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Measuring the stringency of states' indoor tanning regulations:

Instrument development and outcomes

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Abstract

Objectives—We sought to describe the development of an instrument to quantify the stringency of state indoor tanning legislation in the United States, and the instrument's psychometric properties. The instrument was then used to rate the stringency of state laws.

Methods—A 35-item instrument was developed. An overall stringency measure and 9 stringency subscales were developed, including one measuring minors' access to indoor tanning. Stringency measures showed good internal consistency and interrater reliability.

Results—In all, 55% of the 50 states and the District of Columbia had any indoor tanning law, and 41% had any law addressing minors' access. Oregon, Illinois, South Carolina, Florida, Indiana, Iowa, and Rhode Island had high overall stringency scores, and Texas and New Hampshire were the most restrictive with regard to minors' access.

Limitations—Measurement of actual enforcement of the laws was not included in this study.

Conclusions—The instrument appears to be an easy-to-use, reliable, and valid methodology. Application of the instrument to actual laws showed that, in general, state laws are relatively weak, although there was considerable variability by state.

Skin cancer rates in the United States are high, with an estimated 62,190 cases of melanoma and more than 1 million cases of nonmelanoma skin cancer diagnosed in 2006.¹ Exposure to ultraviolet (UV) lamps through indoor tanning is a risk factor for both melanoma^{2,3} and nonmelanoma skin cancer,⁴ can cause acute skin and ocular damage,⁵⁻⁹ and causes molecular damage associated with skin cancer.¹⁰

According to the US indoor tanning industry, as of 2006 the industry is worth \$5 billion, has a customer base of 30 million, and serves approximately 10% of the US public annually.¹¹ The use of indoor tanning by adolescents is particularly disturbing.¹²⁻¹⁴ Approximately 10%

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of US adolescents report using indoor tanning in the past year; older adolescent girls report rates as high as 25% to 40%.^{12,13}

Legislation may have the potential to reduce consumers' risks associated with indoor tanning and to reduce access by youth.^{15,16} Various aspects of sunlamp products used by indoor tanning facilities are regulated by the Food and Drug Administration¹⁷⁻¹⁹; most of these regulations are directed at the equipment manufacturers. The practices of indoor tanning businesses are regulated at the state level. In 1998, 25 states had passed legislation regulating some aspect of indoor tanning and laws were pending in two states.²⁰ As of 2005, 21 states had legislation related to parental consent for or parental accompaniment of minors; 6 of these states had minimum age limits for tanning customers.²¹

Based on the reports of Dellavalle et al,¹⁵ Francis et al,²¹ and our own work,²⁰ we were aware of the variability in the laws. We thought it important to be able to systematically document the level of stringency, so that: (1) state laws could be compared with each other and with a standard or ideal law²²; (2) stringency of legislation could be compared over time; and (3) stringency of legislation—not just presence or absence of law—could be used in future studies to predict density of facilities and local enforcement procedures, each of which may impact use. Therefore, in this article, we extend previous qualitative data for the United States by quantifying the comprehensiveness of state laws, including but not limited to restrictions for youth. This article describes the process used to develop the quantification protocol, and the outcomes from that process.

METHODS

Instrument development

We developed a comprehensive instrument to measure the restrictiveness/stringency of state indoor tanning laws, with an emphasis on minors' access. The goal was to develop an instrument that would grade the stringency on ordinal scales when possible (ie, weakest or no provision, to most restrictive), rather than simple presence/absence measures. In addition, we wanted to create a practical instrument that was easy to use with little training. We wanted to avoid range effects by providing response options that left room at the higher (ie, more restrictive) end, making the instrument applicable even as state indoor tanning laws change.

Development of the stringency instrument began with reviewing similar instruments assessing quality of state tobacco control policies,²³⁻²⁸ reviewing the scant literature on the characteristics of indoor tanning laws to identify important stringency dimensions/areas,^{13, 15,16,20,21} and reading several of the state indoor tanning laws to identify key elements. Items were then constructed and organized into broader topic areas. Feedback from the project's multidisciplinary research team (ie, health economics, health policy, consumer behavior, epidemiology, dermatology, geography, psychology) was incorporated.

The result was a 35-item instrument assessing stringency in specific areas including minors' access, UV exposure control, operator training, penalties for violations, and sanitation. As mentioned above, we attempted to make item response options ordinal (0 = weakest or no provision to 5 = most restrictive) rather than dichotomous. However, this was not always possible because of the nature of certain items. Therefore, dichotomous response options were used (presence vs absence of a characteristic) for some items. The instrument is available from the corresponding author, or on the project World Wide Web site at <http://publichealth.sdsu.edu/city100/index.html>.

Coding of state laws

The instrument was applied to state laws pertaining to indoor tanning in early 2006. A collaborative, consensus approach to state law coding was used because of the complex and ambiguous nature of the legal text, and because there was a manageable number of state laws so that all raters could code all laws. A 3-person consensus group first obtained indoor tanning state laws (if they existed) from two legal databases, WESTLAW and Lexis Nexis. The 3 researchers independently coded each state law and met regularly to review their ratings. The group discussed all discrepancies, referring back to the legal text until consensus was attained. A database was created of the group's scoring of each state (states without a law received zeros on all items).

Interrater reliability

To evaluate interrater reliability, two independent raters used the instrument to code 10 randomly selected laws. The raters were senior-level health researchers who did not know each other and who did not work in areas directly related to the study. They received no training and only minimal instructions, and were paid for their effort. Multirater reliability (ie, 3 raters) was computed using the ratings from the two independent raters and the combined ratings of the expert consensus group.

Stringency items and subscales

Response distributions for each item were examined. Ordinal response options that resulted in highly skewed data or that lacked variability were recoded into dichotomies. Although items had been grouped on the instrument into broad conceptual categories, exploratory factor analysis was conducted to help further conceptualize stringency subscales. Nine dimensions resulted: minors' access, customer notification of risks, UV exposure control, equipment standards, facility operations, operator training/responsibilities, sanitation, enforcement/legal issues, and penalties for violations. Nine subscale scores were computed, usually as the sum of multiple items. Two of the subscale measures (UV exposure control and penalties for violations) were each measured with one item. An overall stringency score was computed by adding the 9 subscale scores.

RESULTS

Psychometric properties of the instrument

Table I presents the number of items comprising each subscale, and the possible range of scores. The maximum possible score for overall stringency was 100. Table I also presents the internal consistency (Cronbach α) of the overall and subscale stringency scores. Internal consistency is reported separately for all 50 states plus the District of Columbia, and for the 28 states with any indoor tanning law. Internal consistency of the measures was generally good (particularly when using the 51 states and District of Columbia). The minors' access scale showed the lowest internal consistency, probably because of both the relatively few number of items and the heterogeneous nature of the items. The overall score showed the best internal consistency. Mean stringency scores, also presented in Table I, fell well below maximum possible scores.

Bivariate correlations among stringency subscales for the 51 states and the District of Columbia were moderate to high, ranging from .44 (minors' access with sanitation) to .91 (facility operations with operator training/responsibilities). The minors' access subscale was correlated with the other subscales ranging from .44 (sanitation) to .67 (facility operations).

Interrater reliability

Two raters—As shown in Table II, the percent agreement on the 35 individual items ranged from 40% to 100%, with an average (mean and median) of about 80% agreement. Reliability coefficients (kappas/weighted kappas) on items ranged from low agreement on a few items (eg, an item measuring timer system standards) to perfect agreement (on 11 items). Of particular interest, interrater reliability was perfect for 2 of the 3 items addressing minors' access; however, the item addressing age limitations for parental accompaniment was lower. The median and mean reliability coefficients were .75 and .70, respectively. Of the items, 60% had an interrater reliability of .70 or greater.

Three raters—As shown in Table II, reliability coefficients ranged from .25 (sanitation of the facility's floor) to 1.00 (on multiple items). The median and mean reliability coefficients were .81 and .75, respectively. Agreement among the 3 raters met or exceeded .70 on 74% of the items.

The 3-rater agreement on the overall stringency scale and the 9 subscales also were examined (Table II). The intraclass correlation was used as the measure of reliability for the subscales with continuous data; Kendall's coefficient of concordance was used for the two single-item scales. Multirater reliability was very good (intraclass correlation $> .80$) for all subscales except one. Stringency of enforcement was .60, indicating substantial, although less-than-ideal, agreement. The scales with highest agreement were facility operations and the overall stringency score.

Law stringency results

In all, 55% ($n = 28$) of the 51 states and the District of Columbia had a law regulating some facet of indoor tanning. In all, 41% ($n = 21$) had a law addressing minors' use. Table III presents ranking of states by their overall stringency scores. Oregon, Illinois, South Carolina, Florida, Indiana, Iowa, and Rhode Island had the highest rankings, with overall stringency scores of more than 70. Minors' access scores, also presented, show that Texas and New Hampshire were the most restrictive, with each earning the highest possible score. Rankings based on overall stringency and minors' access did not always correspond. For example, Michigan's overall stringency was low (4.00 of a possible 100), although its minors' access score was relatively high (2.00 of a possible 3.00). Iowa had one of the highest overall scores, yet had no provision for minors in its law. Arizona and Louisiana, and Kansas and Maine tied for their respective rankings based on overall scores, although one state in each of the pairs was stricter than the other with regard to minors' access. Pennsylvania ranked the worst among states with a law, scoring zero on overall and minors' access stringency.

As a partial test of its validity, we used the instrument to code a model ordinance for indoor tanning. The model ordinance was developed by the American Academy of Dermatology to provide language on which localities or states can develop or improve their regulations governing the operation of indoor tanning facilities.²² The overall stringency score for the model ordinance was 82, which was significantly higher than the average overall stringency among states with a law (mean = 51) ($t = 7.63$, $P \leq .001$), and higher than the overall stringency of any individual state law. In addition, the model law's minors' access score was 3.00, which is the highest possible score.

DISCUSSION

The role of policy-related and environmental factors in influencing individual health behavior has gained considerable attention. Although there has been some effort in quantifying state laws and relating them to outcomes, particularly for tobacco control and minors' access to

tobacco, little work has been done in the area of indoor tanning legislation. Macrolevel ecologic variables, such as state laws, may directly or indirectly impact indoor tanning behavior and health status.

We developed and applied a 35-item instrument to quantify and characterize the stringency of state laws regulating indoor tanning, with an emphasis on minors' access. The instrument appears to be easy to use with little training, and can be applied by individuals who have no specific training in the law or in indoor tanning policy. Interrater reliability (eg, between two untrained independent senior-level health researchers) was good to excellent on most items. Nine stringency subscales and an overall stringency scale were computed to evaluate different content areas of indoor tanning legislation, including minors' access. The stringency measures generally showed good internal consistency and interrater reliability. In addition, the validity of the instrument was supported—a model law received a significantly higher overall stringency score than did typical, actual laws. There was variability in the states' stringency scores and no range effects, indicating sensitivity of the instrument, and its use for showing changes over time.

A few items, including one assessing age limits for minors' use, showed poor interrater reliability. Furthermore, the internal consistency of the minors' access subscale was relatively low, indicating heterogeneous items. Indoor tanning among teenagers is a public health issue that is likely to receive more attention in the future. Therefore, a reliable methodology for evaluating ordinances regulating teen use is essential. Recently, we collected feedback from the independent raters about the few problem items on our instrument, and we will continue to refine them.

Application of the instrument to actual laws showed that, in general, state laws are much weaker than they could be, although there was considerable variability by state. The laws of Oregon, Illinois, South Carolina, Florida, Indiana, Iowa, and Rhode Island were the most stringent overall. Those of Texas and New Hampshire were the most stringent regarding minors' use. Comparison of our results with other studies is difficult because most other studies have focused on *compliance* with regulations.²⁹⁻³² Our results are somewhat consistent with reports from Francis et al²¹ that Texas, Illinois, Wisconsin, California, North Carolina, and New Hampshire have relatively strict youth access laws (ie, minimum age limits). Even among the current study's "best" states, however, there is room for improving specific domains of indoor tanning legislation. Furthermore, given the fact that only 28 of the states have any law regulating indoor tanning, and 21 have any law pertaining to minors' access, adoption of formal regulations may be an important first step to protect customer safety.¹⁵

Measurement of compliance with or enforcement of the laws was beyond the scope of this study. Studies have shown that, even when regulations exist, there is generally low compliance by facilities.^{15,29-31} Even the most stringent/comprehensive of laws, without enforcement, may have a limited impact, although education of tanning facility operators about regulations may help improve compliance with laws, and ultimately patron safety.³²

We contend that the law stringency instrument offers a reasonable methodology for measuring states' efforts to protect consumers from indoor tanning risks. The instrument's stringency items and subscales could highlight what changes are needed, serving as a blueprint for a state's indoor tanning control efforts. Likewise, the instrument could be used to demonstrate improvement in the quality of a state's indoor tanning laws. Finally, the instrument could be used to assess the impact of the stringency of a state's policy on residents' behavior and health status.

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Table 1
Stringency scale internal consistency and means for states with laws and for all states

Stringency scale	No. of items	Potential range of scores	Internal consistency		Mean stringency (SD)	
			28 states with a law	All 51 states	28 states with a law	All 51 states
Minors' access	3	0-3	.43	.62	1.21 (.92)	.67 (.90)
Customer notification of risks	4	0-16	.61	.82	9.07 (3.66)	4.98 (5.29)
UV exposure control	1	0-5	-	-	3.10 (1.44)	1.70 (1.88)
Equipment standards	7	0-28	.82	.88	12.82 (6.53)	7.04 (8.03)
Facility operations	6	0-14	.63	.74	7.75 (4.79)	4.25 (5.25)
Operator training/responsibility	4	0-12	.67	.78	6.42 (3.99)	3.52 (4.36)
Sanitation	4	0-4	.81	.86	1.85 (1.45)	1.02 (1.42)
Enforcement/legal	5	0-13	.66	.73	5.96 (3.89)	3.27 (4.14)
Penalties for violations	1	0-5	-	-	2.79 (1.57)	1.52 (1.81)
Overall	35	0-100	.92	.96	51.00 (21.50)	28.00 (30.11)

Includes District of Columbia.

UV, ultraviolet.

Table II
Interrater reliability for stringency scales and individual items for 10 state laws

Scale/item	Two raters		Three rates	
	Agreement, %	Item reliability*	Item reliability ^{†,‡}	ICC for scales [§]
Minors' access				.91
Age prohibited	100	1.00	1.00	
Age accompanied	50	.19	.28	
Age must provide parental consent	100	1.00	1.00	
Customer notification of risks				.95
Warning signs	70	.60	.80	
Written warnings	40	.38	.69	
Customer acknowledgment	60	.75	.88	
Label of exposure schedule	100	1.00	.76	
Customer UV exposure control				.89
Limitations on frequency and duration	80	.76	.89	
Equipment standards				.89
Timer system	60	.15	.75	
Timer shut-off	100	1.00	1.00	
Timer testing	80	.47	.81	
Physical barriers	90	.74	.81	
Bulb replacement	80	.91	.90	
Eye protection	70	.47	.70	
Stand-up booth safety	80	.41	.58	
Facility operations				.97
Licensing/registration	90	.74	.81	
License for each location	80	.60	.58	
Records of customer session	90	.93	.96	
Incident reporting	100	1.00	.95	
Restrictions on advertising	100	1.00	1.00	
Restrictions on price packages	80	.41	.62	
Operator training and responsibilities				.92
Presence of trained operator	100	1.00	.76	
Operation of timer	100	1.00	.96	
Extent of training	60	.74	.89	
Proof of training	100	1.00	.85	
Sanitation regulations				.87
Eyewear	100	1.00	.76	
Floors	70	.29	.25	
Towels	100	1.00	1.00	
Bed/booth	90	.80	.72	
Enforcement/legal issues				.60

Scale/item	Two raters		Three rates	
	Agreement, %	Item reliability*	Item reliability ^{†,‡}	ICC for scales [§]
Enforcement authority	70	.61	.51	
Funding for enforcement	70	.40	.46	
Inspections	50	.49	.82	
Complaint investigation	70	_//	_//	
Facility liability	90	.78	.86	
Penalties for violations				.80
Penalties/fines for violations	80	.71	.80	
Overall				.95

ICC, Intraclass correlation; UV, ultraviolet.

* Kappas are reported for nominal (dichotomous) items and weighted kappas for ordinal items.

[†] The 3 raters are the two independent raters and the project consensus group.

[‡] Kappas are reported for nominal items, and Kendall's coefficient of concordance is reported for ordinal ratings.

[§] Raters and states were considered random variables (two-way random effects model). Single measure reliability was used. For the two single item subscales, Kendall's coefficient of concordance is used instead of the ICC.

// Kappa could not be computed because there was no variation for one rater.

Table III

Rankings of states based on overall stringency scores

Rank	State	Overall stringency	Minors' access stringency
1	Oregon	79.00	1.00
2	Illinois	76.00	2.00
3	South Carolina	75.00	1.00
4	Florida	74.00	2.00
5	Indiana	73.00	2.00
6	Iowa	72.00	.00
7	Rhode Island	71.00	1.00
8	Ohio	68.00	1.00
9	Massachusetts	66.00	2.00
10	Texas	64.00	3.00
11	Arizona	60.00	1.00
11	Louisiana	60.00	2.00
12	Wisconsin	57.00	1.00
13	Kansas	55.00	.00
13	Maine	55.00	1.00
14	California	52.00	2.00
15	Colorado	51.00	.00
16	Mississippi	48.00	1.00
17	New Hampshire	47.00	3.00
18	Minnesota	40.00	1.00
19	North Carolina	37.00	2.00
20	Georgia	34.00	1.00
21	Virginia	32.00	.00
22	Tennessee	31.00	2.00
23	New Jersey	27.00	.00
24	New York	20.00	.00
25	Michigan	4.00	2.00
26	Pennsylvania	.00	.00
-	Alabama	.00	.00
-	Alaska	.00	.00
-	Arkansas	.00	.00
-	Connecticut	.00	.00
-	Delaware	.00	.00
-	District of Columbia	.00	.00
-	Hawaii	.00	.00
-	Idaho	.00	.00
-	Kentucky	.00	.00
-	Maryland	.00	.00
-	Missouri	.00	.00
-	Montana	.00	.00

Rank	State	Overall stringency	Minors' access stringency
-	Nebraska	.00	.00
-	Nevada	.00	.00
-	New Mexico	.00	.00
-	North Dakota	.00	.00
-	Oklahoma	.00	.00
-	South Dakota	.00	.00
-	Utah	.00	.00
-	Vermont	.00	.00
-	Washington	.00	.00
-	West Virginia	.00	.00
-	Wyoming	.00	.00

Includes District of Columbia.