sunscreens and stabilizers that allow for better UVA coverage. Ecamsule, the newest UVA sunscreen, was approved for use in the United States by the FDA in August 2006.

It should be noted that using a sunscreen with a high level of UVB protection, but little UVA protection can falsely lead a person to believe they are protected as they will not experience the erythema associated with a UVB burn, but will sustain the DNA damage associated with UVA exposure.[68-69]

- **Safety**

Generally, most sunscreens have a good in vivo safety profile. However, there are some precautions of which to be aware. Benzophenones, specifically oxybenzone, have been

shown to penetrate the skin, be absorbed systemically and excreted in human urine. Benzophenones as a class also have one of the highest skin irritation rates. Oxybenzone (benzophenone-3) has been found to cause skin allergy, especially after exposure to UVR.[70] Micronized titanium dioxide has been shown to generate free radicals and cause damage within in vitro cell tissue in the presence of sunlight. However, current research shows, that unless the skin is breached, titanium dioxide is not absorbed systemically and dermal penetration appears to be confined to the outermost surface of the stratum corneum.[71-72] PABA has a high rate of adverse skin reactions and stains clothing. It is rarely found in today's sunscreens. Padimate O was developed in response to this, but use of this sunscreen class has declined due to the issues with the old formulation of PABA.[59]

Many of the studies of sunscreens' estrogen effects are in vitro screening assays, not in vivo results, and are suggestive of only weak activity. Oxybenzone and octylmethylcinnamate have demonstrated estrogen-like effects. Oxybenzone has been shown to be metabolized rapidly and has a favorable toxicity profile based on repeated rodent exposure studies. It also is found in nearly 60% of all US sunscreens making it one of the most common.[71] The benefit of using sunscreen and reducing skin cancer rates needs to be weighed over possible safety risks that have thus far not warranted non-use or removal of a sunscreen from the market. However, long term studies need to be done, and until then, if a patient has breast cancer or a child reacts to a sunscreen, it may be prudent to examine the ingredients and switch to a sunscreen with different ingredients.

Several studies have shown that using a combination insect repellent (N,N-diethyl-meta-toluamide or DEET) and sunscreen or using them concommitantly will increase the repellent and the sunscreen (benzophenones) absorption, and skin penetration,[73] and decrease the SPF.[50, 74] Plus, due to the need to reapply sunscreens more often than repellents, if using a combination, this will result in a higher dose of DEET than recommended.[75] Because higher concentrations of DEET, especially in children, have been associated with eye and skin irritations, headaches, irritability, and seizures, the American Academy of Pediatrics recommends using repellants with less than 10-15% concentrations of DEET.[76] It may be best to apply repellent and sunscreen separately.

Choose a Type (Vehicle)

All sunscreens are mixed with a vehicle that transports the sun protective agent to the skin. These vehicles (lotions, oils, gels, sprays, mists, sticks, powders) have advantages and disadvantages.

- **Lotions and Creams**
  The majority of sunscreens come in lotion form. Lotions and creams spread easily on the skin and therefore offer good, even coverage you can see on the skin. They also come in a variety of smells (baby powder, fruit, coconut, etc.) from which to choose. Some may find them heavy to use on the face (especially water resistant types) or too greasy to apply near clothing or hair. They can also feel hot on a warm day and may be hard to apply or reapply when at the beach due to sand adherence to the skin.

Type	Pros	Cons
Lotions	▪Spread easily ▪Good coverage/Can see coverage ▪Vehicle of most sunscreens ▪Assortment of smells	▪May feel heavy or greasy ▪May feel hot ▪Hard to reapply on beach (sand)
Sport or Dry	▪No oily film, dry to touch ▪Less runny with sweating ▪Often oil-free/non-comedogenic	▪May have higher alcohol content ▪May be more easily removed
Gels	▪Apply easily (hairy surfaces) ▪No greasy film/Dries quickly ▪Cologne-like smell	▪Higher alcohol content ▪May burn sores, cuts or pimples ▪Caution using on face or babies
Sprays	▪Hard to reach areas (back, legs)	▪Machine-gun spray pattern – messy ▪Uneven coverage/Still have to spread ▪Sunscreen lost to air ▪Less thick than lotions
Mists	▪Easy to use/Easy to apply ▪No film, dry to touch, cooling ▪Don't have to spread or rub in ▪Hard to reach areas- back, legs, scalp	▪Hard to see coverage ▪Spotty coverage (windy, focused spray) ▪Sunscreen lost to air ▪Don't inhale
Sticks	▪Heavy coverage ▪Good for nose, lips, ears, sm. areas ▪Stick trick for outdoor sports	▪Wax matrix – hard to spread ▪Uneven coverage over large areas ▪Melts in sun
Mineral Powder	▪Light weight, easy to apply ▪Comes in a variety of skin colors	▪Can clog pores ▪If skin dry, residue may show

Sunscreen Type (Vehicle) Table (modified from [77])

- **Sport Formulations**
  Oil-free and sport formulations are more cosmetically suitable (don't leave an oily film, feel dry to the touch), but may be removed more easily by the salt in the ocean water and the chlorine in the pool water. They tend to be less runny with sweating and often come in non-comedogenic formulations which are good for teens' acne-prone skin. However, sport formulations often have a higher alcohol content so they may be more drying to the skin. Dry touch formulations dry to a powder finish, not tacky. No matter what the bottle claims, they do not last eight hours.

- **Gels**
  Gels are made with a high percentage of alcohol and thus apply quickly over large surfaces (especially hairy skin), leave less residue, and dry quickly. Additionally, they

often smell like cologne, so young males tend to like wearing gels. However, because of the alcohol, if you apply the gel to your face it can burn your eyes and sting any open areas like sores, cuts, rashes or pimples. Since these may run into the eyes or nose with sweating, alcohol-based gels are generally not suitable for young children to use on their face. They also may be drying to the skin, especially the face and hands.

- **Sprays/Mists**
  Sprays tend to spray out of the bottle in a shotgun fashion leaving a glob of sunscreen and small scattered spots that may hit clothing, the floor, and everywhere. They do not cover evenly, tend to be messy, and a portion is lost to your surroundings (in the air, on the ground, on your clothes) making them more costly. Since they have to traverse a pump to be used, the composition also tends to be more watery than lotions. Also, sprays still need to be rubbed in.[78] However, they can be used for hard to reach areas (back, back of legs).

  Mists are good for difficult to reach areas like the back, the back of legs, and areas of sparse hair like a balding scalp or part line. They are also very easy to apply and reapply, but because of their clear color it is difficult to tell what skin you have covered with the sunscreen and what you have missed. Windy weather increases the amount of skin not covered as does the focused spray of the mist sunscreens. Also, some of the misted sunscreen is lost to the air and on surroundings instead of reaching the skin. This can make them slightly more expensive, but their ease of use is a great advantage. They leave no film, rapidly dry to the touch and are cooling in a hot climate.

  Typically, mist sunscreens contain alcohol so they should be sprayed on your hand and then rubbed on your face to avoid burning your eyes and nose.[79] Although, one study found that alcohol-based mists were the favorite sunscreen vehicle for facial application.[80] Additionally, there are no current studies on what inhaling misted sunscreen does to your lungs and body. When using mist sunscreens, instruct students to hold their breath, spray on the sunscreen, and then walk out of the sunscreen cloud to prevent inhalation. This is to keep it from getting in the eyes, nose and/or mouth. For the environmentally conscious, mist sunscreens use a bag-and-valve technology (air pressure pushes the mist out) not an ozone-depleting aerosol.

- **Sticks**
  Sticks are made of a wax matrix (like crayons) and therefore do not spread easily over large surface areas or evenly until very warm, at which point they melt. They are best for small areas that require a heavy coating like the lips, nose and ears. Sticks are also good to use around the eyes as they don't run and can prevent other sunscreens from running into your eyes when you sweat. A tip for athletes: take the stick sunscreen, and draw a circle around each eye, going over the eyebrow and under the eye. The eyebrow is a ridge with hair that is anatomically made to protect your eye. The wax will divert the forehead sweat down the nose and temples, away from the eyes. Additionally, for females, a light dusting of a facial powder will also help absorb sweat. This can be applied over the stick sunscreen (in addition to) or by itself.

- **Mineral Powders**
  Cosmetic powders with sunscreens offer the advantages of ease of application, a lightweight feel, and come in a variety of flesh-tone and tan colors.[81] The minerals are composed of elements such as titanium dioxide, zinc, and bismuth oxychloride which are micronized to refract and reflect UV light, and iron oxides which add color. Disadvantages include possible clogging of pores and if the skin is dry, the powder residue may show. Many bronzers contain sunscreens allowing both a tanned look and protection.

- **Smell**
  It's very important to smell a sunscreen before buying. If you don't like the smell, you will be less likely to apply it in the proper amount or to reapply it when necessary.

How Much and Where?

Sunscreen labels often don't tell us how much to apply. Instructions like "apply liberally before sun exposure" and "apply generously and evenly" don't provide *an amount*. As a result, most of us apply much less than the quantity necessary to receive the SPF protection number listed on the bottle. The FDA-mandated SPF determination requires that sunscreen be applied at a density of 2 mg for every cm^2 of skin. An average adult (5'4", 150#, 32" waist) has two square meters of skin, meaning that the application rate should be 40,000 mg or 40 grams of sunscreen for one adult.[49] This equals about one full ounce or one-fourth cup.[82-82] Larger adults have more body surface area and require more sunscreen (1.5 - 2 ounces). For a child, coverage is achieved with 1/2 - 3/4 ounce, depending on body size. For comparative analogies, one ounce is roughly equivalent to a full shot glass, a golf ball sized glob, or six teaspoons.

Body Area	Amount Needed
Face and Neck	1 teaspoon
Front Torso	1 teaspoon
Back Torso	1 teaspoon
Each arm	0.5 teaspoon
Each leg/foot	1.5 teaspoons

For the average adult, this means a six ounce tube of sunscreen is only good for six applications. Many people not only use one tube of sunscreen for the whole summer, but also share it with family or friends thereby not receiving the full SPF value.

Studies have shown that most people apply one-fourth to one-half of the recommended amount of sunscreen.[84-86] Additionally, studies show sun protection does not fall off in a linear fashion (meaning if you apply half the amount, you get half the protection) but instead approaches the square (if you apply half the amount, you get about one-fourth the protection)[37] or even less. To illustrate this, one study found that applying sunscreen with an SPF of 50 at $0.5 mg/cm^2$ yielded an SPF of only 2.7.[87] In addition, areas such as the neck, ears, and temples are often missed. The solution to both problems is to apply a first coat of sunscreen, wait 20 minutes, and then apply a second coat of sunscreen.[88]

Expiration dates should also be checked. Most sunscreens have a three year shelf-life.[89] In reality, the conditions to which many sunscreens are exposed (high heat and direct sunlight when the bottle is left lying in the sun at the pool or put in the trunk of the car) can more rapidly decrease the shelf life. Use common sense - if you apply last summer's sunscreen and it makes your skin react with redness and itching it may be time for a new bottle. If the consistency of the sunscreen is runny or much thickened compared to what it is like when new, discard the bottle. The same applies if the color or smell have changed. It is a good idea to date the bottom of the bottle or side of the tube with a permanent marker when it is first purchased or better yet, buy new bottles every summer and discard the old ones.

o Reapply Every 1-2 Hours

Substantivity is a term that describes how well a sunscreen affixes to your skin under adverse physical conditions (contact with water, sweating, rigorous exercise). The more substantive a sunscreen is, the better it adheres and the longer it lasts. Water resistant sunscreens are made to last approximately 40 minutes in water, while very water resistant (previously called waterproof) sunscreens last about 80 minutes in water[90] and are the longest lasting sunscreens available (the most substantive). It should be noted that "waterproof" is a misnomer as no sunscreen is totally waterproof. All sunscreens must be reapplied.

In general, the rule is to apply a full one to two ounces of sunscreen every one to two hours[91] while outside. However, Diffey suggests applying the first coat 15-30 minutes before going outside and then reapplying soon afterwards (within 15- 30 minutes) rather than at 2-3 hours to achieve adequate coverage.[88] An early second coat will also double the sun protective factor and cover frequently missed sites (ears, sides of neck, temples).[61, 92] Sweating, swimming,[93] toweling off, the salt in ocean water, and the chlorine in pool water all help to remove sunscreen. Pay particular attention to your shoulders, areas under eyes, lips, nose tip, and ears as these areas tend to be missed, easily burned, and sunscreen is easily rubbed off. The face needs vigilant protection as there are high risk anatomical areas (eyes, nose, mouth, ears) that may require extensive reconstruction if a cancer grows that necessitates removal of a large area of tissue.

Several studies have shown that people who have applied sunscreen tend to spend more hours in the sun both receiving increased sun exposure and elevating their rates of skin cancer.[94-95] This may be due to the fact that they have a false sense of security considering themselves "protected" with one application.[96-97] In addition, Huncharek conducted a meta-analysis of over 9000 patients from 11 different studies and found that increased use of sunscreen is not directly associated with an increased risk of melanoma.[98] Remember that there is no sunscreen that "lasts for 8 hours" or "all day" no matter what is on the label. People who wait longer than 2.5 hours to reapply sunscreen have a five times greater chance of getting sunburned than those who reapply every two hours.[59] It is important to apply sunscreen in the proper amount, reapply regularly, and not rely on sunscreen as your sole protection from UVR. Finally, while it seems contradictory, ultraviolet radiation degrades sunscreens. Avobenzone frequently starts at sun protection factors several fold higher than the number listed on the bottle and within a short time is less than the labeled SPF. Most commercial sunscreens lose a large part of their protective

capacity after only 60 minutes.[64] Sunscreen should be applied daily year-round[99] and use of sunscreen with an SPF of at least 15 has been shown to decrease thymine dimer formation, which are signature UV-induced DNA changes associated with cancer development.[100] For teens and lay people, two of the most important issues regarding sunscreen use are if it provides good UVA /UVB protection and if one will use it consistently.[101]

Sunscreen Basics
• Use a sunscreen with SPF 30 or above, UVA/UVB coverage • For sensitive skin, use straight physical blocks (less irritating, white in color) • Body coverage = 1-2 oz (adult), 1/2 - 3/4 oz (child) • Apply two coats, 20 minutes apart • Apply 20-30 minutes before going into the sun • Reapply every 1-2 hours • Use each bottle for only one summer (date bottle) • Check smell, get one you like • Use lotion/gel on body, stick on nose and lips, spray for scalp/back (no gel on face)

Choose it to use it = pick a sunscreen you like and you will use

• Indoor Tanning Beds

Ultraviolet radiation comes in two common forms: natural sunlight and artificial indoor tanning light. Indoor tanning has been found to cause skin cancer[102] due to the intense UVA[45] and UVB radiation. There are many factors that motivate the use of indoor tanning. Chief among them is the immediate convenience (perceived attractiveness of the tan, relaxation), low cost, and perceived health benefits.[103] Teens tan due to peer pressure, desire for the bronzed look, and because it is condoned by their parents.[104] Behaviorally, indoor tanners fall into three distinct categories: intermittent tanners who predominantly tan before a special event (formals, spring break, start of summer) and then little over the rest of the year, regular tanners (tan 3 times per week, all year) and mixed tanners (combination of both).[105]

Use of indoor tanning is associated with a 2.5 increased risk for SCC and 1.5 increased risk for BCC even after adjusting for the number of sunburns and sun exposure history.[106] Veierod studied over 100,000 women for eight years and found that using indoor tanning only twice a month increased the risk for melanoma by fifty-five percent.[107] Two different studies in Europe concluded that the use of sunbeds or sunlamps resulted in an 8.9-fold and 7.7-fold increased risk of melanoma, especially if used before the age of thirty years.[38] Most indoor tanning beds and standup units use lights that emit a high percentage of UVA radiation (97-98%) and a low percentage of UVB (2-6%).[47] In the higher pressure tanning units, the UVB is removed by special blue glass filters to prevent erythema or burning, since clients want to be tan, not burned.

Lamp Differences

The majority of tanning beds contain thirty to fifty 100-watt light bulbs and require an average tanning time of twenty minutes. Most standup units use 40 or more 160-watt bulbs decreasing the tanning time to only eight to fifteen minutes. The lights or lamps (in order of lowest to highest output) include low-pressure fluorescent lamps that convert UVC radiation into longer UVA and UVB wavelengths through use of a phosphor layer; reflective lamps (RUVA) that focus and concentrate their output through the use of an internal reflective coating; very high output lamps (VHO) that consume more electrical power and put out more radiation, thereby requiring a cooling zone at the end of each light; and high pressure lamps that reach very high radiation intensities and emit a broad spectrum of UVA, UVB and some UVC radiation.[47] Lower output units require about 20 minutes to use, higher output units require a shorter time of 8-15 minutes.

Radiation Levels

Tanning beds often contain a rectangular insert for faces that have even higher intensity lamps than the lamps that radiate the body. In a 2003 study, the average wattage of indoor tanning lamps for UVA radiation was 192 W/m^2 and for erythemally-weighted UVB was 0.35 W/m^2.[108] These lights contain four times more UVA and two times more UVB than the radiation from the noon sun during the summer in Washington, DC.[108] In the high-pressure tanning beds, UVA doses of 10-15 times natural sunlight have been found by the FDA.[109] Tanning indoors also increases one's annual solar UVA exposure from 30-300% over outdoor exposures.[110]

Loosely Regulated, Poorly Enforced

While the FDA has regulations on sunlamps, including the acceptable levels of UVC radiation, requirements for protective eye goggles, a warning label, user instructions, and a timer to limit amount of time under the lights (Chapter 21 of the Code of Federal Regulations, Part 1040.20 or online at www.fda.gov), many salons exceed the number of times allowed per week,[111] allow patrons to start at a high level of radiation,[108] allow restricted minors to tan,[112] and allow eyewear to be brought in by the patron, which may not be protective. Additionally, timers are often off by several minutes. Compliance with voluntary regulations is poor.[113] Without a federal mandate, it is up to each state's government to enforce these regulations, and enforcement is sporadic at best.

Lack of Age Limit

There are no federally mandated age limits restricting use of a tanning device. In February 2005, the World Health Organization and the American Academy of Dermatology called for a ban on the use of tanning beds by minors (those under 18 years of age). Indoor tanning emits considerably more UVA radiation in a shorter timespan than natural sunlight and UVA penetrates deeper (into the dermis[45]) causing long term damage. Several studies indicate that the use of tanning beds not only increases the risk of skin cancer, but that risk is higher if use is begun earlier in life.[114] This growing concern is partially supported by the steadily rising rate of pediatric melanoma,[115] the fact that over 2 million U.S. teens use indoor tanning annually,

and the fact that the percentage of use increases from 5% of 13-14 year-olds to 39.6% of 17-18 year olds.[19] Another study showed that the incidence of indoor tanning use increased in teenage girls who used indoor tanning (3 or more times) from 11.2% at age 13-14 years to 47% by age 18-19 years.[12]

Multiple studies have shown that indoor tanning may be addictive[116-117] since UVR is a reinforcing stimulus in frequent tanners[118] and there is a release of "pleasure" chemicals (endorphins, serotonin) by the brain with the skin's absorption of UV light.[119-120] Younger age with first use of indoor tanning (14-15 years) and more frequent use (> 3 times use in life) were associated with difficulty in quitting.[114] Teens whose parents used tanning machines, used indoor tanning more often and started four years earlier than their parents.[121] This is in spite of the fact that those same parents (69%) stated they did not want their children to use tanning beds, but only 15% had discussed this issue with their adolescents.[121] Teens whose parents allowed them to indoor tan, who believed that most of their peers liked the tanned look, and who perceived that their peers used indoor tanning often were more likely to indoor tan themselves.[14] Excessive tanning can be characterized as a body dismorphic disorder in persons with perceived "defects" such as scarring or mild acne who use tanning as camouflage.[122] Silvan and DeLeo suggest an integrated dermatological approach to addictive sunbathing behavior that finds links between the psyche and the body through exploration of the impact of body image, self-esteem, and development.[123]

Many states have enacted legislation to limit indoor tanning by requiring parental or physician consent to use indoor tanning facilities. However, only a handful of states have enacted a ban *prohibiting* children under 14 or 16 years from using commercial indoor tanning units. The tanning industry is a multibillion dollar business, and it lobbies heavily against these changes.[47] Furthermore, most state laws lack enforcement and salons vary in their adherence to FDA proposed rules.[108, 124-125] In contrast, youth smoking and alcohol consumption dropped significantly in many states with federally-mandated age restrictions. Interestingly, parental signed consent is legally required for minors to be treated for dermatological disorders (psoriasis, atopic dermatitis, granuloma annulare, and scleroderma) utilizing UV light in a medical office. These treatments are done under wattage-controlled and timed conditions by a physician with years of education and experience. However, we allow minors to frequent tanning salons where the level of UVR and timing of exposure vary widely and there is a lack of medical oversight.[126]

• Alternatives to Tanning

Behavioral studies have shown that just teaching the health effects of sun abuse is often not enough to change behaviors,[103] as behaviors have multiple complex associations. Offering other methods for maintaining appearance is advised.[127] Many people believe a tan looks healthy and those that do are five times more likely to use indoor tanning.[128] Behavioral decisions are often conceptualized as a choice between alternative courses of action in which the most positive choice is selected.[129] Teaching alternative methods for appearing tan without accumulating the UV exposure offers teens a more positive, less risky choice. Teens who seek UVR to look bronzed may respond better to suggestions

of using self-tanners and bronzers. Behavioral studies indicate that it is important to offer both healthy alternatives and non-judgmental interventions to affect a higher rate of change.[130] Additionally, it has been shown that the use of self-tanners leads to a reduction in favorable attitudes towards the use of indoor tanning.[131]

It should be noted that there is conflicting evidence regarding the use of self-tanners. One study found users of self-tanners to have a higher rate of sunburns and tanning bed use.[132] However, this may be a consequence of the use of self-tanners in combination with indoor tanning to achieve a very bronzed look in persons who have a strong need (addiction) to be tan or a lack of knowledge regarding the low rate of sun protection (SPF 1-2) from a "fake tan."[133] Conversely, Mahler found that when combined with UV photography, use of self tanners decreased the number of hours spent sunbathing.[134] Additionally, Sheehan found a 73% decrease in use of indoor tanning when using self-tanners.[135] For teens, it is good to warn them that when using self-tanners they should still use a sunscreen[136] or use a self-tanner/sunscreen combined product. Finally, since most teens don't like being told what not to do, and often what to do, for that matter, it is important to offer non-radiation opportunities to look tan. Options include using the spray-on booths at tanning salons, airbrushing either at a salon or home, self-application of sunless tanner, and the use of wash-off cosmetics like powdered bronzers and tinted sunscreens.

Since only 11% of US adults currently use self-tanners,[137] teaching the proper application and rationale may make this a better option for teens to use. If applied properly, most of the current self-tanners do not cause the same orange discoloration of previous formulations. Most self-tanners contain a simple sugar called dihydroxyacetone (DHA). This sugar reacts with amino acids to produce yellow-brown pigments called melanoidins and only dyes the topmost layer of the epidermis known as the stratum corneum. Color change varies from orange to brown depending on skin type and amount of solution applied. Color develops within 3-5 hours after application and lasts about 4-5 days. Maintenance of the DHA "tan" requires reapplication every 2-5 days depending upon skin type and percentage of DHA in product used (most are between 3-5%,[138] daily-use moisturizers with DHA have around 1%).

- **Spray-on/Airbrushing**

  When using the spray-on versions of DHA (salon tanning or airbrushing) there are some safety precautions to follow. While DHA is considered relatively safe, there are no current studies regarding inhalation of DHA, so it is best to hold your breath while inside the booth (spray times run 15-30 seconds). If you are allergic to DHA, are pregnant or have asthma, it is probably best to avoid using spray-on tanning methods.[139] Most salons will provide a shower cap to protect your hair and a towel to wipe off excess solution. One should also use a barrier cream to protect nails, soles of feet, and palms of hands. These areas have thicker skin and will absorb more of the DHA leading to a darker color. Also, areas of skin that are more wrinkled (elbows, knees, ankles, crow's feet, and lines around mouth) tend to absorb more of the DHA and become darker as time goes on. Dihydroxyacetone is minimally photoprotective by itself (SPF 2-3)[133] so you must still use a sunscreen unless the product has a sunscreen built in.

Self Application

There are several techniques that can help create a good overall tan when self-applying DHA. In order to obtain a good coloration from DHA, you should first purchase a self-tanning lotion that is colored or tinted so that you can visually see where and how much you are applying (apply an even coat and prevent streak marks). It is also a good idea to buy a box of inexpensive disposable gloves. Wearing these will prevent your palms from turning dark (if you don't have gloves, wash your hands immediately after applying self-tanner). Prepare the skin surface by shaving (if applying to an area that will be shaved, like females' legs), exfoliating to remove

Self-Tanner (DHA) Application Basics

- Shave and then exfoliate skin
- Moisturize lightly and allow moisturizer to absorb for 3 minutes, or don't moisturize
- Apply self-tanner wearing plastic gloves
- Use a tanner with color to visualize even application
- Use a "light" or "fair" formulation if Skin Type I or II
- Lightly coat wrinkled, bendable areas (ankles, knees, elbows, wrists)
- Reapply every 4-5 days
- Avoid daily application with 3-5% DHA (this will turn you orange!)

dead skin cells (the dead cells uptake more of the self-tanner and will initially appear darker and then peel off to reveal a lighter patch of skin), and then moisturizing the shaved and/or exfoliated skin (allow the moisturizer to sink in for about three minutes). Uniform moisture content of the stratum corneum over several hours is important to the development of even pigmentation from the DHA.[140] Under- and overhydration can decrease the pigmentation reaction. Finally, apply the self-tanner in even strokes and with a lighter application on highly mobile body areas (knees, elbows, ankles, around eyes and mouth), which will uptake more of the self-tanner, turn darker, and accent wrinkles. Those areas of your body naturally tan a lighter color than other parts and will shout "fake tan" if darkened. Since the outer skin layer sloughs off every 4-5 days, this is how often self-tanner needs to be reapplied.

Applying self-tanner daily in an effort to get a dark tan quickly will create an abnormal coloration. It is best to reapply the 3-5% solutions no more than every 2-3 days and to start with a light to medium formulation rather than dark. Many people purchase the "dark" formulation and apply it daily which will eventually turn their skin orange. One percent DHA solutions in moisturizers can be applied daily. Color change is usually seen within an hour and full change takes 8-24 hours.[138] The resulting color is also dependent upon your skin type and natural coloration. Dark blonds and brunettes have the best color results. Redheads and white blonds (Skin Type I) and darker haired persons with olive skin tones do not have as "natural" a result as those with golden undertones.[138] Self-tanners work well for Skin Types II and III if you start with the "light" or "medium" formulations, apply it no more often than every three days, and allow yourself to "tan" over a period of about 1-2 weeks. Trying to get an overnight "tan"

will turn you an abnormal color. Although these instructions may appear cumbersome at first, with successive use self-tanning becomes simple, quick, and easy.

Since DHA is a 3-carbon sugar it tends to smell like burning cookies as the color develops. Allow 3-4 hours for the color to fully develop and then shower to remove the smell. Avoid working out (sweating) and tight clothing as these will make the self-tanner run and leave streaks or marks.

Another option is to use a cosmetic bronzer (powdered or liquid) or a tinted sunscreen or foundation. These have to be applied daily since they wash off with soap and water and can be rubbed or sweated off. The trick to applying bronzers is to place them on the areas of the face normally "kissed" by the sun (apex of nose, middle of forehead, apples of cheeks, and chin). Applying the bronzer liberally all over the face may give one a fake tan appearance due to a too heavy application. Conversely, tinted sunscreens and foundations are to be applied over the entire facial and neck surfaces.

• Non-Sunscreen Sun Protective Methods

o Limit Your Time in the Sun During Midday

The sun's rays are at their greatest strength between 10 am and 4 pm so be careful when outdoors during these times. Since many people go outside during these hours and this message may seem unrealistic and therefore easier to ignore,[25] it may be more practical to strictly limit your time in the sun during the hours of 11 am to 1 pm when the UVR is most direct. Protect yourself and limit your exposure during the other hours.

Short Shadow, Seek Shade Ask the students when their shadow is the longest and the shortest. When is the sun most and least direct? Your shadow is non-existent or minimal at noon when the sun is directly overhead. As the day progresses, your shadow lengthens with the decreasing sunlight. If you have no shadow or a shadow shorter than your height, you should find shade and protect yourself. Meteorologist Leith Holloway devised this rule after discovering that when your shadow is equal to your height, the earth's atmosphere has a sun protective factor of two to three.[141] As the sun sets lower in the sky, it is filtered by more of the atmosphere and at a less direct angle, thus becoming more protective. This method is also a great way to measure sun intensity without having to wear a watch or know the exact time, so even very young children can tell when they need to find shade.

o Wear Sun Protective Hats, Glasses and Clothing

Hats are an easy way to protect your head, face and neck from the damaging effects of the sun. Hats with a wide brim (> 3") are best as they can decrease UVR on the forehead, cheeks and nose by a factor of five[142] and offer coverage of your ears, eyes, and most of your neck. Baseball caps protect the scalp and the upper half of your face, but do not prevent UVR from reaching your ears, lower face or neck. Visors only protect your forehead and leave your

scalp, ears, lower face and neck exposed. Hats are very user specific and can easily be thought unfashionable or expose one to ridicule[143] especially if worn during adolescence. Teens are more likely to wear a hat if many of their peers are wearing the same style and if it is socially acceptable (the norm). A key factor in getting a teen to wear a hat is having them select it themself. Many teens will wear baseball caps (especially those playing outdoor sports), but shy away from wearing the more-protective wider brim hats since it is not what they or their peers wear. However, wearing any hat is better than no hat.

Sunglasses are important to protect you from sunburning your cornea, but perhaps more importantly, for preventing future cataracts and macular (retinal) degeneration. There are two key principles to keep in mind when selecting sunglasses: they should wrap around the temple and have a UV label.[28] Sunglass lenses should wrap around the outer edge of the eye towards the temple and fit closely to the skull because approximately 30% of UV light can enter in the non-covered side areas.

Make sure the glasses have a label that says, "100% UV protected" or "400 UV absorption." These labels should meet ANSI (American National Standards Institute) criteria and block at least 99% of all UV rays.[144] If labeled "Z 80.3," the glasses block 95% of the UVA and 60% of the UVB rays. If labeled "cosmetic," the glasses block approximately 70% of the UVR. Just because the lenses are dark does not necessarily mean they block UVR. The darker the lens, the greater the pupil dilation, the more UVR enters the eye. UV protection is provided by a chemical applied to or mixed in the lenses, not the color, so make sure there is an ANSI label. Some contact lenses and regular glasses have built-in UV protection where the lens darkens with UV contact. Lee found that while 71% of teens owned a pair of sunglasses and the mean age for wearing them was 10.4 years, the majority (81%) wore them occasionally or not at all.[145] Everyone should wear UV protected sunglasses now that they are readily available in sizes for all age groups. Infant sunglasses often have a cloth strap that ties with a Velcro closing that can be adjusted to the baby's growing head circumference and toddler glasses that are made of flexible safety plastic with arms that curve around the ears to keep the glasses on their small heads.

Clothing that is sun-protective can be divided into two categories: Ultraviolet Protection Factor (UPF) clothing and regular clothing of specific fabric qualities. UPF standards were first approved in Australia and New Zealand in 1996 to measure a fabric's ability to block UVR from reaching the skin. UPF clothing has three rating levels, described in the following table.

UPF Rating	Protection Level	Protection Provided
15-24	Good	93.3-95.8% of UVR
25-39	Very good	96-97.4% of UVR
40-50	Excellent	97.5-98% of UVR

In the U.S., these standards are voluntary and were developed by the American Society for Testing and Materials (ASTM). The terms UPF and SPF are interchangeable in percentage of protection (UPF 30 = 96.7% UVR protection). UPF swim shirts for teens are also called "surf shirts." Many of these "surfing" shirts were originally developed to prevent skin rashes from the continuous friction of the surfer's skin and the ocean saltwater with their boards. Surf shirts generally have high (50-150) UPF ratings. However, these surf shirts are made of polyester materials that may be hot in the humid summers in areas of the U.S. like the South or Midwest. Other UPF shirts are available in more breathable fabrics with protective factors of thirty to fifty. Look for UPF labels on sun protective clothing, which can be found online or locally in sporting goods stores.

Depending on a variety of factors, regular clothing can also be very sun-protective. Factors that increase a clothing's amount of sun protection include a tighter weave, a darker color, a heavier weight, and/or less stretch. Additionally, clothes that are drier are better at fending off UV rays.[146] Wet fabrics can have their photoprotectivity reduced by one-third.[147] Synthetic fabrics like polyester and polyacrylics are also better than cotton or nylon because the size of the spaces between the fabric fibers (pore size) is smaller and the composition of the material is denser.[148] Intuitively, one would think that lighter colors would be better as they reflect sun and are cooler (temperature-wise), but studies have shown that darker colored fabrics block more light. Most laundry detergents contain optical brighteners that deflect UV light so cleaner clothes are more sun protective than dirty ones.[149] Denim jeans are one of the best fabrics with an SPF of 1700. Looser fits are more protective due to the air space between the skin and the fabric. However, UVA transmission can be high despite a UPF of 30 or above[150] because the UPF represents the protection from UVB only. Finally, if you are unable to obtain UPF clothing, Rit Dye makes a wash-in sun protective chemical finish for clothes that provides an SPF of 30, is good for 20 washings, and doesn't alter the color of the fabric.

o Know Your Environment

Reflection off natural surfaces, increase in altitude, decrease in latitude,[9, 151] time of day, time of year, and percentage of cloud cover all affect the amount of UV radiation that reaches the earth's surface. According to the CDC, water reflects 100% of UV rays, snow and ice reflect 80-90%, sand 20-30%, and grass reflects 2.5-3% of UV waves.[152] This is important because some teens think they are more protected when snowboarding because they are not lying out on a beach directly in the sun. Skiing and snowboarding have a particularly high level of radiation exposure not only due to the reflection from the snow and ice, but because the atmosphere is thinner at higher altitudes. Additionally, we don't feel the heat, so we tend to stay out in the sun longer and use less sunscreen. Latitudes closer to the Equator have more direct UVR and a thinner ozone layer increasing exposure. Time of day (the sun's rays are most direct at solar noon) and time of year (the narrower angle of the sun's rays in the summer radiates more UVR) are other factors. Scattered clouds and overcast clouds allow 89% and 32% of UV rays to reach the earth, respectively.[152] So even on a cloudy day in the winter, protection is still necessary.

• Keeping Yourself Healthy

○ Perform a Monthly Self-Exam

Learn how to examine your body's skin on a regular basis for changes in existing spots and development of new spots. Make sure to look in areas not typically in direct sunlight (part your hair and examine the scalp, look behind the ears and between the toes) and in areas where the sun does not shine (the genitals, inside of the mouth, soles of the feet, and armpits).

Use a mirror to check areas like your back and the back of your legs that are difficult to see. Keep a diary or mole chart of where the large spots are located and their size (use a ruler or paper tape, measure in millimeters). An easy way to keep track of changing moles is to lay a piece of transparent paper (a transparency used in overhead projectors) over the mole and draw the mole's size and shape using a fine marker. Place the date and location of the mole on the transparency. Photographs of the moles using a ruler for scale can also be helpful. University medical centers often offer mole-mapping which is a digital picture mapping of your skin. Later mappings are then compared for changes. Mole mapping has been shown to increase the accuracy of a person's ability to diagnose changing lesions.[153]

○ Know Your Family History

Skin cancer, like other cancers and diseases (heart disease, hypertension, diabetes, etc.) tends to run in families. Approximately 5-12% of all cutaneous melanomas develop in persons with one or more first degree relatives (mother, father, sibling) with melanoma.[154] You are made up of half your mother's genes and half of your father's genes. It is important to know what diseases have affected your parents and grandparents. If you have one or more first-degree relatives with melanoma this increases your risk of the disease by 8-12 fold.[155] If you have skin cancer in your immediate family – parents and siblings – then you should definitely have regular skin cancer exams performed by a dermatologist. If you do not have a family history of skin cancer, you should still perform skin self-exams (SSE) and consider a professional skin screening exam by a dermatologist to use as a baseline.

Patient's ability to accurately identify changing lesions is increased with the use of baseline photographs combined with a skin self-exam.[156] Regular SSE's also lead to earlier diagnosis of lesions with a lower mean Breslow depth[157] and thus a better prognosis. Recommendations

among world and national agencies vary on the need for professional screenings among the general population versus high risk groups. For the general population, the American Cancer Society recommends a professional skin exam as part of a routine cancer check every three years for everyone aged 20-40 years and annually for those older than forty. The American College of Obstetricians and Gynecologists recommends an earlier start at age 13 years for women with risk factors for skin cancer.

Who Finds Abnormal Spots?

Several studies have been conducted that show the majority of skin lesions are found by the patient, rather than medical personnel. Dr. Howard Koh of the Boston University School of Medicine discovered that melanoma lesions are found by patients in 53% of cases, by medical practitioners in 26%, by family members in 17% and by others in 4%.[158] Other studies list the rate of lesions found by patients as high as 74% with women more likely to diagnose a melanoma than men and physicians more likely to diagnose thinner melanomas than patients.[159-161]

How Long Do People Wait Before Having a Melanoma Lesion Checked?

The average time that most people wait before seeing a physician about a changing mole or spot is 9-12 months, approximately one year.[162-164] For nodular melanomas that have a rapid vertical growth phase, waiting a year will greatly worsen the prognosis.

Conclusion

Protection is only as good as you make it. You have to practice prevention on a daily basis, year round, not just in the summer or on vacation. It is important to remember that sunscreen is only one element of a larger sun-protective program. Limiting your time in direct sun, seeking shade, wearing protective gear, knowing your family history and skin type, monitoring the daily UV index, checking your skin, avoiding indoor tanning, and being familiar with early detection methods will allow you to enjoy the outdoors with minimal worry of future health problems. Enjoy the outdoors, but practice safety in the sun.

Open Discussion

Tell them this is the conclusion to the program. Open this time up to questions they may have about anything that needs clarification or issues they want to discuss. Some students will have spots they are concerned about and want you to diagnose. Some students will have skin conditions they may think are cancer. Skin cancers are not always easy to diagnose. Look at their spots, alleviate their concern if possible (often it may be just a mosquito bite or pimple), answer their questions, and refer them to their family doctor for follow-up. If they insist on a lesion diagnosis, calmly explain that you are a student still in training and they would be better served by seeing their private medical doctor or a dermatologist.