Fitzpatrick Skin Type, Individual Typology Angle, and Melanin Index in an African Population: Steps Toward Universally Applicable Skin Photosensitivity Assessments

Calculation of the individual typology angle (ITA) based on spectrophotometric measurements has been used to classify skin types into 6 physiologically relevant groups: very light, light, intermediate, tan, brown, and dark. This study directly compares ITA values with the melanin index (MI), which is frequently used in assigning Fitzpatrick skin type (FST), to improve understanding of how these measurements correlate when used in a study that primarily includes participants with FSTs V and VI.

Methods | Participants (N = 556) were drawn from the Council for Scientific and Industrial Research campus in Pretoria, South Africa, from October 6 through 22, 2014. The research ethics committee of the Council for Scientific and Industrial Research approved the protocol. All participants provided written informed consent, spoke English, cleaned their nondominant arm with a sanitary wipe, and answered a short questionnaire in which they self-identified their population group and skin reaction to sunlight. We determined the ITA and MI objectively using commercially available devices (Skin Colorimeter CL400 and Mexometer MX18 [Courage+Khazaka Electronics, GmbH], respectively) by holding the devices against the inner part of the upper nondominant arm. We categorized ITA as previously described. The following FST and MI values were found: FST I for an MI of 0 to 99.9, FST II for an MI of 100.0 to 149.9, FST III for an MI of 150.0 to 249.9, FST IV for an MI of 250.0 to 349.9, FST V for an MI of 350.0 to 749.9, and FST VI for an MI of 750.0 or greater. We used commercially available statistical software (STATA, version 10.0; StataCorp) for data analysis.

Results | The 556 participants self-identified race/ethnicity as black (n = 390), Indian/Asian (n = 51), white (n = 99), or colored (mixed race/ethnic group) (n = 16). Because the current procedure for assigning FST relies on perception of how skin burns and/or tans, participants identified whether their skin (1) burned without tanning, (2) burned and then tanned, or (3) only tanned after initial sun exposure. Participants from every ethnic group related to the different tan/burn options and demonstrated some level of sun photosensitivity even in ethnic groups frequently associated with darker skin pigmentation (Indian/Asian, black, and colored) (Table). We compared our questionnaire findings with objective skin measurements and found that participant MI readings and ITA measurements demonstrate a very strong negative correlation (Spearman ρ = −0.98; P < .001) (Figure, A). As ITA val-

Table. Frequency of Responses by Population Group to the FST Tan/Burn Questions*

<table>
<thead>
<tr>
<th>Ethnic Group</th>
<th>FST Tan/Burn Question, No. (%)</th>
<th></th>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Only Burn</td>
<td>Burn Then Tan</td>
<td>Only Tan</td>
<td>Not Applicable</td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>67 (17.2)</td>
<td>138 (35.4)</td>
<td>168 (41.1)</td>
<td>17 (4.4)</td>
<td>390 (70.1)</td>
<td></td>
</tr>
<tr>
<td>Indian/Asian</td>
<td>5 (9.8)</td>
<td>19 (37.3)</td>
<td>26 (51.0)</td>
<td>1 (2.0)</td>
<td>51 (9.2)</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>26 (26.3)</td>
<td>60 (60.6)</td>
<td>13 (13.1)</td>
<td>0</td>
<td>99 (17.8)</td>
<td></td>
</tr>
<tr>
<td>Colored</td>
<td>6 (37.5)</td>
<td>5 (31.3)</td>
<td>5 (31.3)</td>
<td>0</td>
<td>16 (2.9)</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviation: FST, Fitzpatrick skin type.

* Totals are based on row sums except the total column, which is based on all 556 participants.
ues decreased, MI values increased monotonically. We then analyzed how these measurements correlated after raw values were categorized. Although ITA and MI values place individuals into one of six skin types, these classification systems are currently unrelated, with no consensus about which MI values belong to which FST group.4,5 We found that by placing participants with MI values of 750.0 or greater in FST VI, we observed a very strong correlation between these unrelated classification systems (Spearman ρ = 0.95; P < .001) (Figure, B).

**Discussion** | Determining skin type is necessary for understanding personal risk for sunburn and, by extension, skin cancer. Skin type is also important clinically because the cosmetic and medical industries have increased their use of laser applications in recent years.4 Because questions about FST are used to assign skin type and determine laser-based treatment variables, participants were asked questions about FST, and 538 (96.8%) stated that the sun affected their skin in some way. Of the 390 black participants, 373 (95.6%) acknowledged that they were photosensitive (Table). Only individuals who are not photosensitive are typically classified as FST VI, and our data confirm that most black participants should be classified as having an FST other than VI.2 As a result, we defined the MI for FST VI to include only individuals with an MI of 750.0 or greater. Strong correlation between MI and ITA values (Figure) suggests that either of these methods can be used to assess skin pigmentation depending on the relevance of the measurement outcome of the intended study. Recognizing this strong correlation will allow research by health care professionals, biomedical scientists, and public health researchers to be more applicable and comprehensible across disciplines.

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**Study concept and design:** Wilkes, Wright, du Plessis.  
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**Correction:** This article was corrected on August 12, 2015, to fix statistics in the Figure.


**Google Search Trends and Skin Cancer: Evaluating the US Population’s Interest in Skin Cancer and Its Association With Melanoma Outcomes**

Whether there is an association between population inquisitiveness in skin cancer and melanoma incidence, mortality, and the mortality to incidence ratio is unknown. Google Trends quantifies interest in topics at the population level by analyzing all search queries for a specific term, thus serving as an increasingly useful research tool.1 Search volume indexes (SVIs) are normalized values based on total searches during a specified period per selected region. We decided to use this innovative tool to evaluate whether population inquisitiveness on melanoma and skin cancer was correlated with a lower incidence, mortality, and mortality to incidence ratio.

**Methods** | We attained search data using Google Trends,2 extracting data from each state from January 1, 2010, to January 1, 2014, for the search terms skin cancer to represent a lay term and melanoma. Independent review board approval and patient informed consent were not required. The overall SVIs were plotted over time to identify periods with greater interest in skin cancer.