

related muscle cramps with continued use if successful. Further study with a larger randomized clinical trial is warranted.

Mina S. Ally, MD  
 Jean Y. Tang, MD, PhD  
 Joselyn Lindgren, MS  
 Maria Acosta-Raphael, BA  
 Melika Rezaee, BA  
 Anita M. Chanana, BS  
 Ervin H. Epstein Jr, MD

**Author Affiliations:** Department of Dermatology, Stanford University, Stanford, California (Ally, Tang); Children's Hospital Oakland Research Institute, Oakland, California (Lindgren, Acosta-Raphael, Rezaee, Chanana, Epstein).

**Accepted for Publication:** May 19, 2015.

**Corresponding Author:** Ervin H. Epstein Jr, MD, Children's Hospital Oakland Research Institute, 5700 Martin Luther King Jr Way, Oakland, CA 94609 (eepstein@chori.org).

**Published Online:** July 22, 2015. doi:10.1001/jamadermatol.2015.1937.

**Author Contributions:** Drs Ally and Tang 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:* Ally, Tang, Epstein.

*Acquisition, analysis, or interpretation of data:* All authors.

*Drafting of the manuscript:* Ally, Tang, Lindgren, Acosta-Raphael, Rezaee.

*Critical revision of the manuscript for important intellectual content:* Ally, Tang, Lindgren, Rezaee, Chanana, Epstein.

*Statistical analysis:* Ally, Tang, Rezaee.

*Obtained funding:* Lindgren, Epstein.

*Administrative, technical, or material support:* Ally, Lindgren, Acosta-Raphael, Rezaee, Chanana.

*Study supervision:* Tang, Lindgren, Epstein.

**Conflict of Interest Disclosures:** The funding of the clinical trials from which these data were abstracted was supported in large part by Genentech. Dr Epstein reported owning stock in Curis and Infinity. No other disclosures were reported.

**Funding/Support:** This investigator-initiated trial was supported in part by Children's Hospital Oakland Research Institute, Genentech, Clinical and Translational Science Award UL1RRO2413 from the National Institutes of Health, grant 1K23AR056736 from the National Institute of Arthritis and Musculoskeletal and Skin Diseases (Dr Tang), grant RO1CA109584 from the National Cancer Institute (Dr Epstein), Damon Runyon Cancer Research Foundation Clinical Investigator Award CI-54-11 (Dr Tang), and funding from the Swim Across America Foundation and the Michael J. Rainen Family Foundation.

**Role of the Funder/Sponsor:** The funding sources had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data, and preparation of the manuscript. The funding source had a role in reviewing and approving the manuscript and in the decision to submit the manuscript for publication.

**Additional Contributions:** Shufeng Li, MS, helped with statistical analysis. We thank the enrollees and the University of California, San Francisco, Clinical and Translational Science Institute.

1. Epstein EH. Basal cell carcinomas: attack of the hedgehog. *Nat Rev Cancer*. 2008;8(10):743-754.
2. Sekulic A, Migden MR, Oro AE, et al. Efficacy and safety of vismodegib in advanced basal-cell carcinoma. *N Engl J Med*. 2012;366(23):2171-2179.
3. Tang JY, Mackay-Wiggan JM, Aszterbaum M, et al. Inhibiting the hedgehog pathway in patients with the basal-cell nevus syndrome. *N Engl J Med*. 2012;366(23):2180-2188.
4. Teperino R, Amann S, Bayer M, et al. Hedgehog partial agonism drives Warburg-like metabolism in muscle and brown fat. *Cell*. 2012;151(2):414-426.
5. ClinicalTrials.gov. Trial Comparing the Effects of Intermittent Vismodegib Versus Photodynamic Therapy in Patients With Multiple Basal Cell Carcinomas. <https://clinicaltrials.gov/ct2/show/NCT01556009>. Accessed June 1, 2015.

6. ClinicalTrials.gov. Trial Comparing the Effects of Intermittent Vismodegib Versus Photodynamic Therapy in Patients With Multiple Basal Cell Carcinomas. <https://clinicaltrials.gov/ct2/show/NCT01556009>. Accessed June 1, 2015.

7. Ozkul Y. Influence of calcium channel blocker drugs in neuromuscular transmission. *Clin Neurophysiol*. 2007;118(9):2005-2008.

## Prevalence and Correlates of Indoor Tanning in Nonsalon Locations Among a National Sample of Young Women

Indoor tanning is a public health threat,<sup>1</sup> and the Surgeon General has called for its reduction in adolescents and young adults.<sup>2</sup> Research on indoor tanning has not distinguished between tanning-only salons vs other businesses and private residences that provide tanning (ie, nonsalon tanning). For example, gyms often offer free tanning, which may lead to riskier tanning habits.<sup>3</sup> Better understanding of nonsalon tanning could have policy, prevention, and clinical implications. Our study addresses this literature gap by examining the prevalence and correlates of nonsalon tanning in a nationally representative sample of young women, who have the highest rates of indoor tanning use.

**Methods** | Rutgers Institutional Review Board approved the study and all participants signed an online consent form presented prior to the study. A nationally representative sample of 823 women aged 18 to 25 years (mean age, 22.7 years; 463 [56.3%] non-Hispanic white, 118 [14.3%] non-Hispanic black, 174 [21.1%] Hispanic, and 68 [8.3%] non-Hispanic other) was recruited through GfK Knowledge Networks, a research survey firm that uses address-based sampling methods to recruit a probability-based online panel of 55 000 adults from which this sample was drawn. Participants were paid \$5 for completing the survey. Measures included demographics, lifetime indoor tanning use (ever used indoor tanning), current indoor tanning frequency (past 12 months), and indoor tanning location (tanning-only salon or location other than a tanning-only salon). Participants who indicated they tanned at a nonsalon location identified the location as a gym or health club, beauty shop, private home, apartment, or other location. Participants who currently use indoor tanning completed measures of indoor tanning patterns<sup>4</sup> (event or year-round pattern) and indicated whether they used indoor tanning to improve their mood and how difficult it would be to stop using indoor tanning (proxy measure of tanning dependence<sup>5</sup>). History of depression and anxiety were also measured. Analysis of categorical variables used  $\chi^2$  difference tests and continuous outcomes used bivariate general linear models in SPSS Complex Samples, version 21 (SPSS Inc).

**Results** | Forty-one percent (unweighted n = 123) of participants who ever used indoor tanning and 24.6% (n = 34) of current indoor tanning users reported nonsalon tanning (Table 1). Participants who had ever used indoor tanning most commonly used indoor tanning at gyms (64 [18.9%]), beauty shops (39 [13.8%]), and private homes (40 [13.2%]). Participants who were currently using nonsalon indoor tanning most often used indoor tanning at gyms (20 [9.8%]), private homes (13 [7.7%]), and apartment complexes (10 [7.5%]). The number of lifetime indoor tanning sessions was

more than 2 times greater for those who had ever used a nonsalon location (75.7) than those who had not (35.0) ( $P = .02$ ) (Table 2). In participants who were currently using nonsalon indoor tanning, tanning to improve mood ( $P = .06$ ) and year-round tanning ( $P < .001$ ) were more common relative to participants who used tanning-only salons. Participants who were currently using nonsalon indoor tanning reported a history of depression almost 3 times higher ( $P = .047$ ) and difficulty stopping indoor tanning ( $P = .01$ ) than those exclusively using tanning-only salons.

**Discussion** | Our findings indicate nonsalon indoor tanning is common with current indoor tanning users (24.6%) and those who have ever used indoor tanning (41.0%). Gyms are the most typical location of nonsalon indoor tanning. Nonsalon indoor tanning users report more depression, tanning dependence, tanning to improve mood, and lifetime tanning. They are also more likely to use indoor tanning year round. Some indoor tanning users might seek out gyms to circumvent the

federal tanning excise tax, which gyms are not required to collect.<sup>6</sup> Nonsalon tanning locations also seem to attract more high-risk tanners (ie, those who are depressed or have a dependence on tanning). Despite this evidence, we know little about the supervision, regulation, or maintenance of nonsalon tanning locations. Future research needs to assess tanning location along with other indoor tanning variables. Research should examine the reasons nonsalon locations are popular with high-risk tanners, as well as factors that may explain the use of nonsalon locations, such as convenience, cost, physical activity (eg, gym tanning), and living arrangements (eg, apartment tanning). Private home tanning, which has no regulations or oversight, should be carefully studied. We need to better characterize the supervision, maintenance, and regulation of nonsalon locations to inform clinical, prevention, and policy decisions.

Limitations of this study include its focus on adult women only, cross-sectional data, and the inability to assess nonsalon categories independently owing to small sample size.

Physician counseling to reduce indoor tanning is a recommended preventive health service. Physicians should assess patients' tanning locations since nonsalon tanning may indicate more risky behavior.

Joel Hillhouse, PhD  
Jerod L. Stapleton, PhD  
L. Carter Florence, MPH  
Sherry Pagoto, PhD

**Author Affiliations:** Department of Community and Behavioral Health, College of Public Health, East Tennessee State University, Johnson City (Hillhouse, Florence); Rutgers Cancer Institute of New Jersey, Rutgers, The State University of New Jersey, New Brunswick (Stapleton); Department of Medicine, University of Massachusetts Medical School, Worcester (Pagoto).

**Accepted for Publication:** April 8, 2015.

**Corresponding Author:** Joel Hillhouse, PhD, Department of Community and Behavioral Health, College of Public Health, East Tennessee State University, Campus Box 70674, Johnson City, TN 37614 (hillhou@etsu.edu).

**Published Online:** June 24, 2015. doi:10.1001/jamadermatol.2015.1323.

**Table 1. Prevalence of Nonsalon Indoor Tanning Among Young Adult Women Who Reported Indoor Tanning**

Characteristic	Indoor Tanning History, Unweighted No. (Weighted %)	
	Lifetime Users <sup>a</sup>	Used in the Past 12 mo <sup>b</sup>
Prevalence of nonsalon indoor tanning	123 (41.0)	34 (24.6)
Location of nonsalon tanning		
Gym or health club	64 (18.9)	20 (9.8)
Beauty shop	39 (13.8)	8 (4.0)
Private home	40 (13.2)	13 (7.7)
Apartment complex	19 (5.7)	10 (7.5)
Other	16 (6.4)	5 (3.5)

<sup>a</sup> Among participants who reported ever using indoor tanning (estimate of weighted  $n = 217.5$ ; 26.7% of the weighted sample).

<sup>b</sup> Among participants who reported any indoor tanning in the past 12 months (estimate of weighted  $n = 107.9$ ; 13.2% of the weighted sample).

**Table 2. Bivariate Analyses of the Correlates of Nonsalon Indoor Tanning Among Young Adult Women Who Use Indoor Tanning**

Characteristic	Mean Weighted (95% CI)					
	Ever Used Indoor Tanning <sup>a</sup>			Currently Use Indoor Tanning <sup>b</sup>		
	Salon-only	Nonsalon	P Value	Salon-only	Nonsalon	P Value <sup>c</sup>
Lifetime indoor tanning sessions, No.	35.0 (26.9-43.1)	75.7 (41.6-109.8)	.02	76.4 (38.9-113.9)	82.8 (45.5-120.2)	.81
Past 12-mo indoor tanning sessions, No.	7.0 (4.0-9.9)	11.3 (4.1-18.5)	.81	15.2 (10.6-19.8)	25.6 (3.0-47.6)	.38
Nonmetropolitan area, %	15.1 (9.9-22.6)	25.4 (17.0-36.2)	.07	21.7 (13.3-33.4)	36.2 (18.3-58.9)	.20
Ever experienced depression, %	13.7 (8.3-21.9)	17.3 (10.9-26.4)	.49	11.6 (5.1-24.2)	31.6 (15.3-54.1)	.047
Ever experienced anxiety, %	16.8 (10.2-26.5)	17.0 (10.9-25.5)	.97	18.1 (9.2-32.4)	18.2 (6.5-41.5)	.99
Mean difficulty to stop tanning <sup>d</sup>				3.3 (2.5-4.2)	5.28 (4.1-6.5)	.01
% Event tanning pattern, % <sup>d</sup>				69.0 (56.3-79.4)	36.4 (19.5-57.5)	.007
% Mood tanning pattern, % <sup>d</sup>				15.4 (7.8-28.1)	37.6 (18.1-62.1)	.06
% Year-round tanning pattern, % <sup>d</sup>				7.5 (3.3-16.1)	35.4 (17.8-58.1)	<.001

<sup>a</sup> Among participants who reported ever using indoor tanning (estimate of weighted  $n = 217.5$ ; 26.7% of the weighted sample).

<sup>b</sup> Among participants who reported any indoor tanning in the past 12 months (estimate of weighted  $n = 107.9$ ; 13.2% of the weighted sample).

<sup>c</sup> P values represent results of overall significance tests based on the adjusted F statistic provided by SPSS with analyses of weighted data.

<sup>d</sup> Variables assessed only for participants who reported at least 1 indoor tanning session in the past 12 months.

**Author Contributions:** Drs Hillhouse and Stapleton 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:* Hillhouse, Florence, Pagoto.

*Acquisition, analysis, or interpretation of data:* Hillhouse, Stapleton, Pagoto.

*Drafting of the manuscript:* Hillhouse, Stapleton.

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

*Statistical analysis:* Hillhouse, Stapleton.

*Obtained funding:* Hillhouse, Stapleton, Pagoto.

*Administrative, technical, or material support:* Hillhouse, Stapleton, Florence.

*Study supervision:* Hillhouse, Stapleton, Pagoto.

**Conflict of Interest Disclosures:** None reported.

**Funding/Support:** Drs Stapleton and Hillhouse reported receiving grants R03CA165801 and R01CA134891, respectively, from the National Cancer Institute. Dr Pagoto reported receiving grant U48DP001933 from the Centers for Disease Control and Prevention.

**Role of the Funder/Sponsor:** The funding sources had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

1. Colantonio S, Bracken MB, Beecker J. The association of indoor tanning and melanoma in adults: systematic review and meta-analysis. *J Am Acad Dermatol.* 2014;70(5):847-857e818.
2. US Department of Health and Human Services. *The Surgeon General's Call to Action to Prevent Skin Cancer.* Washington, DC: US Dept of Health and Human Services Office of the Surgeon General; 2014.
3. Pagoto SL, Lemon SC, Oleski JL, et al. Availability of tanning beds on US college campuses. *JAMA Dermatol.* 2015;151(1):59-63.
4. Hillhouse J, Turrisi R, Shields AL. Patterns of indoor tanning use: implications for clinical interventions. *Arch Dermatol.* 2007;143(12):1530-1535.
5. Zeller S, Lazovich D, Forster J, Widome R. Do adolescent indoor tanners exhibit dependency? *J Am Acad Dermatol.* 2006;54(4):589-596.
6. Internal Revenue Service. indoor tanning services tax center: filing and paying the indoor tanning services excise tax. <http://www.irs.gov/Businesses/Small-Businesses-&Self-Employed/Indoor-Tanning-Services-Tax-Center>. Accessed February 10, 2015.

## OBSERVATION

### Erythema in Skin Adjacent to Area of Long-term Brimonidine Treatment for Rosacea: A Novel Adverse Reaction

We describe a case of compensatory vasodilation in the vasculature surrounding the site of long-term brimonidine use for the treatment of rosacea.

**Report of a Case |** A 57-year-old woman with a medical history of rosacea, anxiety, hyperlipidemia, and hypertension presented with persistent, patchy erythema on the lateral face and neck of several weeks' duration. Seven months before presentation, she had been prescribed brimonidine, 0.33%, topical gel for persistent facial erythema secondary to rosacea. She reported appropriate use of the medication, applying the prescribed amount only to affected areas on her central face. Physical examination revealed marked bright erythema diffusely covering areas of the lateral cheeks, neck, and upper chest (**Figure, A**). Interestingly, there was clear sparing of the sites of brimonidine application on the central face.

Review of systems revealed only that the eruption was associated with mild burning. Prior to presenting to our clinic, she saw several other dermatologists. Over the course of these visits, several laboratory studies were ordered, including a complete blood cell count with differential, a complete metabolic panel, a lipid panel, and measures of C1, total complement, antinuclear antibody (ANA), and tryptase, all of which yielded normal results. A cutaneous punch biopsy of the left neck was performed and revealed nonspecific findings of photodamaged skin with telangiectasias and scant perivascular lymphocytic inflammation with

**Figure. Clinical Images Before and After Brimonidine Treatment Cessation**



**A,** Patient at initial clinic visit after 7 months of brimonidine treatment, showing compensatory vasodilation and flushing in untreated areas of right lateral cheek, neck, and chest. **B,** Patient 1 week after cessation of brimonidine treatment, showing marked improvement in compensatory vasodilation and flushing.