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Density of Indoor Tanning Facilities in 116 Large U.S. Cities

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Abstract

Background—U.S. adolescents and young adults are using indoor tanning at high rates, even though it has been linked to both melanoma and squamous cell cancer. Because the availability of commercial indoor tanning facilities may influence use, data are needed on the number and density of such facilities.

Methods—In March 2006, commercial indoor tanning facilities in 116 large U.S. cities were identified, and the number and density (per 100,000 population) were computed for each city. Bivariate and multivariate analyses conducted in 2008 tested the association between tanning-facility density and selected geographic, climatologic, demographic, and legislative variables.

Results—Mean facility number and density across cities were 41.8 (SD=30.8) and 11.8 (SD=6.0), respectively. In multivariate analysis, cities with higher percentages of whites and lower ultraviolet (UV) index scores had significantly higher facility densities than those with lower percentages of whites and higher UV index scores.

Conclusions—These data indicate that commercial indoor tanning is widely available in the urban U.S., and this availability may help explain the high usage of indoor tanning.

Introduction

Use of tanning lamps is associated with both melanoma and squamous cell cancer.¹ Approximately 20% of U.S. adults aged 18–29 years used indoor tanning in the past 12 months,² and rates are also high among adolescents,^{3,4} with estimates for older teen girls as high as 40%.⁴

Based on built environment–related research for other health-related behaviors such as alcohol and tobacco,^{5–7} the availability of commercial indoor tanning likely influences indoor tanning use. Therefore, accurately measuring the availability of indoor tanning facilities and identifying correlates of availability are important. CITY100 (Correlates of Indoor Tanning in Youth) is a multicomponent project focusing on potential correlates of adolescents' use of indoor tanning.^{8–10} In this tanning-facility–availability component, updated estimates from a 1998 study¹¹ are provided with the following methodologic improvements: (1) higher-quality

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procedures for identifying indoor tanning facilities, (2) more accurate identification of city borders, and (3) the inclusion of a larger number of cities (N=116 vs N=80).

Methods

Cities

The sample consisted of the 100 most populous U.S. cities, which were located in 34 states, plus the most populous city in each of the remaining 16 states.¹²

For each of the 116 cities, geographic boundaries for the city proper were created with GIS.¹³ Buffer zones of 1, 2, and 3 miles around the boundary of each city were created, because the residents living in the city proper likely travel beyond the formal boundaries.

Outcome Variable

The outcome variable was tanning-facility density, computed by dividing the number of indoor tanning facilities in the city plus those in the 3-mile buffer zone by the city proper's total population¹² and then multiplying the result by 100,000. Inclusion criteria for facilities were (1) must offer ultraviolet radiation indoor tanning and (2) must be open to the public and not require a membership (thereby being more accessible to adolescents).

In March 2006, with *tanning salons* as the key word, eligible commercial establishments in each city and its buffer zones were identified using two Internet business listings: Reference USA. com was the primary search engine and SuperPages.com was the secondary search engine. Businesses were entered into a database file and geocoded to the city-specific map. For 30 of the cities (25.8%), two research assistants independently counted the number of facilities.

Predictor Variables

Geographic variables included the region of country,¹² the latitude, longitude, and elevation,¹⁴ and whether the city is on an ocean coast. Climatologic data consisted of the annual average temperature (°F), the mean days that the temperature was $\geq 90^{\circ}\text{F}$, the mean days that the temperature was $\leq 32^{\circ}\text{F}$, the mean days that precipitation was at least 0.01 inches, the average percentage of possible sunshine,¹⁵ and the average daily ultraviolet (UV) index.¹⁶ Demographic data consisted of the percentage of whites in the total city population, the percentage aged 15–19 years, the percentage with at least some college, and median family income.¹² Legislative data included whether the state had any indoor tanning law, whether the state had a law restricting youth access to indoor tanning, and the stringency score of the general law, using data collected in a previous study.¹⁰ The range of possible stringency scores was 0–100, and cities in states without an indoor tanning law were given a score of zero. Additionally, whether tanning facilities in states with indoor tanning laws were inspected at least annually was included.⁹

Contextual Data

Placing the number of indoor tanning facilities in a socio-culturally meaningful context was desirable. Therefore, the numbers of Starbucks and McDonald's for each of the cities were estimated by systematically searching Superpages.com.¹⁷

Statistical Analysis

Analyses, performed in Spring 2008, included examining bivariate relationships between facility density and potential predictors using independent *t*-tests, ANOVA, or zero-order correlations. With facility density as the dependent variable, multiple linear regression was

conducted with those variables found to have significant associations with density in the bivariate tests. Due to multicollinearity between several study variables, only five variables were included in the multivariate model: coastal/noncoastal status, annual average temperature, UV index, the percentage of whites, and the percentage with some college or more. Variables were selected based on what was thought to more directly influence indoor tanning availability (e.g., temperature and UV index versus latitude were selected).

Results

A total of 4561 facilities were identified. The raters had exact agreement on the number of indoor tanning facilities for 22 (73.3%) of the 30 cities; for the remaining eight cities, they differed by only one facility. The mean number of facilities for the 116 cities was 41.8 (SD=30.8), and the mean density was 11.8 (SD=6.0). The number and density of indoor tanning facilities for each city are provided in Table 1. The mean numbers of Starbucks and McDonald's per city were 19 (SD=25.2) and 29.6 (SD=22.5), respectively.

Table 2 shows results from bivariate analyses. The multivariate model accounted for 23.8% of the variance in facility density and was a good fit ($F=6.56$; $p<0.001$). Cities with higher percentages of white residents ($\beta=0.29$, $p=0.004$) and cities with a lower UV index ($\beta=-0.46$, $p=0.02$) had significantly higher facility density. Coastal status, annual average temperature, and the percentage of residents having some college or more were no longer significantly associated with facility density.

Discussion

High numbers of indoor tanning facilities and high facility density were found in many of the cities, and the number of facilities exceeded the numbers of two ubiquitous institutions—Starbucks and McDonald's. Facility density was higher in cities with a larger percentage of whites and with a lower UV index. The percentage of the white population also had predicted facility density in two previous studies.^{11,18} Given that whites are more likely to use indoor tanning facilities,⁸ the finding regarding an association between the percentage of whites and facility density may reflect the business plan of indoor tanning facilities to be located in areas with higher demand. The association between a lower UV index and higher facility density may be due to residents' desires to seek warmth, tanned skin, or both when natural sunlight is less available.

Methodologic limitations included the study's cross-sectional design, the inclusion of only large cities, and not validating the sources used to identify the indoor tanning facilities, Starbucks, and McDonald's. Therefore, causality between density and its correlates should not be inferred, and the findings may not generalize to smaller cities or rural areas. These estimates provide a snapshot of facility availability; it was outside of the study's scope to evaluate facility stability. Thus, some facilities may subsequently have gone out of business, while new businesses may not have been listed yet in the directories. Strengths included carefully identifying facilities using precise geographic boundaries, including a broad range of potential predictor variables, and using a sample that represented the largest U.S. cities and all 50 states.

In conclusion, this study documents the wide availability of indoor tanning facilities in the U.S. In other areas of public health, the availability of built-environment resources has been linked with both health-risk and health-protective behaviors.^{5–7,19,20} Likewise, the availability of commercial tanning may be partly responsible for the high rates of indoor tanning among young adults and teens.^{2–4,8,21–23} Future research should systematically assess whether tanning-facility availability is associated with indoor tanning and skin-cancer incidence.²⁴

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Table 1
City population size, facility number, and facility density

City	Population ^a	Number of facilities ^b	Facility density (per 100,000 population) ^c
Northeast			
Pittsburgh PA	334,563	93	27.8
Portland ME	64,249	16	24.9
Providence RI	173,618	41	23.6
Burlington VT	22,876	7	18.0
Manchester NH	107,006	19	17.8
Rochester NY	219,773	38	17.3
Boston MA	589,141	90	15.3
Yonkers NY	196,086	23	11.7
Newark NJ	273,546	30	11.0
Jersey City NJ	240,055	25	10.4
Buffalo NY	292,648	21	7.2
Bridgeport CT	139,529	8	5.7
Philadelphia PA	1,517,550	83	5.5
New York NY	8,008,278	183	2.3
South			
Charleston WV	53,421	18	33.7
Columbia SC	116,278	28	24.1
Plano TX	222,030	52	23.4
Birmingham AL	242,820	49	20.2
Chesapeake VA	199,184	40	20.1
Fort Worth TX	534,694	90	16.8
Tulsa OK	393,049	65	16.5
Jackson MS	184,256	30	16.3
Mobile AL	198,915	32	16.1
Louisville KY	256,231	41	16.0
Oklahoma City OK	506,132	79	15.6
Baton Rouge LA	227,818	33	14.5
Shreveport LA	200,145	29	14.5
Augusta GA	195,182	28	14.0
Tampa FL	303,447	41	13.5
Richmond VA	197,790	26	13.2
Garland TX	215,768	28	13.0
Arlington TX	332,969	41	12.3
St. Petersburg FL	248,232	30	12.1
Greensboro NC	223,891	27	12.1
Raleigh NC	276,093	33	12.0
Virginia Beach VA	425,257	50	11.8
Norfolk VA	234,403	26	11.1
Irving TX	191,615	21	11.0

City	Population ^a	Number of facilities ^b	Facility density (per 100,000 population) ^c
Lexington KY	260,512	28	10.8
Charlotte NC	540,828	56	10.4
Lubbock TX	199,564	20	10.0
Jacksonville FL	735,617	73	9.9
Wilmington DE	72,664	7	9.6
Atlanta GA	416,474	40	9.6
Dallas TX	1,188,580	111	9.3
Austin TX	656,562	58	8.8
Nashville TN	545,524	50	8.8
Montgomery AL	201,568	17	8.4
Little Rock AR	183,133	15	8.2
Houston TX	1,953,631	137	7.0
Baltimore MD	651,154	41	6.3
New Orleans LA	484,674	28	5.8
Memphis TN	650,100	37	5.7
Miami FL	362,470	19	5.2
San Antonio TX	1,144,646	39	3.4
Corpus Christi TX	277,454	9	3.2
Washington DC	572,059	12	2.1
El Paso TX	563,662	9	1.6
Hialeah FL	226,419	3	1.3
Midwest			
Akron OH	217,074	57	26.3
Grand Rapids MI	197,800	41	20.7
Des Moines IA	198,682	39	19.6
Fargo ND	90,599	15	16.6
Fort Wayne IN	205,727	34	16.5
Columbus OH	711,470	116	16.3
Toledo OH	313,619	47	15.0
Madison WI	208,054	31	14.9
Kansas City MO	441,545	65	14.7
St. Paul MN	287,151	38	13.2
Lincoln NE	225,581	29	12.9
Omaha NE	390,007	50	12.8
Cleveland OH	478,403	60	12.5
Indianapolis IN	781,870	98	12.4
Wichita KS	344,284	41	11.9
Milwaukee WI	596,974	68	11.4
Cincinnati OH	331,285	36	10.9
Sioux Falls SD	123,975	13	10.5
Minneapolis MN	382,618	38	9.9
St Louis MO	348,189	19	5.5

City	Population ^a	Number of facilities ^b	Facility density (per 100,000 population) ^c
Detroit MI	951,270	49	5.2
Chicago IL	2,896,016	135	4.7
West			
Scottsdale AZ	202,705	44	21.7
Tacoma WA	193,556	40	20.7
Cheyenne WY	53,011	9	17.0
Glendale AZ	218,812	32	14.6
Boise ID	185,787	27	14.5
Billings MT	89,847	13	14.5
Bakersfield CA	247,057	34	13.8
Anaheim CA	328,014	43	13.1
Denver CO	554,636	71	12.8
Spokane WA	195,629	25	12.8
Mesa AZ	396,375	47	11.9
Las Vegas NV	478,434	56	11.7
Aurora CO	276,393	32	11.6
Salt Lake City UT	181,743	21	11.6
Portland OR	529,121	60	11.3
Anchorage AK	260,283	29	11.1
Colorado Springs CO	360,890	38	10.5
Sacramento CA	407,018	41	10.1
Riverside CA	255,166	25	9.8
Seattle WA	563,374	54	9.6
Santa Ana CA	337,977	31	9.2
Glendale CA	194,973	17	8.7
Phoenix AZ	1,321,045	99	7.5
San Diego CA	1,223,400	90	7.4
Fresno CA	427,652	31	7.3
Long Beach CA	461,522	31	6.7
Albuquerque NM	448,607	27	6.0
Tucson AZ	486,699	26	5.3
San Jose CA	894,943	32	3.6
Honolulu HI	371,657	13	3.5
Los Angeles CA	3,694,820	128	3.5
Fremont CA	203,413	7	3.4
Oakland CA	399,484	11	2.8
Stockton CA	243,771	6	2.5
San Francisco CA	776,733	18	2.3

^aBased on U.S. Census 2000 data for the city proper

^bWithin a 3-mile buffer zone surrounding the city proper

^cBased on the population and number of facilities listed in the adjacent columns

Table 2
Bivariate associations between study variables and facility density

	M density	SD	Test statistic ^a
Geographic variables			
Region	—	—	F=2.58
Northeast	14.2	7.8	—
Midwest	13.4	5.1	—
South	11.8	6.3	—
West	9.8	4.9	—
Coastal city status	—	—	<i>t</i>=2.34*
No	12.4	6.0	—
Yes	9.2	5.4	—
Northern latitude	—	—	<i>r</i>=0.27**
Western longitude	—	—	<i>r</i>=-0.28**
Elevation (feet)	—	—	<i>r</i> =0.04
Climatologic variables			
Annual average temperature in 2005 (°F)	—	—	<i>r</i>=-0.28**
M # days maximum temperature ≥90°	—	—	<i>r</i> =-0.12
M # days minimum temperature ≤32°	—	—	<i>r</i>=0.33***
M # days precipitation ≥0.01 inch	—	—	<i>r</i>=0.31***
Annual sunshine (mean % of possible)	—	—	<i>r</i>=-0.26*
Ultraviolet (UV) index (cloudy)	—	—	<i>r</i>=-0.32***
Demographic variables			
% white	—	—	<i>r</i>=0.38***
% teens	—	—	<i>r</i> =0.08
% some college or more	—	—	<i>r</i>=0.2*
Median family income (dollars)	—	—	<i>r</i> =0.12
Legislation variables			
State indoor tanning law	—	—	<i>t</i> =0.98
No	12.7	6.1	—
Yes	11.4	6.0	—
Youth indoor tanning law	—	—	<i>t</i> =1.37
No	12.7	6.0	—
Yes	11.1	6.0	—
Annual inspection of facilities	—	—	<i>t</i> =-1.19
No	11.0	5.9	—
Yes	12.8	6.0	—
Law stringency	—	—	<i>r</i> =-0.07

^a Significant bivariate associations are shown in boldfaced type.

* *p*<0.05

** *p*≤0.01

 $p \leq 0.001$