LA ROCHE POSAY
LABORATOIRE DERMATOLOGIQUE

PHOTOPROTECTION
IN CHILDREN

LATEST SCIENTIFIC INFORMATION

LA ROCHE-POSAY, COMMITTED TO DERMATOLOGY

MAIN MESSAGES

THE SKIN OF CHILDREN IS STRUCTURALLY AND FUNCTIONALLY DIFFERENT FROM THE SKIN OF ADULTS. IT IS THEREFORE MORE SENSITIVE TO SUN EXPOSURE AND MORE PRONE TO SUNBURNS.

UP TO 50% OF LIFETIME SUN EXPOSURE OCCURS BEFORE 18-20 YEARS OF AGE AND THE INCIDENCE OF SKIN CANCER AND OTHER SUN-RELATED DISORDERS INCREASES.

EXPERIENCING AT LEAST ONE SUNBURN DURING CHILDHOOD ALMOST DOUBLES THE RISK OF DEVELOPING MELANOMA AND A HISTORY OF FIVE SUNBURNS PER DECADE INCREASES THE RISK OF MELANOMA APPROXIMATELY THREE-FOLD.

PROPER PHOTOPROTECTION MEASURES, INCLUDING THE USE OF PROTECTIVE CLOTHING, HATS AND BROAD-SPECTRUM SUNSCREEN, CAN EFFECTIVELY MITIGATE THE HARMFUL EFFECTS OF SUN RADIATION.

While sunlight is essential for key biological functions such as vitamin D synthesis and the regulation of circadian rhythms, excessive or unprotected exposure to solar radiation can have detrimental effects on human skin and especially on the skin of children. Childhood and adolescence are often considered to contain “critical periods of vulnerability” when individuals are especially susceptible to effects of toxic exposures.

APPROXIMATELY 25 TO 50% OF LIFETIME SUN EXPOSURE OCCURS BEFORE 18-20 YEARS OF AGE. [1, 2]

The alarming rise in the incidence of skin cancer and other sun-related disorders necessitates a comprehensive understanding of the importance of photoprotection in children.

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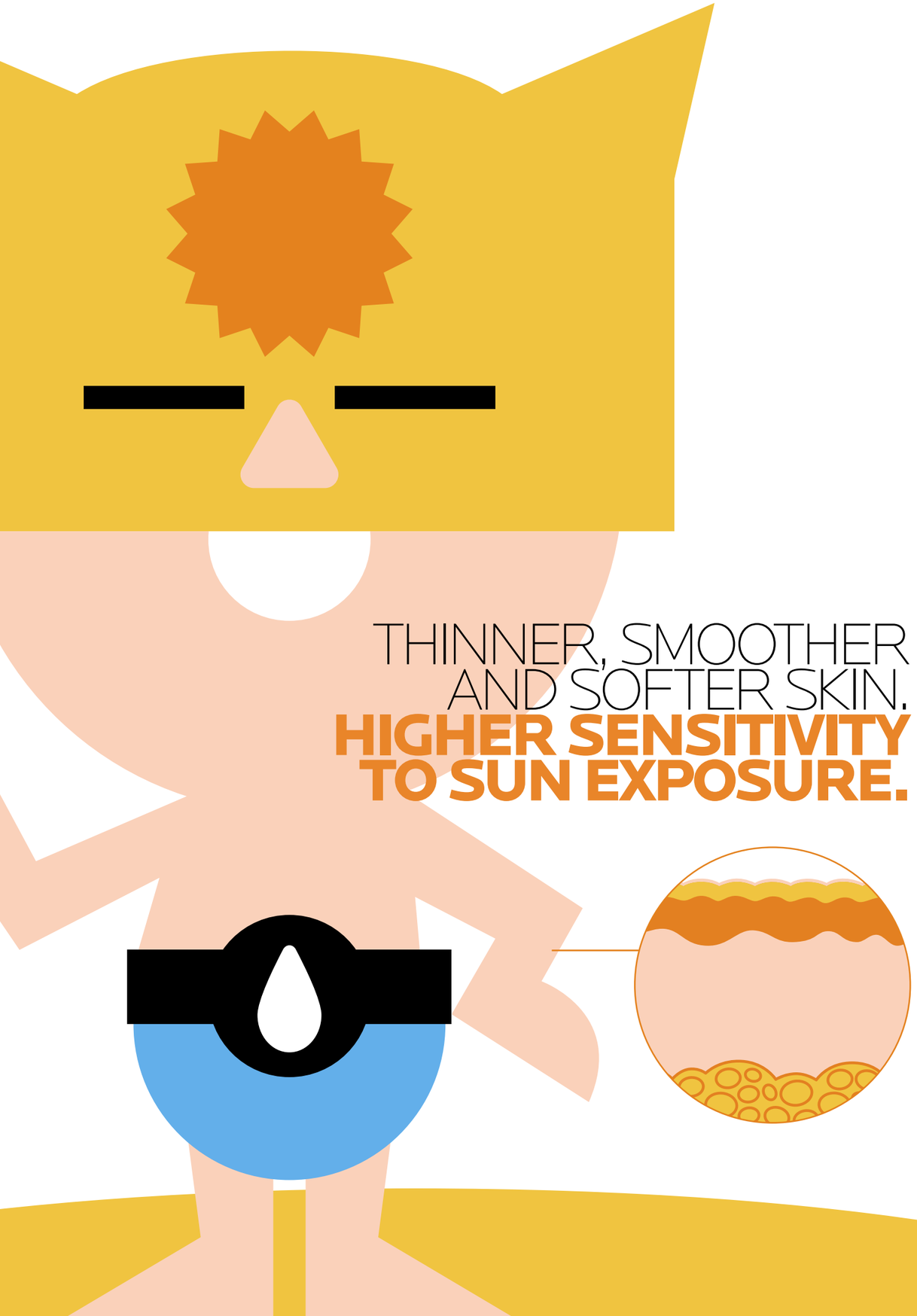


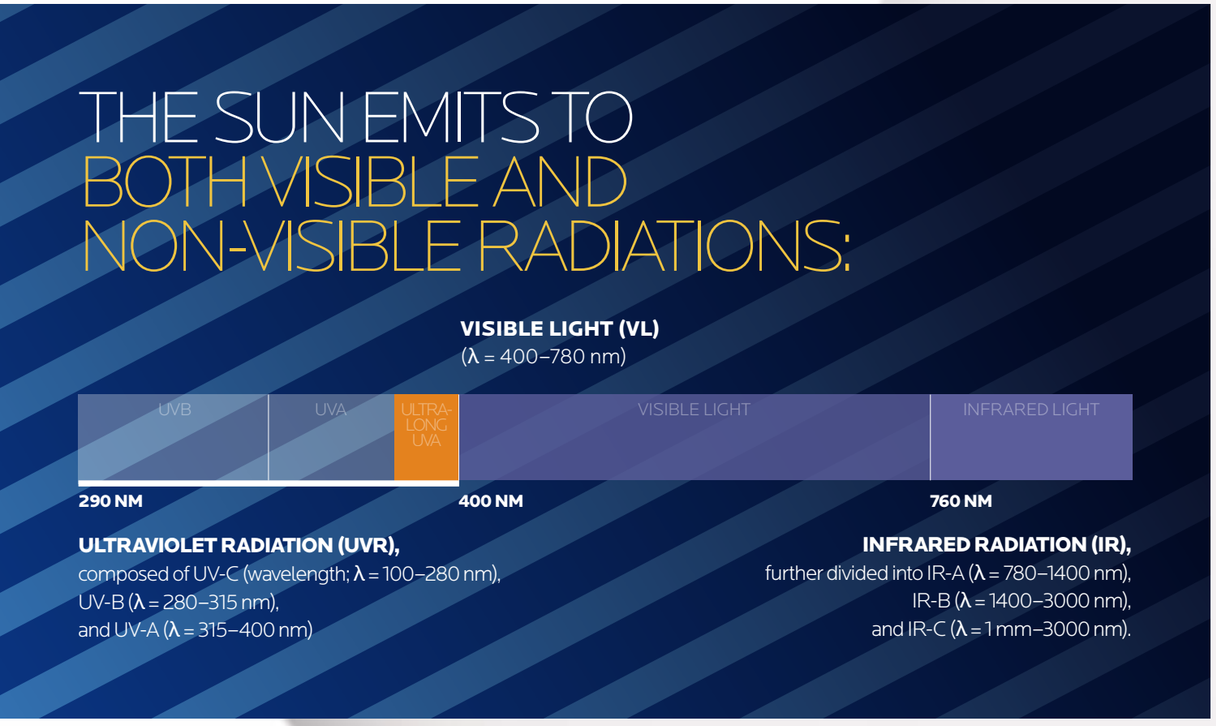
1. CHILDREN'S SKIN CHARACTERISTICS

First of all, children's skin is not adult's skin.[3] It's thinner due to a thinner dermis, even though a full-term neonate has a well-developed epidermis, comparable to an adult skin regarding the epidermis and stratum corneum thickness and number of keratinocyte layers.[4] However, a process of maturation occurs after birth. This process involves increased epidermal cellularity and undulation of rete ridges at the dermo-epidermal junction, sweating, pH, vasoconstriction of dermal capillaries, desquamation, and sebum levels.

The skin of infants and children is often characterized as smoother and softer than in the adult.[5] In infants, the stratum corneum is thinner, water handling is different, and natural moisturizing factor and skin lipid production are reduced compared with adults.[6, 7] **Because of these developmental differences, the skin in children may be more sensitive to irritation and inflammation. These differences can help explain some of the increased sensitivity of the infant to specific skin insults that are not as prevalent in adults and that can result in diaper dermatitis and atopic dermatitis.**[8] As children age, there is a significant decrease in trans epidermal water loss (TEWL) and a concomitant decrease in moisture content, reaching a maximum at about 5 years of age, which leads to a more permeable skin barrier to water in younger children than in adults.[9] Moreover, the structure of juvenile skin shows the position of vellus hair follicles (containing stem cells that give rise to melanocytes inter alia) to be closer to the exposed skin surface than stem cells in adult hair follicles, so that the same amount of surface UV exposure may result in increased UV dosage and DNA damage to the cells that give rise to melanocytes than in older skin, contributing to increased childhood susceptibility to melanoma genesis.[10]

The mentioned differences in anatomic structures and functionality between children's and adult's skin may account for a higher sensitivity to sun exposure, which plays an important role in skin cancer etiology. Indeed, epidemiological studies show a correlation with sunburn in childhood and the risk for malignant melanoma in adulthood,[11] [12] [13] [14] **although a similar hazardous impact of sunburns during the whole lifetime is also observed.**[15] [16]

2. SUN RADIATION



The total UVR that reaches the Earth's surface is composed of 5% UV-B and 95% UV-A since all the UV-C and a large fraction of the UV-B radiation are absorbed by the ozone layer in the stratosphere. UVA radiation is subdivided into short wavelength UVA2 (λ = 315-340 nm) and long UVA1 (λ = 370–400 nm). Out of the total UV dose received by an individual during 30 minutes of outdoor sun exposure (8.250 J/cm2): approximately 3% (250 m J/cm2) is from UVB and 97% (8 J/cm2) is from UVA, with approximately 80% contribution from UVA1. Despite being less energetic, UV-A radiation is abundant at the Earth's surface and penetrates much deeper into the skin than UV-B radiation, reaching far into the dermis. [17] [18]

Solar UV irradiance depends on latitude, time of the year (season), hour of the day, meteorological conditions, and the thickness of ozone layer. UV radiation can penetrate to a depth of 60 cm in water and result in significant exposure. UVA radiation is less affected by those parameters and varied to a lesser extent than UVB radiation. For example, UVA irradiance is less affected by seasons, and decreases to a lesser extent in winter. The time of the day plays an important role too. Indeed, UVA and UVB radiations both raise from the beginning of the day, peak at noon and decrease at the end of the day but UVA radiation is present for most part of the day as it follows the variation of visible light whereas UVB rays are at the highest between 10 a.m. and 4 p.m., especially around midday. **Another interesting characteristic of UVA radiation is that it comes through glass, whereas UVB rays are almost entirely absorbed. Thus, high UVA doses may be received even in indoor conditions while erythemal UVB radiation is filtered out.** [18]

3. EFFECTS OF SUN EXPOSURE ON CHILDREN'S SKIN

3.1. ERYTHEMA AND SUNBURN

Exposure to solar radiation causes vasodilatation and increases the volume of blood in the dermis, which results in erythema. The minimal erythema (or erythemal) dose (the amount of UVR exposure that will cause minimal erythema or slight pinkness of the skin) depends on factors such as (1) skin type, (2) skin thickness, (3) the amount of melanin in the epidermis, (4) melanin production after sun exposure, and (5) the intensity of the radiation. The action spectrum for erythema is mainly in the UVB range. [19] However, UVA and UVB rays both play a role in sunburn, though UVB rays are responsible for directly damaging DNA, and subsequent induction of apoptosis of cells and the release of inflammatory markers. This leads to vasodilation, edema, and pain which translates into the classically red, painful skin seen in a sunburn. [20].

3.2. PIGMENTATION

Pigmentation is a protective response to sun exposure. [21] Immediate pigmentation (or immediate pigment-darkening) results from oxidation of existing melanin after exposure to visible light and long UVA1. Immediate pigment-darkening becomes visible within several minutes and usually fades within 1 to 2 hours. Delayed tanning occurs when new melanin is formed after UVB exposure. Delayed tanning becomes apparent 2 to 3 days after exposure, peaks at 7 to 10 days, and may persist for weeks or months.

3.3. PHOTOAGING

Chronic unprotected exposure to UVR alters cellular components and the extracellular matrix, weakens the skin's elasticity and results in sagging cheeks, deeper facial wrinkles, and skin discoloration. [22]Healthy white-skinned children living in places of high ambient solar UV radiation such as Australia, display early clinical evidence of photodamage in the form of photoaging, which detectable as young as the early teens. Visible clinical signs of skin photoaging include progressive flattening and creasing of the skin surface with increasing UV damage. [1]

3.4. MELANOCYTIC NEVI

Acute sun exposure is implicated in the development of nevi (moles) in children. The number of nevi increases with age; nevi occur with more frequency on sun-exposed areas, and the number of nevi on exposed areas increases with the total cumulative sun exposure during childhood and adolescence. Children with light skin who tend to burn rather than tan have more nevi at all ages, and children who have more severe sunburns have more nevi. [23] [24] There is a relationship between the number and type of melanocytic nevi and the development of melanoma. [25] [26]

3.5. MELANOMA

The occurrence of melanoma is low in children, with only 1–3% of all cases observed in patients under age 20 years. [27] [28] Studies have documented an increase in the incidence in children and adolescents. [29] [30] While less than 0.5% of melanomas occur in the first decade of life [31], a relatively sharp rise in cases occurs following puberty such that 15–19 year olds account for 85% of melanomas diagnosed in under 20 year olds. [32] Epidemiological shows that melanoma has a better latitude correlation with UVA than with UVB. [33]

3.6. NONMELANOMA SKIN CANCER

Nonmelanoma skin cancer (NMSC) is rare in children and young adults. In contrast to adults, where chronic sun exposure is a primary risk factor, NMSC is more often reported in children and young adults with predisposing conditions, including tumor syndromes and photosensitivity disorders. [34] Prolonged immunosuppression, radiation therapy, and voriconazole therapy are established in the adult literature as iatrogenic risk factors for NMSC but have only been reported anecdotally in children. In contrast to adults, the role of sun exposure in the occurrence of nonmelanoma skin cancer in children is not clearly established. [35, 36]

4. IMPORTANCE OF SUNSCREEN EARLY USE

UP TO 50% OF LIFETIME SUN EXPOSURE OCCURS BEFORE 18-20 YEARS OF AGE. [1, 2]

A meta-analysis revealed that having experienced sunburn at least once during childhood almost doubles the risk of developing melanoma and a history of five episodes of sunburn per decade increases the risk of melanoma approximately three-fold. This meta-analysis also concluded that the risk of melanoma augmented with increasing number of sunburns during all life-periods, not just childhood. [15] Nonetheless, sunburn prevalence among children is high, with reported percentages of children having experienced sunburn at least once during the previous year ranging from 29% to over 60% in the Netherlands, United States, Denmark, and Switzerland. [37] [38]

Interestingly, among the factors associated with sunburn in fair skin children is the use of sunscreen, others being sunburn in the adult respondent, increasing age of the child. [38, 39] Among both children and adolescents, sunscreen is the most frequently used method of sun protection, [39] and is often used as the sole prevention method among parents. [37] [40]

5. GOOD PHOTOPROTECTION HABITS

PROTECTING CHILDREN'S SKIN IS OF UTMOST IMPORTANCE.
TO ACHIEVE THIS, SEVERAL MEASURES MUST BE CONSIDERED.

FOR INFANTS AGED < 6 MONTHS

- Keep out of direct sunlight
- Cover with appropriate protective clothing and hats
- Apply sunscreen on small, exposed areas only when sun avoidance impossible

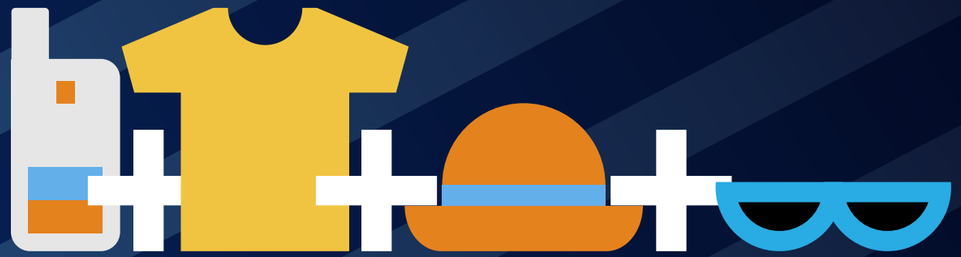
FOR INFANTS AGED > 6 MONTHS AND CHILDREN

- Protect skin by dressing in cool, comfortable clothing that covers the body
- Use a broad brimmed hat
- Limit sun exposure between 10 AM and 4 PM
- Use child-sized sunglasses with UV protection
- Use broad-spectrum sunscreen (UVB, UVA) of at least SPF 30;
  apply 15-30 min before going outside and reapply every 2h and after swimming, sweating, or drying off with a towel to ensure maintaining the level of coverage
- Sunscreens should be water resistant, with
  low potential of irritation to the skin and eyes
- Make sure to apply on exposed areas but also unexposed:
  hands, ears and behind the neck

Performing these behaviors simultaneously is recommended, and should start in early life. [41] Seeking shade and wearing protective clothing are also considered highly important to enhance sun safety, but sunscreen is still advised to be applied as an adjunct to other forms of sun protection.

Parents, and caregivers overall, play an important role in building and implementing children's sun safety habits and subsequent prevention of sunburn experience. Parents are primarily responsible for the application of sun protection measures for their children (shade, clothing, sunscreen) and are most critical in teaching children to perform their own sun protection behaviors. The significant influence of parents, as active agents and role models is well reflected in strong correlations between parents' own sun protection behavior and their children's sun safety. Parents are therefore recommended to strictly adhere to sun protection guidelines and to teach their children adequate sun protection behaviors rendering them an essential target group for communication and intervention aimed at preventing children's sunburn. [37]

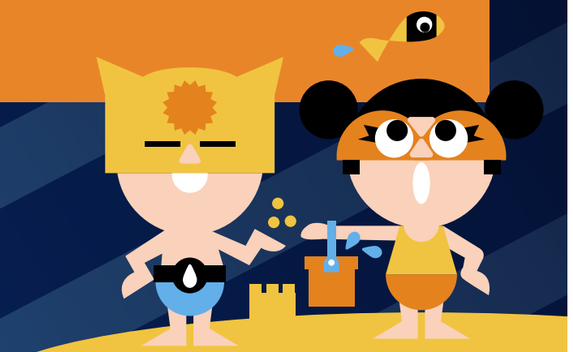
6. CONCLUSION



PROPER PHOTOPROTECTION MEASURES, INCLUDING THE USE OF BROAD-SPECTRUM SUNSCREEN, PROTECTIVE CLOTHING AND HATS, CAN EFFECTIVELY MITIGATE THE HARMFUL EFFECTS OF SUN RADIATION.

Understanding the significance of photoprotection in children is paramount for parents, caregivers and healthcare professionals healthcare professionals. Education about sun safety and photoprotection, for both caregivers and children, is crucial to instill sun-safe habits in children and promoting long-term skin health.

The scientific evidence presented herein underscores the importance of implementing comprehensive sun safety measures during childhood to minimize the risk of pigmentation, erythema, sunburns, photoaging and skin cancer. By prioritizing photoprotection, healthcare professionals can play a vital role in safeguarding the health and well-being of children in the face of escalating sun radiation exposure.



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