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 healthcare professionals, biomedical scientists, and public health researchers to be more applicable and comprehensible across disciplines.

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Accepted for Publication: February 7, 2015.

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Drafting of the manuscript: Wilkes, Wright, Reeder.

Critical revision of the manuscript for important intellectual content: All authors.

Statistical analysis: Wilkes, Wright.

Obtained funding: Wilkes, Wright.

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. 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.
We used Pearson correlations to evaluate the association of skin cancer and melanoma SVI data from 2010 with melanoma incidence, mortality, and mortality to incidence ratios. Incidence and mortality values were taken from the 2011 US Cancer Statistics. We used data for melanoma because non-melanoma skin cancer data are not routinely reported. Data were managed using SPSS statistical software, version 20 (SPSS Inc), with significance set as $P < .05$.

**Results** | Searches increased during each summer yearly but have remained stable for 5 years (2010-2014) (Figure). Searches for melanoma mirrored the search volume for skin cancer. There is a significant correlation between skin cancer SVI for all states and melanoma mortality ($R = 0.345, P = .01$); however, no significant correlation was found between SVI and melanoma incidence ($R = 0.061, P = .67$). At the level of individual states, the 2010 SVI data for the terms skin cancer and melanoma did not significantly correlate with melanoma incidence and mortality. Moreover, no significant correlation was found between SVI and the melanoma mortality to incidence ratio ($R = 0.225, P = .13$). Of note, this analysis was not performed for Alaska, the District of Columbia, Nevada, or Vermont because neither mortality nor incidence was reported. States with the top 10 SVIs for skin cancer and melanoma are listed in the Table.

**Discussion** | Our study found an increase in the general populations’ interest in learning about skin cancer during the summer months. The level of interest for skin cancer and melanoma by state did not correlate with the melanoma mortality to incidence ratio, suggesting that increased search volumes may not be associated with early detection. The positive correlation between skin cancer SVI and increased melanoma mortality may be explained by increased searches from those directly or indirectly affected by advanced melanoma.

Several limitations exist in using Google Trends analysis as an indicator of general population interests in skin cancer. Google Trends analysis is restricted to only the segment of the population with access to the Internet. As of March 2014, this was estimated to be 87% of the US population. As a whole, Google search represents 64.5% of all US desktop search engine queries. Our study is additionally limited by the use of only melanoma data because nonmelanoma skin cancer data are not routinely reported in the United States. Regardless, analysis using melanoma data is still relevant because it provides an important benchmark for prevention and outcome.

### Table. Top 10 States by Search Volume Index (SVI) for Skin Cancer

<table>
<thead>
<tr>
<th>State</th>
<th>SVI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nevada</td>
<td>100</td>
</tr>
<tr>
<td>Tennessee</td>
<td>77</td>
</tr>
<tr>
<td>Missouri</td>
<td>70</td>
</tr>
<tr>
<td>Alabama</td>
<td>70</td>
</tr>
<tr>
<td>South Carolina</td>
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<tr>
<td>Kansas</td>
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</tr>
<tr>
<td>West Virginia</td>
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</tr>
<tr>
<td>Kentucky</td>
<td>68</td>
</tr>
<tr>
<td>Ohio</td>
<td>67</td>
</tr>
<tr>
<td>Florida</td>
<td>66</td>
</tr>
</tbody>
</table>

### Table. Top 10 States by Search Volume Index (SVI) for Melanoma

<table>
<thead>
<tr>
<th>State</th>
<th>SVI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pennsylvania</td>
<td>100</td>
</tr>
<tr>
<td>Tennessee</td>
<td>98</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>93</td>
</tr>
<tr>
<td>Alabama</td>
<td>90</td>
</tr>
<tr>
<td>Indiana</td>
<td>90</td>
</tr>
<tr>
<td>Kentucky</td>
<td>90</td>
</tr>
<tr>
<td>Maine</td>
<td>88</td>
</tr>
<tr>
<td>North Carolina</td>
<td>87</td>
</tr>
<tr>
<td>Missouri</td>
<td>87</td>
</tr>
<tr>
<td>New Hampshire</td>
<td>87</td>
</tr>
</tbody>
</table>

This graph depicts the SVI for the term skin cancer over time from 2010 to 2014. Peaks in search volume are seen during the summer months.
A better understanding of the US population’s interest and means of accessing information regarding skin cancer is essential to improving educational and preventive initiatives. The use of the Google Trends application provides a novel means for determining this interest. Because the US population seeks information regarding skin cancer at a greater level during the summer months, this might be the most efficient time for educational and public health initiatives.

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Accepted for Publication: March 30, 2015.

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Conflict of Interest Disclosures: None reported.


Discussion
Dermatologists have been effective in calling attention to the dangers of tanning salons for noncompliance with state and federal legislation. Our investigation suggests that noncompliance is also problematic when apartment buildings have indoor tanning beds and booths operated by office staff whose primary job is not monitoring these devices. The majority of employees that we questioned did not adhere to the Texas state regulation banning access to indoor tanning facilities to minors. This phenomenon of free on-site tanning in apartment buildings is substantial—more than 29 000 renters in close proximity to UT Austin and TAMU campuses have such access. When students go to college they are exposed to a plethora of risk behaviors. We can now add indoor tanning to this list.

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Indoor Tanning Devices in Student Apartment Complexes: A Study of 2 Texas University Communities

Indoor tanning increases the risk for melanoma and nonmelanoma skin cancer. It is popular among college students; researchers estimate that 43% of university students had used indoor tanning in the prior year. A recent study of 125 US universities found that nearly half had indoor tanning available on campus or at apartments near campus, 96% of which offered indoor tanning without charge. We investigated the prevalence of apartments offering on-site free tanning as well as adherence to Texas state law prohibitions against indoor tanning for minors at the University of Texas at Austin (UT Austin) and Texas A&M University (TAMU). Specifically, we assessed compliance with the Texas Administrative Code that outlaws the use of indoor tanning devices by minors.

Methods
We used the websites google.com, apartmentguide.com, collegestudentapartments.com, and daftlogic.com to find apartments within a 5-mile radius of the center of both campuses. From June 17, 2014, through July 30, 2014, one of us (D.B.) called each apartment to ascertain the approximate number of residents in the building who were students, whether free indoor tanning was offered, and whether indoor tanning for minors was allowed. This was not considered human subjects research, and the Institutional Review Board of the Office of Research Facilitation, Seton Family of Healthcare waived the requirement for approval.

Results
Fifty percent (12 of 24) of apartments within 1 mile of UT Austin and 31% (22 of 72) within a 2-mile radius of TAMU offer free on-site indoor tanning. Within a 5-mile radius, more than 11 500 renters near UT Austin and 17 500 renters near TAMU have access to free indoor tanning on site. Most of these locations were apartments with predominantly undergraduate and graduate students. Of these apartments, 18% (3 of 17) and 32% (8 of 25) near UT and TAMU, respectively, of personnel answered that no consent was needed for a 17-year-old to use the tanning facilities and 53% (9 of 17) and 48% (12 of 25), respectively, answered that minors were allowed to use the tanning facilities with parental consent. Only 1 of 17 and 1 of 25 apartment personnel at UT and TAMU, respectively, knew that use of indoor tanning facilities was prohibited for minors.

Letters