ABSTRACT: For many years, individuals around the world have relied on sunscreen alone as their primary form of protection against ultraviolet rays (UV-R). Australia has shown that a multitactic approach to skin cancer prevention, combining sun-protective clothing with sunscreen, can be both highly effective and widely accepted by the general public. In the US, the aging baby boomer generation and rising skin cancer epidemic call for a fundamental behavioral shift toward this combination approach to sun protection. Sun-protective clothing, such as that manufactured by Coolibar and awarded the Seal of Recommendation by The Skin Cancer Foundation, offers millions of Americans the opportunity to significantly improve the quality of their lives and is an essential step in eliminating skin cancer in our world.

In order to be certified by The Skin Cancer Foundation, the Coolibar clothing product must undergo extensive UPF testing to confirm the accuracy of the product labeling. Laundry additives evaluated by The Skin Cancer Foundation undergo similar tests to that of...
photoprotective clothing after a uniform laundering method is used to apply the product to the clothing fibers. Both of these certification processes confirm the UPF, UV-A and UV-B transmittance, and percentage blocking UV-A and UV-B. The certification process is reviewed on an annual basis.

KEYWORDS: photoprotective clothing, skin cancer, in vivo testing, in vitro testing, ultraviolet protection factor (UPF), UV-A transmittance, UV-B transmittance, percentage blocking UV-A and UV-B, spectrophotometer, Coolibar, CoolMax®, Rit® Sun Guard™, TINOSORB™FD, The Skin Cancer Foundation, Seal of Recommendation

I. INTRODUCTION

Throughout the world, there is an increasing frequency of skin cancer.¹ More than one million new cases of skin cancer will be diagnosed in the United States this year (American Cancer Society, Atlanta, Georgia); furthermore, more than half of all new cancers in the US are skin cancers. About 80% of these new skin cancer cases are basal cell cancer, 16% are squamous cell, and 4% are melanoma cancer. An estimated 9600 Americans will die of skin cancer this year, 7400 from melanoma and 2200 from other skin cancers. The incidence of melanoma more than tripled among American Caucasians between 1980 and 2002.

Although there are many factors that predispose to the development of skin cancers, the key environmental factor is the cumulative ultraviolet (UV) exposure of an individual. While the best technique for reducing UV exposure is to avoid the sun, this is an unacceptable solution in our global society. In the absence of this alternative, the most frequently recommended form of UV protection has been sunscreen. However, in practice sunscreens often provide inadequate UV protection because of improper consumer use.² Long overlooked, sun-protection strategies have recently focused on sun-protective clothing, designed to block ultraviolet-A (UV-A) and ultraviolet-B (UV-B) radiation. Sun-protective clothing gives consumers a crucial, proactive, effective path to prevent skin diseases.

II. QUANTITATIVE ASSESSMENT OF UV-PROTECTIVE TEXTILES

During the last two decades, it has been recognized that textiles are a reliable means of photoprotection. Australia has played a leadership role in establishing skin cancer education programs that have urged the use of clothing in conjunction with hats and sunscreens for UV protection. The assumed protective benefits of regular clothing have been recently questioned because some studies have shown that many textiles provide only limited UV protection.³ In 1998, Right et al.⁴ reported that the protection afforded by a light-colored cotton shirt was equivalent to a sun-protection factor (SPF) of only 10. Based on laboratory testing of UV transmission through fabrics, Ravishankar and Diffey⁵ reported that UV protection by clothing depended upon a large number of factors, such as type of fiber, color, or moisture content.

In the summer of 1997, the Swiss Cancer League began to focus on sun-protective clothing during the yearly sun-protection campaign. A special education campaign under the title “How sun-proof are your clothes?” was started to gain public interest. In 1999, Gies et al.³ reported the results of this evaluation of the UV transmission of clothing in nine German and 30 Swiss cities. During these campaigns, the UV transmission of 1604 items of clothing, predominantly cotton, worn by the public was measured using a LabSphere™ Transmittance Analyzer UV-1000F (Ciba
Specialty Chemicals, Basel, Switzerland). They recorded the results by demonstrating the erythemally weighted UV-R transmission in percent of the garments tested.

It was disappointing to learn that over 25% of items did not fulfill the protective properties advocated by the Australian/New Zealand Standard (AS/NZS), where the ultraviolet protection factor (UPF) must be greater than 15. For in vitro measurements such as those performed by Gies et al.,³ the UPF is recorded as the ratio of the erythemally weighted UV-R irradiance without fabric protection to the erythemally weighted UV-R irradiance with a fabric specimen present. About one-quarter were classified as providing “Good Protection” (UPF 15-24), “Very Good Protection (UPF 25-39),” and “Excellent Protection” (UPF>40), according to this Standard.

The investigators concluded that this excessive exposure to UV light, stemming from insufficient protection by clothing, might contribute to the skin cancer epidemic, as well as creating health problems in patients suffering from photosensitive diseases. They believed that UV-R exposure could be simply reduced with special UV-protective clothing that regularly guarantees a UPF of 30+. A label documenting the UPF rating would obviously be helpful in identifying these products, especially for light-colored and thin garments.

In a research investigation reported by Gambichler et al.,⁶ the authors documented very similar results to those noted by Gies et al.³ Gambichler et al.⁶ investigated 236 apparel textiles in the Spring/Summer collections 2000 and 2001. Using the European Standard, they reported the UPF of the fabrics spectrophotometrically. They demonstrated that the vast majority of the textiles offered limited photoprotection. Seventy-eight (33%) of the fabrics provided a UPF of less than 15. Forty-five (19%) provided a UPF equal to or greater than 15 and less than 30. One hundred and thirteen (48%) provided a UPF equal or greater than 30 (30+). They further reported that more than 70% of the wool, polyester, and fabric blends provided UPF values of 30+, while less than 30% of the cotton, linen, and viscose fabrics provided UPF values of 30+. It is interesting that fabrics in colors of black, navy-blue, white, green, and beige most frequently provided UPF values of 30+. On the basis of this study, they concluded that it was difficult for the sun-aware consumer to select the right garment, with a third of summer clothing providing insufficient UV protection and only half of the fabrics having a UPF of 30+, the UPF recommended by the European Standards. They recommended that summer apparel fabrics should be measured and labeled in accordance with this European Standard.

Several different effects occur when UV-R strikes a textile surface and the UV-R is broken into several components. A portion of the radiation is reflected at the boundaries of the textile surface. Another part is absorbed when it penetrates the sample, being converted to a different energy form; the remaining portion of radiation travels through the fabric and reaches the skin. This part of UV-R is appropriately referred to as the transmission component. Today, there are two methods for determining the UPF—an in vivo method and an in vitro method. The in vivo method is recorded by determining the minimal erythema dose (MED) with and without textiles on test subjects. When this in vivo method is used, a distinction is made between the “on skin” method, in which the fabric sample is applied directly to the skin of test subjects, or the “off skin” method, in which the fabric is placed at a distance of 2 mm from the skin surface during the measurements.⁷ Using the in vitro method, the UV transmission of the fabric is determined by spectrophotometry, after which the UPF is then calculated from this value.⁸

The transmission of UV-R through a specimen is recorded on a spectrophotometer or a spectroradiometer at known wavelength intervals.⁷ The calibration of the wavelength scale of the spectrophotometer or the spectroradiometer is calculated using the spectro-emission lines of an electrical discharge in mercury vapor. Reference wavelengths for both mercury arc emission and holmium oxide absorption are provided in the ASTM International practice E 275, Standard Practice for Describing and Measuring Performance
Spectroradiometers or spectrophotometers collect transmitted and scattered radiation with the aid of an integrating sphere positioned behind a textile sample. As recommended by the AS/NZS¹¹ and European Standards,¹² the spectrophotometer should be fitted with a UV-R transmitting filter for wavelengths of less than 400 nm (UG-11 filter; Schott, Nainz, Germany) to limit errors caused by fluorescents from whitening agents. The spectrophotometric measurements are performed in the wavelength range of 240–400 nm, in 5-nm steps or less. At least four textile samples must be taken from a garment for UPF determination, two in the machine direction and two in the cross-machine direction. To determine the in vitro UPF; the spectral irradiance (of the source and transmitted spectrum) is weighted against the erythemal action spectrum.¹³ Inter-comparison measurements of different testing laboratories have documented that spectrophotometry is an accurate and reproducible test method for determining UPF, particularly for samples with UPFs below 50.¹⁴

III. STANDARD GUIDE FOR LABELING OF UV-PROTECTIVE TEXTILES

The in vitro UPF method is the major technique of measurement of the photoprotection of textiles in all countries. UPF is a measure of total UV blocked, both UV-B and UV-A. The total UV transmission through the textile is measured by a radiometer. For accurate measurement, this test requires a UV source that closely matches the solar spectrum, with detectors that respond similarly to those of human skin. The technology is simple and suitable when a relative variation in UPF must be measured.

The first UPF program was developed in 1996 by the Australian Radiation Agency, then adopted and enhanced for the US by the American Association of Textiles, Chemists, and Colorists (AATCC; 2000) and ASTM International (ASTM; 2003) organiza-
tions. These Standards are the most stringent UV protection standards for fabrics in the world. However, no manufacturer of photoprotective textiles in the United States is required to follow these standards; they are followed voluntarily by the manufacturers of these products. These standards rate the UPF, not the SPF, of a fabric. One major difference between the UPF and SPF rating systems is that the UPF system measures both UV-A and UV-B radiation blocked, while SPF is a measurement of UV-B radiation only.

The ASTM D 6603 describes the labeling requirements for textile products for the protection of humans from UV-A and UV-B radiation.¹⁵ This standard was not intended for labeling of medical device sun-protective fabrics and clothing, whose labeling is specified in the US Food and Drug Administration's (FDA) Draft Guidance for the Preparation of a Pre-Market Notification. The FDA does, however, regulate any products that make explicit medical or health-related claims, such as the prevention of skin cancer. To date, the FDA has cleared no such photoprotective clothing products. In the past, the FDA also regulated sun-protective clothing designed to block UV radiation; it ceased to regulate these garments in 1996.

A UV-protective textile is any textile whose manufacturer and/or seller claims that it protects consumers from UV light, as well as indicates a reduction in the risk of skin injury associated with UV exposure. UV-protective textiles are used to manufacture various articles of apparel, accessories, hats, and shoes, shade devices such as umbrellas, awnings, and baby-carriage covers. ASTM D 6603¹⁵ indicates a uniform system of labeling on UV-protective textile products that informs consumers about the amount of UV protection provided. This labeling also allows the consumer to compare the amount of protection provided by various textiles, and to purchase the product that best meets their sun protection needs. This UV-label system supplements other required labeling of garments, including permanent care labels and fiber content composition labels.

UV-protective textiles, according to this standard, will be labeled with a UPF. A label UPF value equals the mean UPF calculated for a set of sample observations less the standard error for that sample set. The calculated value is then rounded down to the nearest 5 to produce a label UPF value that may be used as part of the consumer information attached to a textile product. This standard for a label UPF indicates certain UV protection categories. Fabrics determined to have label UPF values of 15–24 are classified in and labeled as having “Good UV Protection.” In addition, fabrics determined to have label UPF values between 25 and 39 are labeled as “Very Good UV Protection.” In contrast, fabrics determined to have label UPF values greater than 40 are labeled as having “Excellent UV Protection.”

These UPF values must be determined by the AATCC Test Method 183.¹⁶ Using this Standard, the UPF values must be evaluated for unprepared specimens, specimens prepared using ASTM D 6544,¹⁷ which outlines preparation for testing specimens and for specimens taken from garments labeled “Wash once before wearing.” In the latter testing, these specimens are taken after the garment is laundered once. Usually, the value to be placed on the product label will be the UPF calculated for the prepared-for-testing specimen or the label UPF calculated for the unprepared specimen, whichever is the lower value. In the case of products to be labeled “Wash once before wearing,” the UPF value to be placed on the product label will be either the UPF calculated for the prepared-for-testing specimens or the laundered-once specimen, which ever is the lower value.

It is important to emphasize that the UPF value to be placed on a garment label needs to be the lowest UPF value expected during consumer use over a two-year period. For synthetic fabrics, this UPF value will typically be obtained for the prepared-for-testing specimens after they have been laundered 40 times and exposed to 100 fading units of UV-radiation, to simulate conditions to lower the UPF during consumer use. For other fabrics, knits in particular, the fabric manufacturer must stretch the fabric to standard width for the garment manufacturer. This
stretching process reduces the UPF of the fabric dramatically because the optical porosity is increased. Because the first laundering of such fabrics will shrink the fabric and reduce the optical porosity of the fabric, the UPF will be restored after laundering. For cotton or cotton-blend knit fabrics, the laundered-once UPF value will typically be lower than the prepared-for-testing value, because optical porosity continues to decline over the life of the garment while calculated UPF values increase.

The ASTM D 6603 Standard ends with this final statement about labeling information. “It is important to emphasize that the actual size and graphic layout of the labeling information is the responsibility of the final product manufacturer or marketer.”¹⁵ It is our belief that this requirement is a missed opportunity for the manufacturer, as well as the consumer, because the consumer will not be able to read it if the writing on the label has a very small font size. Moreover, if the label is not permanently attached to the garment, the consumer will not be reminded of the potential unique benefits of sun-protective clothing and will wear other fabrics that have no sun protection.

IV. THE SKIN CANCER FOUNDATION SEAL OF RECOMMENDATION

The Skin Cancer Foundation is the only national and international foundation concerned exclusively with skin cancers. Their mission is to stem the epidemic of skin cancer with preventative public education campaigns to teach adults, children, and caregivers about the dangerous UV rays of the sun as well as change public attitudes and behaviors toward tanning and sun exposure. The Foundation encourages detection of skin cancers at the earliest stage when they are almost always curable, offers physician education and training programs, and supports research into effective new skin cancer diagnostic techniques and therapies. Since 1981, it has offered a Seal of Recommendation for the photoprotective products that reinforce the Foundation’s educational guidelines and advocacy of the use of UV-protective products. Photoprotective product categories include not only sunscreens, but also sunglasses, window films, laundry detergent additives, and photoprotective fabrics, including clothing. More than 200 products in the United States and some 60 abroad currently have been awarded the Seal.

In order to receive the Seal, clothing products must undergo extensive UPF testing to confirm the accuracy of their product labeling. The Skin Cancer Foundation’s required testing criteria indicates that sun-protective fabrics may be tested in accordance with either the AATCC test method 183¹⁶ or the AS/NZS 4399.¹¹ At least four samples of the fabric are tested while it is in a dry, non-stretched state. If a fabric will be used in a variety of colors and/or textures, each color and textural area must be tested using four samples in each case. This process confirms the UPF, UV-A, and UV-B transmittance and percentage blocking UV-A and UV-B.

UV-absorber laundry additives that qualify for the Seal of Recommendation may be tested in accordance with either the AATCC test method 183¹⁶ or the AS/NZS 4399.¹⁰ Four samples of three test fabrics (Test Fabrics, Inc., Middlesex, New Jersey) are tested while they are in a dry, non-stretched state. These fabrics have first had the laundry additive washed into their fibers through standardized wash conditions. Each fabric sample is then measured for UV four times at various locations within a general area on the fabric. If the laundry additive exceeds a UPF performance of 15 after five wash cycles and a UPF performance of 30 after 10 wash cycles, then the product achieves the performance standard for good protection against UV-R and is eligible for the Seal. This process confirms the UPF, UV-A, and UV-B transmittance and percentage blocking UV-A and UV-B.

The certification process for all products recommended by The Skin Cancer Foundation is reviewed on an annual basis. To receive the most updated information on the recommended products, the reader can visit The Skin Cancer Foundation website at www.skincancer.org, which is updated regularly. The Skin Cancer Foundation recommends that sunscreen...
be applied to all exposed areas of skin when sun-protective clothing is worn.

V. SUN-PROTECTIVE CLOTHING PRODUCTS AND LAUNDRY ADDITIVES

Realizing the urgency of protecting people against skin photodamage, one company, Coolibar (St. Louis Park, Minnesota), has taken a leadership role in making solely sun-protective clothing and labeling its textile fabrics with the appropriate classification category, determined by an independent certifying agency. In addition, The Skin Cancer Foundation certifies the UV protection of many Coolibar products as well as the UV-protective laundry additive Rit® Sun Guard™.

V.A. Coolibar Products

John Barrow heads the Coolibar management team as president. Mr. Barrow, born in Australia, founded Coolibar in 2001 after realizing that while the market for sun-protective clothing is larger than the sunscreen market in Australia, it was essentially a new concept for most Americans. Moreover, he was also aware that the “baby boomer” population had reached the age at which skin cancer is commonly diagnosed, and he believed that sun-protective clothing could make a significant contribution to baby boomers’ health and lifestyle, as well as that of their children and grandchildren. In developing Coolibar, Mr. Barrow drew upon the expertise of a range of individuals in Australia and the US, including scientists, sun-protective clothing manufacturers, marketing/merchandising managers, public health educators, and a variety of physicians.

The Coolibar clothing products cover a set of proven methods for effective sun protection as recommended by the American Academy of Dermatology, the American Academy of Pediatrics, and The Skin Cancer Foundation. Coolibar uses a range of different fabrics in their clothing, which is designed to cover a maximum area of skin; designs also incorporate hidden ventilation and specialized moisture managing fabrics, such as CoolMax®, to attempt to combine protection and comfort. All fabrics are independently tested using AATCC Test Method 183,¹⁶ with specimens prepared according to ASTM D 6544.¹⁷ Products are then labeled according to ASTM D 6603.¹⁵

For example, in some garments, such as Coolibar’s men’s everyday button-down shirt (Fig. 1), Coolibar uses a tightly woven micro fiber containing enhanced titanium dioxide (an UV diffuser) combined with CoolMax® mesh for ventilation and moisture management. In other garments, such as its long-sleeve polos, Coolibar uses a plaited fabric in which the weave and cover factor of the cotton exterior provides protection, while the CoolMax® interior wicks away moisture, keeping the skin dry. CoolMax®, first

### TABLE 1. Comparison of Fabrics

<table>
<thead>
<tr>
<th>Fabric type</th>
<th>Moisture management</th>
<th>Breathability</th>
<th>Fabric care</th>
</tr>
</thead>
<tbody>
<tr>
<td>CoolMax®</td>
<td>Over 90% dry in 30 min Sweat wicked away</td>
<td>Very air permeable</td>
<td>Machine wash and dry</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Shrink resistant</td>
</tr>
<tr>
<td>Cotton</td>
<td>Over 50% dry in 30 min Sweat swells fibers</td>
<td>Sweat swells fibers</td>
<td>Shrinks in dryer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Air permeability restricted</td>
<td>Can lose shape</td>
</tr>
<tr>
<td>Polypropylene</td>
<td>Over 80% dry in 30 min Sweat not wicked away</td>
<td>Varies with construction</td>
<td>Shrinks in dryer</td>
</tr>
<tr>
<td>Nylon</td>
<td>Over 70% dry in 30 min Sweat clings to chemical treatment</td>
<td>Varies with construction</td>
<td>Machine wash and dry</td>
</tr>
</tbody>
</table>

© 2004 American Academy of Dermatology
Figure 1. Men’s Everyday Button Down Shirt

Figure 2. Women’s Classic Knitted Dress

Figure 3. Child’s Long-Sleeve Swim Suit

Figure 4. All Sport Hat

All Coolibar clothing products pictured here are recipients of the Seal of Recommendation from The Skin Cancer Foundation.
constructed from DuPont’s proprietary Dacron fibers in 1986, provides superior moisture management because it moves body perspiration from the skin to the outer layer of the fabric (Table 1). The four-channel fibers of CoolMax® wick moisture away from the skin. The body retains a lower temperature because it requires less energy to cool itself. The fabric fibers are structured to provide consistent air permeability and do not require chemical treatments to maintain this function.

Coolibar garments such as its dress (Fig. 2) use a proprietary knitted polyester/Lycra blend that has a high cover factor, excellent moisture management, and some stretch. UV-protective swimwear, such as the child’s short- and long-sleeve swim shirts (Fig. 3), uses tightly knitted synthetics that provide excellent protection, stretch well, and are chlorine and salt water resistant. Some sun hats, such as the all sport hat (Fig. 4), use the Coolibar micro-fiber fabric with enhanced titanium dioxide, while other sun hats, such as the Coolibar women’s signature hat, use a natural cotton canvas with a tight weave that creates a good cover factor.

All Coolibar clothing products carry a minimum UPF rating of 30, blocking 97% UV-R or greater. Each product in the Coolibar clothing line is individually tested and rated for its UV protection level, which is then explained in a thorough hangtag attached to the product. This tag specifies what UPF the product has received, how the UPF is figured, which testing procedures the individual product was submitted to, and if that product has received the Seal of Recommendation from The Skin Cancer Foundation.

V.B. UV-Protective Laundry Additives

Recently, UV-absorber laundry additives have been developed that augment the UPF of clothes. Dyes and whiteners applied to clothing can raise their UPF significantly; however, their UV protection lags over time as repeated use and cleaning cause them to fade.¹⁸ Rit® (Rit, Indianapolis, Indiana) Sun Guard™, the only UV-absorbent laundry additive currently recommended by The Skin Cancer Foundation, causes the clothing fibers to absorb UV-R instead of allowing UV-R to penetrate the fabric. A typical white cotton T-shirt, with a UPF of 5, develops a UPF of 30 after a single treatment of Rit® Sun Guard™ is laundered into the fabric.¹⁹ Effects of clothing treatment with Rit® Sun Guard™ are cumulative when done in quick succession; two treatments will raise the UPF of the clothing to 50. The increased photoprotection of the clothing will survive approximately 20 launderings and will never alter the color or texture of the clothing in any way. In fact, once an item of clothing is effectively treated, the UV absorption retains its durability through wetness or perspiration, prolonged sun exposure, and chlorine bleach.

The active ingredient in Rit® Sun Guard™ is a compound called TINOSORB™FD, developed by Ciba Specialty Chemicals Corporation, North America. TINOSORB™FD acts as an invisible dye that permeates the cloth’s fibers so it does not block clothing porosity or change the fabric’s texture. Tinosorb compounds, such as TINOSORB™FD, have proven to be excellent filters of both UV-A and UV-B.²⁰ Full-spectrum UV protection is enabled when TINOSORB™FD is chemically combined with fluorescent whitening agents (FWAs) in Rit® Sun Guard™. Fabrics, especially cotton fabrics, can increase their UV absorption when they are laundered with detergents containing FWAs, also called optical brightening agents (OBAs). The FWAs absorb a limited portion of the UV spectrum, absorbing from the upper UV-B spectrum (310–320 nm) to encompass UV-A I (320–340 nm) and UV-A II (340–400 nm).

In testing by Eckhardt and Rohmer,²¹ the UPF of cotton test fabrics increased moderately when different FWAs were added to clothing fabrics (UPF ≤20 after 10 launderings), and increased significantly with the addition of TINOSORB™FD (UPF ≥40 after 10 launderings). A study yet to be published by Eckhardt et al. tested the effects of TINOSORB™FD on polyester/cotton blends. They found that the UPF rating results of the blend exceeded those of 100%
cotton of similar fabric styles, because polyester polymer is more absorbent and has some titanium dioxide delusterant embedded in its fiber. This UV absorber can provide very good to excellent sun protection after 10 wash cycles, while FWAs reach comparable values after at least 20 washes.²¹ TINOSORB™FD has a constitution of two UV-B-absorbing moieties bound to a UV-A absorbing structure. The UV-A moiety also functions to provide solubility, affinity to cotton, and fluorescence.²²

The addition of UV-absorbers such as Rit® Sun Guard™ to the laundry cycle is very cost effective (approximately $20.00 for six treatments) and will work on most natural fabrics. However, there are limitations to this approach to photoprotective clothes; the garments may expose too much skin to the sun’s rays if they lack a collar or long sleeves. Also, some synthetic fabrics lack the fiber construction to absorb the UV additive. The effects of UV-absorber additives to blended fabrics have not yet been significantly researched.

VI. DISCUSSION

At this time, a compulsory standard for photoprotective clothing needs to be legislated. The FDA issued a statement June 3, 1993, that declared, “Any clothing that is labeled or promoted as providing protection against the sun, or limiting exposure to the sun’s UV-A or UV-B rays, is considered to be a medical device and is regulated by the FDA.” It further explained that at the date of publication, only one company had received clearance from the FDA to market clothing for sun protection, and that the FDA allowed the firm to claim an SPF of 30 for its products. However, a 1997 FDA report³³ highlights the FDA 1996 policy shift, which says the FDA will regulate these clothes only if the clothing label makes a medical claim, such as that it prevents skin cancer; at the date of publication, the FDA said they had not approved any sun clothing for medical uses. Currently, all other documents relating to photoprotective clothing have been removed from the FDA website.

Without mandatory, legislated UV testing, the general public is left to make uneducated guesses about the best means to protect itself from the sun. Unfortunately, today many physicians are not aware of the documented benefits of sun-protective clothing. Photoprotective clothing is an essential step in eliminating skin cancer from our world; yet the government, many garment manufacturers, and even, to an extent, the medical community refuse to acknowledge the benefits of photoprotective clothing against skin cancer. There is an urgent need for the Federal government, the FDA, the EPA, and the medical community to join together and mandate photoprotective clothing that protects our citizens against skin cancer and other photosensitive diseases. We also must acknowledge The Skin Cancer Foundation, Coolibar, and Rit® for their valiant efforts to awaken society to this serious and potentially life-threatening societal problem in the United States.

VII. CONCLUSION

For many years individuals around the world have relied on sunscreen alone as their primary form of protection against excessive UV. Australia has shown that a multitactic approach to skin cancer prevention, combining sun-protective clothing with sunscreen, can be both highly effective and widely accepted by the general public. In the US, the aging baby boomer generation and rising skin cancer epidemic demand a fundamental behavioral shift toward this combined approach to sun protection. Sun-protective clothing, such as that manufactured by Coolibar and awarded the Seal of Recommendation by The Skin Cancer Foundation, and clothing laundered with Rit® Sun Guard™ offer millions of Americans the opportunity to significantly improve the quality of their lives. This is an essential step in eliminating skin cancer in our world.

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REFERENCES
