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# Availability of tanning salons in Ontario relative to indoor tanning policy (2001–2017)

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ABSTRACT

Ultraviolet (UV) radiation from indoor tanning equipment is a known cause of skin cancer; however, little is known about how the availability of indoor tanning salons has been impacted by indoor tanning legislation, including Ontario's *Skin Cancer Prevention Act: Tanning Beds* (SCPA). Tanning salon listings were obtained from the 2001 to 2017 editions of InfoCanada's Ontario Business to Business Sales and Marketing directories. Using descriptive statistics and regression analysis, we assessed the number of tanning salons before and after: 1) the 2006 International Agency for Research on Cancer (IARC) report on indoor tanning and skin cancer; 2) the 2009 World Health Organization (WHO) reclassification of artificial UV radiation as carcinogenic; and 3) the passing and enactment of Ontario's SCPA in 2013 and 2014, respectively. There were fewer tanning salon listings in the years after vs. before the IARC report, the WHO reclassification, and the passing and enactment of the SCPA. The number of tanning salons in Ontario, Canada has been declining since 2006, which may reflect a decline in indoor tanning bed use. Key public health policy instruments, including legislation and public education, appear to be associated with this trend, suggesting they may contribute to deterring indoor tanning.

## 1. Introduction

Skin cancer is the most common form of cancer in Canada (Canadian Cancer Society's Advisory Committee on Cancer Statistics, 2014). The number of new skin cancer cases in the country is almost equal to the number of new cases of breast, colorectal, prostate, and lung cancer combined (Canadian Cancer Society's Advisory Committee on Cancer Statistics, 2014). Even though skin cancer is often preventable, the incidence in Canada continues to rise (Canadian Cancer Society's Advisory Committee on Cancer Statistics, 2014).

Common risk factors for skin cancer include susceptible phenotype, family or personal history of the disease, history of sunburns, and number of moles (Canadian Cancer Society, n.d.-b; Canadian Cancer Society, n.d.-c). The main risk factor for skin cancer, however, is excessive ultraviolet (UV) exposure, either from the sun or from indoor tanning equipment (Canadian Cancer Society, n.d.-b; Canadian Cancer Society, n.d.-c). Indoor tanning equipment (e.g., tanning beds) emits high doses of artificial UV radiation to produce a deep tan (Gerber et al., 2002). Over 450,000 cases of skin cancer are attributable to UV indoor tanning each year in the United States, Europe, and Australia (Wehner et al., 2014). For context, this number is higher than the number of lung cancer cases due to smoking each year (Wehner et al., 2014).

Despite the known link to skin cancer (The International Agency for Research on Cancer Working Group on Artificial UV Light, 2006), approximately 1.35 million Canadians reported using indoor tanning equipment in 2014 (Qutob et al., 2017). Of those, over 70% of the individuals were female and over half of them were between the ages of 18 to 35 (Qutob et al., 2017). This raises concern as the International Agency for Research on Cancer (IARC), the cancer research arm of the World Health Organization (WHO), noted in their 2006 reported that the risk of developing skin cancer increases by 75% with the use of UV tanning equipment before the age of 35 (The International Agency for Research on Cancer Working Group on Artificial UV Light, 2006). Subsequently, the WHO/IARC reclassified artificial UV radiation and tanning devices as a Group 1 carcinogen (known human carcinogen) in 2009 (El Ghissassi et al., 2009). This international report and decision generated an increase in media coverage on tanning and skin cancer in North America (McWhirter and Hoffman-Goetz, 2015; McWhirter and Hoffman-Goetz, 2014).

*Abbreviations:* SCPA, Skin Cancer Prevention Act; UV, ultraviolet; WHO, World Health Organization; IARC, International Agency for Research on Cancer

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In Canada, the use of indoor tanning facilities is provincially regulated. In Ontario, indoor tanning is regulated under the *Skin Cancer Prevention Act* (*Tanning Beds*) (hereafter referred to as the "SCPA"), which was passed in 2013 and came into effect on May 1, 2014 (Government of Ontario, n.d.-a). Under the SCPA, the sale of tanning services is prohibited to anyone under the age of 18 and tanning bed operators must ask for age identification from any individual appearing younger than the age of 25 (Government of Ontario, n.d.-a). Other key areas of the SCPA include prohibiting advertisement to minors, posting of age and health warning signs (one at the entrance, two at point of sale, and one in the room with tanning equipment), and provision of protective eyewear (Government of Ontario, n.d.-a). Prior to 2014, the only indoor tanning legislation affecting the province was the federal *Radiation Emitting Devices Act*, which regulates the manufacture, sale, and labelling of tanning equipment itself, but not the use of the equipment (Government of Ontario, n.d.-b).

At the time of writing, there has been no research published regarding the number of indoor tanning facilities in Canada. Hence, we aim to provide evidence of the scope of the industry by quantifying the current number of tanning salons and, further, investigate how this has changed temporally using Ontario as a case study. The rationale for this work and the related hypotheses are as follows.

First, this research will help to provide those working in cancer prevention and health policy with basic, but currently lacking, information about the size of the indoor tanning industry in Ontario as determined by the number of indoor tanning salons. This information also serves as a proxy of the prevalence of indoor tanning use in Ontario, under the assumption that the number of facilities fluctuates with demand for and use of the service. Because access and use of indoor tanning equipment is regulated provincially, province-specific information is particularly relevant.

Second, we aim to shed light on how the number of indoor tanning facilities has changed over time, especially relative to Ontario's SCPA. This information will contribute to understanding the impact of this legislation on indoor tanning. We hypothesize that the number of indoor tanning salons will have decreased in the years after the SCPA. In an Australian study, the number of indoor tanning salon listings decreased following indoor tanning legislation and negative media coverage (Makin and Dobbinson, 2009). We may see similar trends in Ontario.

As a secondary analysis, we will determine if the number of indoor tanning salons has changed relative to two other key public health initiatives: the landmark 2006 IARC report linking indoor tanning and skin cancer and the subsequent 2009 WHO/IARC reclassification of indoor tanning beds as a known human carcinogen. We anticipate the number of indoor tanning salons has changed after, relative to before, these international public health initiatives.

Hence, this work will assess the effectiveness of regulation, as well as public education through expert exhortation and public health knowledge dissemination, as policy instruments that can impact indoor tanning use.

## 2. Methods

Tanning salon listings were obtained from the 2001 to 2017 editions of InfoCanada's Ontario Business to Business Sales & Marking Directories, inclusively, accessed through Toronto Reference Library. Editions of the directory are published in March/April of each year and contain up-to-date listings for that year (personal communication, InfoCanada, July 25, 2017).

The total number of tanning salons for each year was determined by adding up all the tanning salon listings in each annual edition of the Directory. To help gauge the accuracy of the InfoCanada list, we used YellowPages.com, Google.ca, and telephone calls to develop our own list of Ontario tanning salons for 2017.

Using descriptive statistics (means, counts, percent change), we assessed whether the number of indoor tanning salons in Ontario changed relative to the 2006 IARC report, 2009 WHO carcinogen reclassification, and the 2013 passing and 2014 enactment of the SCPA. We selected two timeframes for these comparisons: three years before and after, to reflect the minimum afforded by the data, and the maximum number of years afforded by the data for each initiative assessed (Table 1).

**Table 1**
Number of tanning salons in Ontario relative to key public health and policy initiatives.

| Key initiative | Number of tanning salons | | | |
|---|---|---|---|---|
| | Before | | After | |
| | (mean) | (n, %) | (mean) | (n, %) |
| 2006 IARC report[a] | | | | |
| 3 years (2004–2006 vs. 2007–2009) | 1022.3 | 3067 (51.3) | 969.0 | 2907 (48.7) |
| 6 years (2001–2006 vs. 2007–2012) | 955.5 | 5733 (51.6) | 894.5 | 5367 (48.4) |
| 2009 WHO carcinogen reclassification[b] | | | | |
| 3 years (2007–2009 vs. 2010–2012) | 969.0 | 2907 (54.2) | 820.0 | 2460 (45.8) |
| 8 years (2002–2009 vs. 2010–2017) | 974.8 | 7798 (61.0) | 624.4 | 4995 (39.0) |
| 2013 SCPA passed[c] | | | | |
| 3 years (2010–2012 vs. 2013–2015) | 820.0 | 2460 (59.9) | 550.0 | 1650 (40.1) |
| 5 years (2008–2012 vs. 2013–2017) | 875.8 | 4379 (63.3) | 507.0 | 2535 (36.7) |
| 2014 SCPA enacted[d] | | | | |
| 3 years (2012–2014 vs. 2015–2017) | 621.0 | 1863 (56.8) | 473.0 | 1419 (43.2) |

IARC = International Agency for Research on Cancer; WHO = World Health Organization; SCPA = Skin Cancer Prevention Act.

[a] 2006 considered a "before" year because the IARC report was published November 2006.

[b] 2009 considered a "before" year because the reclassification was published August 2009.

[c] 2013 considered an "after" year because the legislation was introduced March 2013 and passed October 2013.

[d] 2014 considered a "before" year because the legislation was enacted May 2014.

Data were analyzed using SPSS 24.0 for descriptive statistics and SAS 9.4 using the PROC MIXED procedure, a mixed linear model, to do the means and regression analyses, and to attempt to account for potential autocorrelation. Using the mixed linear model, we assessed the means, intercepts, and slopes for defined timeframes in order to show the trends. Fixed effects included treatment and year, where treatment was defined sections in time. Two models were fitted: a simple means model with treatment as the only factor; a more comprehensive model that allowed for time trends by treating year as a continuous explanatory variable and by allowing a treatment by year interaction (i.e., different slopes in year). Because the data are measured over time, we expected some sort of autocorrelation, so we tried different autocorrelation structures offered by SAS. We used an AIC to choose an error structure. The assumptions of the ANOVA were examined via residual analyses, which included formally testing the residuals for normality. All four tests computed in SAS suggest the data is normal (Shapiro-Wilk, Kolmogorov-Smirnov, Cramer-von Mises, Anderson-Darling). Also, the residuals were plotted against the predicted values and the explanatory variables used in the model. Results were considered statistically significant at $p < 0.05$.