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# SKIN CANCER PREVENTIVE BEHAVIOR AND SUN PROTECTION RECOMMENDATIONS

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**OBJECTIVES:** *To summarize, in tabular form, the current literature and information available for skin cancer preventive behaviors and sun protection recommendations.*

**DATA SOURCES:** *Peer-reviewed literature, web sites of professional and federal organizations.*

**CONCLUSION:** *The link between skin cancer and ultra-violet radiation (UVR) exposure is well documented. Primary skin cancer prevention must focus on proven ways to reduce the amount of UVR that reaches the skin, including avoiding UVR, covering up, wearing a wide-brimmed hat and sunglasses and use of sunscreen.*

**IMPLICATIONS FOR NURSING PRACTICE:** *Nurses play a key role in patient education and should use evidence-based resources to provide skin cancer prevention recommendations.*

**KEY WORDS:** *skin cancer, sunscreen, prevention, sun protection*

**T**HE link between skin cancer and ultraviolet radiation (UVR) exposure is well documented. UVR penetrates skin and causes damage that may lead

to non-melanoma skin cancer or melanoma.<sup>1-3</sup> UVR also damages the eyes (potentially influencing development of ocular melanoma, cataracts).<sup>4</sup> Tanning bed use also greatly increases

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the risk of skin cancer.<sup>5,6</sup> The International Agency for Research on Cancer classified UVR-emitting tanning devices as “carcinogenic to humans” in 2006.<sup>3</sup> Melanoma risk may increase significantly if first exposure to a tanning bed is before 35 years of age.<sup>3,5</sup> Primary skin cancer prevention behaviors that focus on proven ways to reduce the amount of UVR reaching

the skin include avoiding UVR exposure, covering sun-exposed skin, wearing a wide-brimmed hat and sunglasses, and sunscreen use.<sup>7</sup> There is little research or evidence for primary prevention behaviors influencing decreased skin cancer recurrence. Table 1 provides recommendations for sun protection behavior and rationale.<sup>7-20</sup>

**TABLE 1.**  
**Sun Protection Behavior**

Recommendations	Rationale
Avoid natural and artificial UVR	<ul style="list-style-type: none"> <li>• Avoid sun exposure from 10AM-4PM when UVR is most damaging to the skin.<sup>7</sup> Use another form of sun protection if avoidance is not possible.</li> <li>• Stay in the shade for optimal (but not complete) protection. Shade protection relies on shade density, shade structure, season, and sun angles.<sup>1</sup> UVR bounces off reflective surfaces such as sand, concrete, or water.<sup>8</sup></li> <li>• Avoid indoor tanning beds. Skin cancers, including melanoma, are linked to the use of tanning beds.<sup>5,6</sup></li> </ul>
Cover up with clothing	<ul style="list-style-type: none"> <li>• Wear long sleeves and long pants to cover UVR-exposed skin.<sup>9</sup></li> <li>• Choose dark colors, tight weaves, and thick fabrics, which UVR is less able to penetrate. Light colors, loose weaves, and thin fabrics allow much more UVR to reach the skin.<sup>10,11</sup></li> <li>• Choose fabrics labeled as having UPF of 40 or higher.<sup>12,13</sup> These are effective alternatives to fabrics such as linen and white cotton, which have very low UPF ratings.<sup>14</sup> UPF fabrics with a high rating are specially treated or constructed of fibers that naturally block and/or absorb UVR before it reaches the skin.</li> </ul>
Wear sunglasses in combination with a wide-brimmed hat that shades the eyes and face	<ul style="list-style-type: none"> <li>• Wear large-framed, wrap-around sunglasses in combination with a wide-brimmed hat for optimal eye protection.<sup>15</sup> Evidence suggests wearing sunglasses alone may not adequately protect eyes because of poor construction and fit.<sup>16,17</sup> Adding the protective shade of a hat may reduce this risk.</li> <li>• Choose sunglasses with 99% to 100% UVA/UVB protection.<sup>15,18-20</sup> This value may also be reported as 400 nm.</li> <li>• Wear UVR-blocking contact lenses that reduce the amount of radiation that reaches the surface of eye and protects the eye from UVR entering from the periphery of ill-fitting sunglasses.<sup>17</sup> Little evidence exists for the protective values of clear, UVR-treated prescription glasses.</li> </ul>

Abbreviations: nm, nanometers; UPF, ultraviolet protective factor; UVR, ultraviolet radiation; UVA, ultraviolet A radiation; UVB, ultraviolet B radiation.

**TABLE 2.**  
**Sunscreen Recommendations and Rationale**

Sunscreen Recommendations	Rationale
Use quality sunscreen	<ul style="list-style-type: none"> <li>• Use a product labeled with an SPF of 15 to 30 or greater.<sup>24,25</sup></li> <li>• Use SPF as a comparison between product coverage, not to determine absolute protection.<sup>26</sup></li> <li>• Use “broad spectrum” sunscreen to protect against skin cancer and not just sunburn.<sup>27</sup> For a product to be labeled as “broad spectrum” it must offer protection against both UVA and UVB.<sup>23</sup></li> </ul>
Apply the appropriate amount	<ul style="list-style-type: none"> <li>• Read the directions on the sunscreen product. The product label may use the terminology “Apply Liberally.”</li> <li>• To achieve the labeled SPF level, apply the product in a thickness of 2 mg/cm<sup>2</sup>. Thickness is based on the definition of SPF, which is the ratio of the dose of UVR required to produce one MED on sunscreen-protected skin after application of 2 mg/cm<sup>2</sup> of product.<sup>28</sup> MED is the lowest dose of UVR that produces perceptible reddening of the skin.</li> <li>• The thickness volume has been interpreted as “The Teaspoon Rule” for ease of consumer understanding.<sup>29,30</sup> Consumers typically do not apply this much<sup>31</sup> and should engage in other sun protection behaviors described to compensate for lowered actual SPF.</li> <li>• Decreased SPF associated with decreased application volume is linear-to-exponential, depending on the product, skin type, and body area of application typically resulting in an SPF of less than half of the labeled SPF (specifically the SPF should be divided by 1.5 to 3.8 for half an application of 1 mg/cm<sup>2</sup>).<sup>32-34</sup></li> </ul>
Apply and re-apply at the appropriate time	<ul style="list-style-type: none"> <li>• Apply sunscreen 15 minutes before sun exposure.<sup>23</sup></li> <li>• Re-apply sunscreen within 15 to 60 minutes after exposure to increase the thickness and uniformity of coverage and compensate for uneven application.<sup>31,35-37</sup></li> <li>• Re-apply sunscreen every 2 hours or after swimming or sweating.<sup>23,38</sup></li> <li>• The SPF value of a product decreases by 25% after 8 hours without activity and by about 55% with activity.<sup>39</sup></li> </ul>
Use sunscreens that are water resistant	<ul style="list-style-type: none"> <li>• Note that there is no water-proof sunscreen. The new FDA labeling specifies water-resistance up to 40 or 80 minutes.<sup>20</sup></li> <li>• Only use a product specifically designed for use in water.</li> </ul>
Note sunscreen expiration information	<ul style="list-style-type: none"> <li>• FDA guidelines<sup>23</sup> specify that all sunscreens must retain their original strength for 3 years.</li> <li>• Store sunscreens in a cool location; the expiration date does not account for degradation that results from heat (in a car or in the sun).</li> </ul>

Abbreviations: FDA, US Food and Drug Administration; MED, minimum erythema dose; SPF, sun protection factor; UVR, ultraviolet radiation; UVA, ultraviolet A radiation; UVB, ultraviolet B radiation.

Sunscreen protects against the acute, sunburn-causing effects of UVR and chronic UVR exposure that can result in photoaging and skin cancer.<sup>21,22</sup> In combination with sun-safe behaviors, sunscreen can reduce the risk of skin cancer and early skin

aging.<sup>23</sup> New US Food and Drug Administration sunscreen product labels are available at: <http://www.fda.gov/downloads/ForConsumers/ConsumerUpdates/UCM258910.pdf>. Table 2 provides recommendations and rationale for sunscreen use.

## REFERENCES

1. Norval M, Lucas RM, Cullen AP, et al. The human health effects of ozone depletion and interactions with climate change. *Photochem Photobiol Sci* 2011;10:199-225.
2. Armstrong BK, Krieger A. The epidemiology of UV induced skin cancer. *J Photochem Photobiol B-Biology* 2001;63:8-18.
3. The International Agency for Research on Cancer (IARC) Working Group on artificial ultraviolet (UV) light and skin cancer. The association of use of sunbeds with cutaneous malignant melanoma and other skin cancers: a systematic review. *Int J Cancer* 2006;120:1116-1122.

4. Gallagher RP, Lee TK. Adverse effects of ultraviolet radiation: a brief review. *Prog Biophys Mol Biol* 2006;92:119-131.
5. Dore JF, Chignol MC. Tanning salons and skin cancer. *Photochem Photobiol Sci* 2012;11:30-37.
6. Zhang M, Qureshi AA, Geller AC, et al. Use of tanning beds and incidence of skin cancer. *J Clin Oncol* 2012;30:1-6.
7. Kasparian NA, McLoone JK, Meiser B. Skin cancer-related prevention and screening behaviors: a review of the literature. *J Behav Med* 2009;32:406-428.
8. Turner J, Parisi V. Measuring the influence of UV reflection from vertical metal surfaces on humans. *Photochem Photobiol Sci* 2009;8:62-69.
9. Hatch KL, Osterwalder U. Garments as solar ultraviolet radiation screening materials. *Dermatol Clin* 2006;24:85-100.
10. Wolska A, Owczarek G, Bartkowiak G. UV protective textile clothing for workers exposed to natural and artificial UV radiation. *Conf Proc IEEE Eng Med Biol Soc* 2010;2010:6260-6263.
11. Davis S, Capjack L, Kerr N, et al. Clothing as protection from ultraviolet radiation: which fabric is most effective? *Int J Dermatol* 1997;36:374-379.
12. Gonzaga ER. Role of UV light in photodamage, skin aging, and skin cancer. *Am J Clin Dermatol* 2009;(suppl 1):19-24.
13. Gambichler T, Laperre J, Hoffmann K. The European standard for sun-protective clothing: EN 13758. *J Eur Acad Dermatol Venereol* 2006;20:125-130.
14. Kullavanijaya P, Lim HW. Photoprotection. *J Am Acad Dermatol* 2005;52:937-958.
15. American Academy of Ophthalmology. Available at: <http://www.aao.org/> (accessed February 20, 2013).
16. Coroneo M. Ultraviolet radiation and the anterior eye. *Eye & Contact Lens* 2011;37:214-224.
17. Sliney DH. Intraocular and crystalline lens protection from ultraviolet damage. *Eye & Contact Lens* 2011;37:250-258.
18. Walsh JE, Bergmanson JPG. Does the eye benefit from wearing ultraviolet-blocking contact lenses? *Eye & Contact Lens* 2011;37:267-272.
19. Anonymous. Statement on ocular ultraviolet radiation hazards in sunlight. St. Louis, MO: American Optometric Association; 1993.
20. American Optometric Association. Sunglasses shopping guide. Available at: <http://www.aoa.org/x6385.xml> (accessed February 20, 2013).
21. Diffey BL. Sunscreens as a preventative measure in melanoma: an evidence-based approach or the precautionary principle? *Br J Dermatol* 2009;161(suppl 3):25-27.
22. Seite S, Fourtanier AM. The benefit of daily photoprotection. *J Am Acad Dermatol* 2008;58(suppl 2):S160-S166.
23. US Food and Drug Administration. Sunscreen. Available at: <http://www.fda.gov/Drugs/ResourcesForYou/Consumers/BuyingUsingMedicineSafely/UnderstandingOver-the-CounterMedicines/ucm239463.htm> (accessed February 28, 2013).
24. Ou-Yang H, Stanfield J, Cole C, et al. High-SPF sunscreens (SPF  $\pm$  70) may provide ultraviolet protection above minimal recommended levels by adequately compensating for lower sunscreen user application amounts. *J Am Acad Dermatol* 2012;67:1220-1227.
25. Weinstock MA. Updated sunscreen advice: SPF30. *J Am Acad Dermatol* 2000;43:154.
26. Loden M, Beitner H, Gonzalez H, et al. Sunscreen use: controversies, challenges and regulatory aspects. *Br J Dermatol* 2011;165:255-262.
27. Moyal DD, Fourtanier AM. Broad-spectrum sunscreens provide better protection from solar ultraviolet-simulated radiation and natural sunlight-induced immunosuppression in human beings. *J Am Acad Dermatol* 2008;58(suppl 2):S149-S154.
28. Damian DL, Halliday GM, Ste Barnetson R. Sun protection factor measurement of sunscreens is dependent on minimal erythema dose. *Br J Dermatol* 1999;141:502-507.
29. Schneider J. The teaspoon rule of applying sunscreen. *Arch Dermatol* 2002;138:838-839.
30. Isedeh P, Osterwalder U, Lim HW. Teaspoon rule revisited: Proper amount of sunscreen application. *Photodermatol Photoimmunol Photomed* 2013;29:55-56.
31. De Villa D, Nagatomi AR, Paese K, et al. Reapplication improves the amount of sunscreen, not its regularity, under real life conditions. *Photochem Photobiol* 2011;87:457-460.
32. Couteau C, Papis E, El-Bourry-Alami S, et al. Influence on SPF of the quantity of sunscreen product applied. *Int J Pharm* 2012;437:250-252.
33. Bimezok R, Gers-Barlag H, Mundt C, et al. Influence of applied quantity of sunscreen products on the sun protection factor—a multicenter study organized by the DGK task force sun protection. *Skin Pharmacol Physiol* 2007;20:57-64.
34. Liu W, Wang X, Lai W, et al. Sunburn protection as a function of sunscreen application thickness differs between high and low SPFs. *Photodermatol Photoimmunol Photomed* 2012;28:120-126.
35. Diffey BL. When should sunscreen be reapplied? *J Am Acad Dermatol* 2001;45:882-885.
36. Pruij B, Green A. Photobiological aspects of sunscreen re-application. *Australas J Dermatol* 1999;40:14-18.
37. Teramura T, Mizuno M, Asano H, et al. Relationship between sun-protection factor and application thickness in high-performance sunscreen: double application of sunscreen is recommended. *Clin Exp Dermatol* 2012;37:904-908.
38. Wright MW, Wright ST, Wagner RF. Mechanisms of sunscreen failure. *J Am Acad Dermatol* 2001;44:781-784.
39. Beyer DM, Faurschou A, Philipsen PA, et al. Sun protection factor persistence on human skin during a day without physical activity or ultraviolet exposure. *Photodermatol Photoimmunol Photomed* 2010;26:22-27.