What’s new on the regulation of sunscreens and its impact on the environment and health?

Tasneem F. Mohammad, MD, FAAD
Senior Staff Physician
Department of Dermatology
Henry Ford Health Systems, Detroit, MI, USA
Disclosures

• Sub-investigator for Allergan and Ferndale Laboratories
Sunscreen Regulation
Sunscreen Landscape


- Paucity of new filters approved by the FDA
  - Most recent was ecamsule in 2006 through the new drug application process
  - Last filter approved through the OTC monograph was over ten years ago
  - Currently 16 approved sunscreen filters

- European Commission currently has 27 approved sunscreen filters
  - Sunscreens treated as cosmetics instead of OTC medications

2019 Proposed Rule


- **Categorization of sunscreen filters**
  - Category I: Generally recognized as safe and effective (GRASE)
  - Category II: not GRASE
  - Category III: insufficient data available to determine if GRASE
Sunscreen Filter Categorization

<table>
<thead>
<tr>
<th>Category I: GRASE</th>
<th>Category II: Not GRASE</th>
<th>Category III: insufficient data available to determine if GRASE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zinc Oxide</td>
<td>Para-aminobenzoic Acid (PABA)</td>
<td>Avobenzone</td>
</tr>
<tr>
<td>Titanium Dioxide</td>
<td>Trolamine Salicyclate</td>
<td>Homosalate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Octinoxate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Octisalate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Octocrylene</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Oxybenzone</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cinoxate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dioxybenzone</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Enslulizole</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Meradimate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Padimate O</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sulisobenzone</td>
</tr>
</tbody>
</table>
Category III Filters

- Require further testing by industry before they can reach GRASE
- Specific testing is currently being discussed
  - Developmental and reproductive toxicity (DART)
  - Absorption, distribution, metabolism, and excretion (ADME)
  - Maximal usage trials (MUsT)
  - In vitro permeability test (IVPT)
  - Post marketing safety data
  - SPF Tests
Coronavirus Aid Relief and Economic Security Act


• Enacted March 27th, 2020
  – Reform and modernize regulation of OTC monograph drugs
  – Administrative order system
    • More efficient than previous call and response system
  – 18-month exclusivity period for new sunscreen filters
Coronavirus Aid Relief and Economic Security Act

• Changes to sunscreen principal display panel (PDP)
  - Requires active ingredients to be placed on the PDP
    • Facilitate product comparison
Principal Display Panel Comparison

Health Concerns

- 24 subjects applied sunscreen at a concentration of 2mg/cm² to 75% body surface area for 4 days
  - Looked at spray, lotion, and cream formulations
- Systemic concentrations of greater than 0.5 ng/mL reached at the end of the first day
  - Avobenzone, oxybenzone, octocrylene, homosalate, octisalate, octinoxate
Sunscreen Absorption


- Second study with 48 subjects randomized to different formulations also showed systemic absorption
- Exceeds FDA threshold for waiving nonclinical toxicology studies for sunscreens
Sunscreen Absorption

- Clinical relevance of systemic absorption of sunscreen filters is uncertain
  - Further testing required
- The FDA continues to recommend regular sunscreen use while further testing is being performed on Category III filters
Safety of Oxybenzone

• Benzophenones named the 2014 Allergen of the year
  – Most common cause of photoallergy and contact allergy
• Largely replaced by other filters in Europe
Endocrinologic Effects of Oxybenzone


• Studies in rat and fish models
  - Derangements in reproductive hormones when high doses of oxybenzone administered

• Would need to apply 2mg/cm² of oxybenzone to 100% BSA daily for 35 years to achieve similar concentrations
Endocrinologic Effects


- Review of 29 human studies on the impact of systemic levels of:
  - Oxybenzone
    - No adverse effect on
      - Fertility
      - Female reproductive hormone levels
      - Adiposity
      - Fetal growth
      - Child neurodevelopment
      - Sexual maturation
Safety of Organic Sunscreen

- **Oxybenzone**
  - Alterations in:
    - Thyroid hormone levels
    - Testosterone levels
    - Kidney function
    - Pubertal timing
  - Not consistent across studies, showed association but not causation, normal hormone variations
  - Further studies needed
Safety of Organic Sunscreen

- Octinoxate
  - Fewer studies than oxybenzone
    - Lower dermal penetration and absorption
  - No adverse effect on:
    - Reproductive hormones
    - Thyroid hormones
Nanoparticles in Sunscreen


- Micronization of zinc oxide and titanium dioxide to make sunscreens more cosmetically acceptable
Nanoparticles in Sunscreen

- In vitro generation of free radicals (FR) and reactive oxygen species upon exposure of zinc oxide and titanium dioxide to UVR
  - Usually coated with silica to limit release of FR
  - Penetration limited to S. corneum of normal, healthy skin
  - Increased epidermal penetration of UVR damaged skin in porcine model
- No intradermal or systemic absorption
Nanoparticles in Sunscreen

- Zinc oxide and titanium dioxide are the only sunscreen filters recognized as GRASE
  - Subcutaneous and intravenous administration of micronized forms have shown low toxicity
- Safe to use and more cosmetically acceptable
  - Higher likelihood of use
Many Sunscreens Have High Levels of a Carcinogen, Pharmacy Tells

Carcinogen found in sunscreens and including Neutrogena

J&J Recalls Aveeno, Neutrogena Spray Sunscreens

Company is pulling the products after detecting a cancer-causing chemical known as benzene in some samples.

How do you deal with vaccine hesitancy among colleagues and patients? Tell us what you think.
Sunscreen Contaminants

- Valisure-Independent testing agency
  - Tested multiple batches of 69 sunscreen and aftercare products
    - 78 batches contained benzene
      - Carcinogen causing leukemia and lymphoma
    - Products were organic, inorganic, and some did not have any sunscreen filters
    - Multiple formulations tested positive
      - Sprays more heavily represented
Sunscreen Contaminants

- Result of contamination from the manufacturing process NOT because of sunscreen filters
- People should continue to wear sunscreen
  - Valisure has a list of sunscreens and after sun products that did not contain benzene
- Companies have started recalling contaminated products
- Valisure is offering free evaluation of products not previously tested
Environmental Impact
Oxybenzone


• Concern for coral reef bleaching based on in vitro studies
  – 8 to 340 ppb over 4 hours of exposure
• Measurement of oxybenzone in water
  – Most places had concentrations with no or close to zero toxicity
  – Virgin Islands was the notable exception with concentrations of 75-1400 ppb
Oxybenzone

• Other contributory factors
  – Warming ocean temperatures
  – Pollutants
  – Decreasing ocean salinity
  – Greater role in bleaching than oxybenzone

• Bans enacted in Hawaii, Key West, the Virgin Islands, and Aruba on the sale of oxybenzone and other organic sunscreens
Conclusions

• Additional sunscreen filters are needed to provide better broad-spectrum coverage to consumers
• Many concerns are being raised about current filters, including health and environmental impact
• Further testing is being required by the FDA
• We should continue to educate consumers and encourage sunscreen use as part of a total photoprotection package
Thank you!

https://www.michigan.photography/product/downtown-detroit-skyline-at-night-aglow/