

# UV Radiation Transmittance: Regular Clothing Versus Sun-Protective Clothing

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## Practice Points

- Dermatologists routinely advise patients that clothing is a method of UVA/UVB protection.
- Regular clothing items provide similar, if not superior, UVA/UVB protection compared to sun-protective clothing.
- Physicians may confidently inform patients that regular clothing items will provide adequate UVA/UVB protection.

*There are many clothing options available for patients who are interested in limiting their exposure to UV radiation; however, these options can be confusing for patients. For dermatologists, there is limited clinical data regarding the advantages, if any, of sun-protective clothing. In this study, we examined the UV radiation transmittance of regular clothing versus sun-protective clothing. We found that regular clothing may match or even exceed sun-protective clothing in blocking the transmittance of UV radiation. These data will help dermatologists better counsel their patients on clothing options for sun protection.*

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Dermatologists frequently encounter patients who inquire about the need to buy special clothing and hats that claim to block UV light rather than using their regular clothing and hats. A patient may argue that he/she has never gotten sunburned through his/her favorite T-shirt

while fishing, so why does he/she need to buy special clothing? The answer to this question is not straightforward. The dermatologist could easily say yes and advise patients to buy special sun-protective clothing, which could be especially tempting if a practitioner actually sells these items in the office. However, when considering evidence-based medicine, one needs to look at the data to appropriately answer the question.

Although it is still evolving, a standard has been set for UV protection factor (UPF) in the United States as well as other countries.<sup>1</sup> Clothing with the maximum UPF rating of 50 blocks 98% of UVA/UVB radiation. Although there are data published in the literature regarding sun-protective clothing, there are scant data in the clinical dermatologic literature.<sup>2-5</sup> To give patients an educated answer to this question, we measured and compared UVA/UVB radiation transmittance through regular (ie, non-UPF rated) clothing versus sun-protective clothing with a UPF rating.

## Materials and Methods

A digital handheld UVA/UVB meter with an absorption spectrum of 280 to 400 nm was used to measure UV energy transmitted through sample clothing articles. The meter measured UVA/UVB light with a maximum reading of 40 mW/cm<sup>2</sup>. Clothing articles were selected of varied material/color and intended use.

Regular clothing articles included a straw golf hat (Figure 1A), an off-white and blue baseball hat (70% wool)(Figure 1B), a black baseball hat

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## Regular vs Sun-Protective Clothing

(100% wool)(Figure 1C), a white athletic tank shirt (100% cotton), a white T-shirt/undershirt (100% cotton), a thin-weave blue T-shirt (100% cotton), and a conventional-weave blue T-shirt (100% cotton)(Figure 1D). The regular clothing items, with the exception of the hats, had been laundered in conventional (ie, non-UV blocking) laundry detergent and no chemicals were applied to enhance UVA/UVB blocking properties. The exact number of times the items were laundered was unknown.

Sun-protective clothing articles included a polyester floral splash bucket hat and a polyester ruffled swim romper (Figure 2), both with a UPF rating of 50+. These items were purchased from a manufacturer who regularly promotes sun-protective clothing to both dermatologists and the general public.

The company “guarantees” a UPF rating of 50 and advertises that these clothing articles block 98% of harmful UV rays. These items were not laundered prior to the study, and no chemicals were applied to enhance UVA/UVB blocking properties.

The UVA/UVB meter was calibrated on a clear cloudless July day in Frankfort, Illinois. An initial reading was taken without any obstruction to the sunlight. The regular and sun-protective clothing



**Figure 1.** Regular clothing articles included a straw golf hat (A), an off-white and blue baseball hat (B), a black baseball hat (C), and white and blue T-shirts (D).



**Figure 2.** Sun-protective clothing articles included a floral splash bucket hat and a ruffled swim romper (UV protection factor 50+).

articles then were placed over the meter to measure the amount of UVA/UVB transmitted through each item. Measurements were taken for each article of clothing after the meter was covered by the respective material for 10 seconds. Care was taken to cover the meter with only 1 layer of material for each article, which was intended to mimic the degree of UVA/UVB blocking and transmittance during normal wear.

### Results

The full results from the study are outlined in the Table. The unobstructed sunlight exposure exceeded the maximum measure of 40 mW/cm<sup>2</sup>, indicating there was a sufficient amount of sunlight to conduct testing.

The data show that both regular and sun-protective clothing blocked UVA/UVB rays in the 280- to 400-nm range. The Table outlines the level of UVA/UVB transmittance for each article of clothing; a lower number indicates less UVA/UVB transmittance occurred and more radiation was blocked.

Several of the regular clothing blocked more UV radiation than the sun-protective clothing; specifically, the data indicate that the baseball hats or the straw golf hat provided better protection than the sun-protective bucket hat. The black baseball hat provided the best UV protection. However, the straw golf hat provided adequate protection and better coverage, making it the best recommendation for patients.

### UVA/UVB Transmittance of Regular Clothing Versus Sun-Protective Clothing

Clothing Type	UVA/UVB Transmittance, <sup>a</sup> mW/cm <sup>2</sup>
Regular clothing	
Black baseball hat (100% wool)	0.64
Straw golf hat	4.97
Off-white and blue baseball hat (70% wool)	5.05
Blue T-shirt (100% cotton; conventional weave)	9.62
Blue T-shirt (100% cotton; thin weave)	12.26
White T-shirt/undershirt (100% cotton)	12.60
White athletic tank shirt (100% cotton)	13.38
Sun-protective clothing	
Floral splash bucket hat (UPF 50+)	11.13
Ruffled swim romper (UPF 50+)	13.05

<sup>a</sup>A lower number indicates less UVA/UVB transmittance occurred and more radiation was blocked.

### Comment

Several of the regular items included in the study allowed less UVA/UVB transmission than the sun-protective clothing. Although our small study tested a limited number and type of articles, we assert that similar regular clothing would have similar transmittance.

There are various factors that affect UVA/UVB transmittance. Fabric construction, weight, thickness, composition, and color will affect the degree of UVA/UVB transmittance.<sup>1</sup> In our study, the thickness, weave, and color of the fabric of the regular hats may have contributed to the superior results compared with the sun-protective hat. It could be postulated that cotton is inherently a superior fabric to the polyester sun-protective clothing fabric. With regard to the regular T-shirts, thickness, weave, and color also may have played a role in blocking UVA/UVB transmittance.

Patients may be assured of a sufficient amount of UVA/UVB blocking with sun-protective clothing. However, our study indicated that the regular clothing articles we tested provided similar, if not better, protection against UV radiation compared with the sun-protective clothing articles.

### Conclusion

Based on the data, we would advise patients that they do not need to buy special sun-protective clothing that claims to block UV radiation, as regular clothing will provide equivalent protection against UVA/UVB radiation. However, these findings do not suggest that the claims for sun-protective clothing are inaccurate. Nevertheless, similar UVA/UVB blocking may be achieved with clothing already owned by patients.

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