Letters

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Author Contributions: Dr Guy and Ms Berkowitz had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Guy, Berkowitz, Holman, Garnett, Watson. Acquisition, analysis, or interpretation of data: Guy, Berkowitz, Everett Jones, Holman, Garnett. Drafting of the manuscript: Guy, Berkowitz, Everett Jones, Garnett, Watson. Critical revision of the manuscript for important intellectual content: Guy, Berkowitz, Holman. Statistical analysis: Berkowitz, Everett Jones. Administrative, technical, or material support: Guy, Garnett, Watson. Study supervision: Guy.

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The Risk of Melanoma in Pilots and Cabin Crew: UV Measurements in Flying Airplanes

Recently, a meta-analysis reported an increased incidence of melanoma in pilots and cabin crew, which was possibly due to occupational exposures.1 Cabin crews’ exposure to cosmic radiation was assessed in different studies and always found below the allowed dose limit.2 However, the cumulative

Results | University of California, San Francisco. viewed and approved by the Committee on Human Research, Omega UV-A tanning bed. The study design has been re-

Methods | 

Table 1. UV Measurements Performed at Pilot Seat Inside a Socata TBM850 at Different Altitudes

<table>
<thead>
<tr>
<th>Altitude, ft</th>
<th>San Jose, CA (49 ft)*</th>
<th>Las Vegas, NV (2030 ft)*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>UV-A and UV-B, μW/cm²</td>
<td>UV-B only, μW/cm²</td>
</tr>
<tr>
<td>Ground level</td>
<td>137</td>
<td>0</td>
</tr>
<tr>
<td>2500</td>
<td>135</td>
<td>0</td>
</tr>
<tr>
<td>6000</td>
<td>138</td>
<td>0</td>
</tr>
<tr>
<td>10 000</td>
<td>189</td>
<td>0</td>
</tr>
<tr>
<td>15 000</td>
<td>228</td>
<td>NA</td>
</tr>
<tr>
<td>20 000</td>
<td>234</td>
<td>0</td>
</tr>
<tr>
<td>25 000</td>
<td>250</td>
<td>0</td>
</tr>
<tr>
<td>30 000</td>
<td>NA</td>
<td>0</td>
</tr>
</tbody>
</table>

Abbreviation: NA, not available. *Measurements in parentheses indicate height above sea level.

All measurements were obtained in April 2015. The UV-A dose in a UV-A-only tanning bed was 706 μW/cm². The carcinogenic effective dose was calculated using the Skin Cancer Utrecht–Philadelphia human action spectrum, and the dose for a 20-minute tanning session was 2940 μJ/m². The carcinogenic effective doses of UV-A radiation in tanning beds and airplanes are compared in Table 2.

Discussion | The pathogenic role of UV-A in melanoma is well established. UV-A is capable of causing DNA damage in cell culture and in animal models. Pilots flying for 56.6 minutes at 30 000 feet receive the same amount of UV-A carcinogenic effective radiation as that from a 20-minute tanning bed session. These levels could be significantly higher when flying over thick cloud layers and snow fields, which could reflect up to 85% of UV radiation. Airplane windshields do not completely block UV-A radiation and therefore are not enough to protect pilots. UV-A transmission inside airplanes can play a role in pilots' increased risk of melanoma.

We recommend further studies to establish recommendations for occupation-related UV radiation dose limits. These studies should include more precise measurement in several airplanes. We believe that better UV protection on aircraft windshields is necessary to offer cabin crew a hazard-free work environment. We strongly recommend the use of sunscreens and periodical skin checks for pilots and cabin crew.

Table 2. UV Carcinogenic Effective Doses in Airplanes and in Tanning Beds

<table>
<thead>
<tr>
<th>Location</th>
<th>Carcinogenic Effective Irradiance, μW/cm²</th>
<th>Time to Receive the UV-A Dose of a Tanning Bed Session, 2940 μJ/m², min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inside tanning bed</td>
<td>0.87</td>
<td>56.60</td>
</tr>
<tr>
<td>In pilot seat at 30 000 ft</td>
<td>2.45</td>
<td>20.00</td>
</tr>
</tbody>
</table>

Intrigued by our findings and the clinical observation of pilots developing melanomas on sun-exposed skin, we measured the amount of UV radiation in airplane cockpits during flight and compared them with measurements performed in tanning beds.

Ultrasound | UV radiation measurements were performed using a Solartech UV index meter designed to measure UV radiation from 280 to 400 nm (UV-B and UV-A) and a Solartech UV index meter designed to measure UV-B only (280-320 nm) (Solartech Inc). We first measured UV radiation in the pilot seat inside a general aviation turboprop airplane (Socata TBM850) through the acrylic plastic windshield (1.6-cm thick) at ground level and at 2500, 6000, 10 000, 15 000, 20 000, 25 000, and 30 000 feet above sea level. The measurements were taken in 2 locations with different solar exposures: San Jose, California, and Las Vegas, Nevada, around midday in April. Later, the same meters were used to measure UV radiation levels in an Omega UV-A tanning bed. The study design has been reviewed and approved by the Committee on Human Research, University of California, San Francisco.

Results | Our measurements inside the airplane revealed that the windshields blocked UV-B but allowed UV-A transmission. The amount of UV-A at 30 000 feet measured in Las Vegas, Nevada, was approximately 242 μW/cm² (Table 1). The UV-A dose in a UV-A-only tanning bed was 706 μW/cm². The carcinogenic effective dose was calculated using the Skin Cancer Utrecht–Philadelphia human action spectrum, and the dose for a 20-minute tanning session was 2940 μJ/m². The carcinogenic effective doses of UV-A radiation in tanning beds and airplanes are compared in Table 2.

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Study concept and design: Sanlorenzo, Ortiz-Urda.
Acquisition, analysis, or interpretation of data: All authors.  
Drafting of the manuscript: Sanlorenzo, Vujic, Cleaver, Ortiz-Urda.  
Critical revision of the manuscript for important intellectual content: Sanlorenzo, Vujic, Posch, Quaglino, Ortiz-Urda.  
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Obtained funding: Ortiz-Urda.  
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OBSERVATION  

Homoygous Missense Mutation in IL36RN in Generalized Pustular Dermatosis With Intraoral Involvement Compatible With Both AGEP and Generalized Pustular Psoriasis  
Acute generalized exanthematous pustulosis (AGEP) and generalized pustular psoriasis (GPP) show multiple overlapping clinical features. Recently, mutations in the IL36RN gene encoding the interleukin (IL)-36 receptor antagonist (IL-36Ra) have been found to cause increased secretion of inflammatory cytokines in GPP and in a subset of AGEP.1,2 In both conditions, half of the patients with IL36RN variants had oral involvement.1,2  

Report of a Case | Herein we report a man in his 40s who initially presented with fever, systemic inflammatory response syndrome, and generalized, sterile, nonfollicular pustules (Figure 1) accentuated in the major flexures and on the palatal mucosa 5 days after intake of amoxicillin, which he took as postoperative prophylaxis after surgery of the thumb. His family history was negative for psoriasis. Medical history and clinicopathologic findings (Figure 2) were consistent with AGEP due to amoxicillin. After obtaining a EuroSCAR AGEP validation score of 10, we considered the diagnosis definite.2 Discontinuation of amoxicillin therapy and initiation of treatment with topical and systemic corticosteroids led to rapid resolution of this episode. A patch test with amoxicillin performed 6 weeks later showed a pustular skin reaction, further implicating amoxicillin as the trigger of this AGEP.  

Nine months later, the patient again developed a generalized pustular reaction with systemic inflammatory response syndrome 3 days after a throat infection with β-hemo-

Figure 1. Clinical Photograph of the Head After the First-Described Acute Generalized Pustular Eruption

Compatible with acute generalized exanthematous pustulosis, nonfollicular pustules on confluent erythematous and edematous plaques are seen on the head.

Figure 2. Right Thoracic Histologic Specimen Taken After the First-Described Generalized Pustular Eruption

Numerous subcorneal pustules, necrotic keratinocytes, edema of the papillary dermis, and perivascular lymphocytic infiltrate consisting mainly of neutrophils and eosinophils (hematoxylin-eosin, original magnification ×100).