

Consumer Foraging for Safer Tanning Alternatives: A Naturally Occurring Experiment on Informational Reinforcement in the UK

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In this study, we examined whether ultra-violet indoor tanning (UVIT) bans for minors in the United Kingdom increased consumer foraging for spray tanning – a safer alternative to UVIT. Research suggests that the use of UVIT can result in an increased likelihood of developing skin cancer and/or indoor tanning addiction, and is predictive of other maladaptive behaviors (Reed, 2015). Furthermore, an increased prevalence in indoor tanning among minors correlates with health complications later in life (Wehner et al., 2012). Using data from Google Trends, we constructed a natural multiple baseline investigation to demonstrate that searches for spray tans increased as a function of the UVIT legislation. Findings suggest that spray tanning may serve as a substitute for UVIT, offering implications for behavioral economic approaches to policies aimed at decreasing UVIT in the United States.

Key words: behavioral perspective model, cancer, Google Trends, indoor tanning, public policy

Healthy People 2020, a national health-care agenda based on scientific evidence put forth by the United States (US) Department of Health and Human Services, specifically targets the use of ultraviolet indoor tanning (UVIT; primarily, sunbeds [also known as tanning beds]) in minors (Objective C-20) (U.S. Department of Health and Human Services. Office of Disease Prevention and Health Promotion, 2010). Indeed, the use of UVIT in high school aged minors has been

on the rise in US regions lacking sunbed restrictions (Cokkinides, Weinstock, Lazovich, Ward, & Thun, 2009). Recent survey data suggest that nearly 44% of non-Hispanic white female high school students use UVIT at least once per year, with 68% of these users using UVIT more than 10 times per year (Guy, Berkowitz, Watson, Holmon, & Richardson, 2013). Data on the prevalence of UVIT usage in this population is concerning given evidence that engaging in such behavior before the age of 25 increases the risk of nonmelanoma cancer by up to 102% (Wehner et al., 2012), with every additional UVIT act increasing the risk of melanoma by an additional 1.8% (Boniol, Autier, Boyle, & Gandini, 2012). Given the high prevalence of UVIT usage, the incidence rate of melanoma of the skin has increased signifi-

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cantly among men and women from 2001 to 2010 by 1.6% and 1.4%, respectively, and melanoma related deaths have accounted for about \$3.5 billion in lost productivity each year (CDC, 2014).

Despite the alarming data on UVIT use among high school students, public policy efforts in the US have done little to discourage minors' use of such devices. As of January 1, 2014, only six states in the United States of America had legislation banning the use of UVIT for minors aged 18 or under (National Conference of State Legislatures, 2014). Such legislation is relatively new to the US, where the earliest enactment appeared in two states during 2012 (California and Vermont) with the four other states (Illinois, Nevada, Oregon, and Texas) enacting such legislation in the past year (i.e., 2013). While outright bans may prohibit minors from accessing UVIT, public health advocates (e.g., Sinclair & Makin, 2013) warn that failing to promote sunless alternatives (e.g., spray tans) could result in an increasing rate of natural UV sunbathing (i.e., lying on a beach), as it may be considered a functional substitute to UVIT given emerging evidence of UV tanning as a behavioral addiction (see reviews

by Kourosh, Harrington, & Adinoff, 2010; Reed, 2015).

The purpose of the present study was to examine Google searches from the United Kingdom (UK; specifically, Scotland, Wales, and England) for "spray tan" where national UVIT bans for minors have been in existence for a number of years. From a behavioral perspective, the search results for "spray tan" may be considered a form of informational reinforcement within Foxall's *behavioral perspective model* of consumer behavior analysis (BPM; 1998). The BPM, a variation of the 4-term contingency, can provide a behaviorally-based description of consumer behavior. By analyzing molar contingencies with the inclusion of either motivating or abolishing operations, the influence of novel policies can be conceptually analyzed. Figure 1 provides an example of the UVIT ban in a BPM framework.

As described by Foxall, informational reinforcement "consists not in information per se but in feedback on an individual's performance. Informational reinforcement attests to the level of correctness or appropriateness of a person's performance" (pg. 326). Online searches for "spray tan" constitute foraging

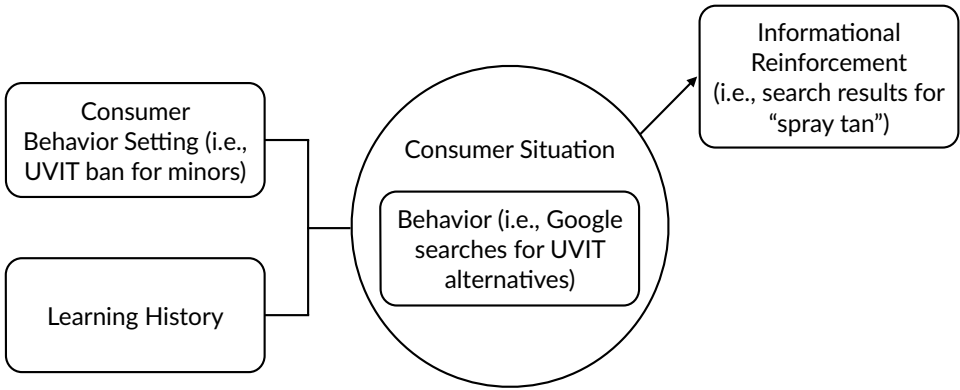


Figure 1. Demonstration of the Behavioral Perspectives Model (BPM) in relation to UVIT bans for minors in the UK. Discriminative stimuli and motivating operations (i.e., UVIT ban) are shown on the left hand side, the behavior (i.e., Google searches for UVIT alternatives) is shown in the middle circle, and the consequences for such behaviors (i.e., search results for "spray tan").

for feedback on the consumer's interest in the commodity. Thus, a Google search is not just a proxy to consumer foraging for information; such a search constitutes behavior in its own right. Furthermore, past research suggests that Google Trends offers predictive capabilities regarding direct consumer behaviors (Schmidt, & Vosen, 2009; Goel, Hofman, Lahaie, Pennock, & Watts, 2010; Preis, Susannah Moat, & Stanley, 2013), suggesting that online searches predict real-world outcomes such as consumer purchases.

While it is preferred to focus the analysis within the US given the recent changes in public policy, these policies have not been in place long enough to permit an adequate analysis of impact. The similarities in political and economic structures between the UK and US permit a possible prediction of how such large-scale policies could change consumer behavior in the US. We interpreted Google searches as a form of consumer foraging (see Rajala & Hantula, 2000) for a safe substitute to UVIT (informational reinforcement) within Foxall's BPM (1998). The basis for this interpretation stems from a behavioral definition of foraging; that is, distributing responses based on the relative reinforcement rates associated with the "patches" of reinforcement (i.e., the choice alternatives; Baum, Schwendiman, & Bell, 1999; Houston & McNamara, 1981). The internet provides an immense amount of information as a consequence for searches. In other words, online searches (i.e., behavior/foraging) yield information regarding access to potential reinforcers (i.e., indoor tanning alternatives). Given this assumption, the informational reinforcement (i.e., search results) obtained may be considered an initial-link in a chain of responding that eventually results in access to various primary reinforcers (e.g., UVA/UVB light that results in feeling attractive or evoking feelings of euphoria from the UV rays) and secondary reinforcers (e.g., social praise about looking attractive or fit).

The analysis of rule-governed contingencies can assist in understanding why there are increases in the relative search volume for tanning alternatives following UVIT bans for minors. Within rule-governed contingencies, motivating operations are described as motivating augmentals, or verbal antecedent stimuli that either increase or decrease the likelihood of selecting a choice by augmenting the relative reinforcing value of the choice alternative (Fagerström, Foxall, & Arntzen, 2014). Put simply, a motivating augmental is a rule that alters the value of a reinforcer. By instilling a ban (and thus decreasing the availability of the commodity being banned), there is a subsequent increase in the relative reinforcing value of substitutable commodities. In this case, the UK bans themselves could decrease the availability and reinforcing value of UVIT for minors, while subsequently increasing the value of other substitutable UVIT safe alternatives. Such behavioral processes underlying online consumer behavior are well described elsewhere and expand beyond the scope of this manuscript (see Fagerström et al., 2014; Hantula, 2010), but can provide theoretical assertions as to why there are changes in both the relative search volume, as well as potential increases in the consumption of information regarding tanning alternatives.

The staggered nature of the UK bans result in natural multiple baselines, similar to previously published accounts of broad policy analyses published in other behavior analytic outlets (e.g., Seekins et al., 1988). Evidence of a functional relation between UVIT bans and increases in searches for spray tan would provide the first single-case design demonstration of policy-level effects of UVIT legislation and would lend support to the notion that spray tans may serve as a substitute to UVIT in minors and possibly adults. Additionally, the current research lends support to the utility of large scale data sets to demonstrate consumer behaviors, with the potential to eventually influence public policy.

Method

Natural Multiple Baseline Dates

Dates for legislative enactment were derived from the Public Health etc. (Scotland) Act 2008 and the Sunbeds (Regulation) Act 2010 for Wales and England. Thus, 2004–2008 constituted the pre-UVIT ban baseline period for Scotland, while 2004–2010 served as the baseline period for Wales and England. Dates subsequent to the baseline periods constitute full enactment of relevant legislation banning the use of UVIT for minors aged 18 and younger (the Under-18 UVIT Ban condition of our analysis).

Under-18 UVIT Ban

As described below, the UVIT restrictions for minors are nearly identical for the countries of interest; minors under the age of 18 are not permitted to use a sunbed. The only exceptions are in minor phrasing and the magnitude of fines for tanning salons caught violating the regulation.

Scotland. The Public Health etc. (Scotland) Act 2008 states that “An operator of sunbed premises who, without reasonable excuse, allows a person who is under 18 to use a sunbed on those premises commits an offence” (S.95), with sunbed defined as “an electrically-powered device designed to produce tanning of the skin by the emission of artificial ultraviolet radiation” (S.108). Violations to this legislation may be fined up to £2,500.

Wales and England. The Sunbeds (Regulation) Act 2010 states that, in Wales and England, “A person who carries on a sunbed business . . . must secure that no person aged under 18 uses on relevant premises a sunbed to which the business relates” (S.2), with sunbed defined as “an electrically-powered device designed to produce tanning of the human skin by the emission of ultra-violet radiation” (S.1). Violations to this legislation may be fined up to £20,000.

Data Aggregation and Analysis

Data on Google searches were derived from Google Trends (www.google.com/trends) – a free online resource that quantifies the percentage of Google searches using a target term (word or phrase) comprising the total number of Google searches for a particular region over a specific time period (beginning in 2004). Data returned by Google Trends are reported as a relative (normalized) search index, ranging from 0 to 100, where 100 represents the highest recorded search volume for a target term within a set time period. This index thereby standardizes searches to the region of interest (and therefore controls for variables such as population density, Google usage rates, etc. across different regions of interest). Search terms with substantially low search volumes do not return a value (not even “0”). Precision of indices varies as a function of the time window of analysis; annual analyses yield weekly search indices, while weekly analyses yield daily search indices. In the present study, the relative search index would only reach 100 on the annual plots if the peak search volume maintained across an entire year (52 week period), beginning in January and ending the last week of December. Thus, the peak week of search volume (relative search index = 100) is subsumed into the aggregate of the month.

For our study, we conducted analyses of the search term “spray tan” for the time period beginning in 2004 and continuing through 2013 for each country, individually. Searches for “spray tan” were selected over alternatives such as “sunbed” and “tanning salon” for two reasons. First, we were interested in identifying safe substitutes to UV tanning. Second, searches for “risks of sunbeds,” “sunbed restrictions,” or “tanning salons with spray tanning” would be counted as searches for phrases such as “sunbed” or “tanning salon” (along with a myriad of other confounding phrases containing such words). Consumers foraging for news

regarding the UVIT restrictions might also use the terms “sunbed” or “tanning salon” to find information on the legislation; there is substantially less risk of this confound by using the term “spray tan.” Weekly search indices were obtained via the *Download as CSV* export function in Google Trends and then aggregated (in Excel) into yearly averages to aid in visual inspection. Specifically, we averaged across the 52 weeks of search indices per calendar year to yield one annual average of search indices. Yearly data were plotted within a concurrent multiple baseline across countries design with phase change lines embedded at the dates specified in the Natural Multiple Baseline Dates section above.

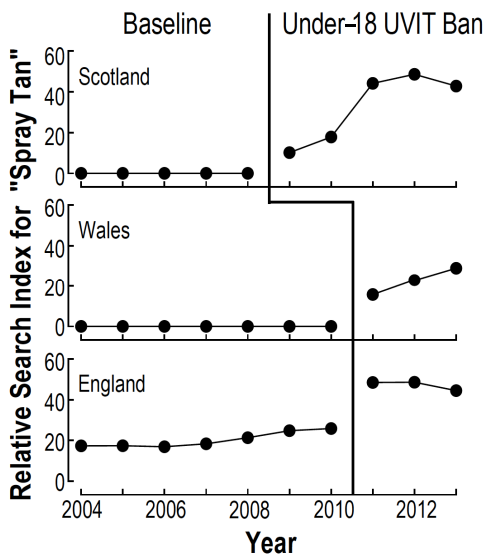


Figure 2. Natural multiple baseline design investigation in Scotland, Wales, and England. Relative search indices for the search term “spray tan” from Google Trends are plotted as a function of year. Baseline periods constitute the years preceding UVIT bans for minors (national enactment of bans indicated via phase change lines).

Results and Discussion

Figure 2 depicts the natural multiple baseline investigation on UK consumer foraging behavior for a safer UV-free tanning alternative (spray tans) as a function of UVIT bans for minors. For all three countries, relative search indices remained low and steady in the period leading to relevant legislative enactment. Scotland and Wales (top and middle panels) featured such low search volumes during the years preceding the under-18 UVIT ban that the relative search indices averaged zero. Recall that a complete absence of searches for a target term returns no data in Google Trends; in such instances, Google Trends reports that data cannot be provided, rather than returning a “0.” We received data for every week analyzed ($n = 520$) for each of the three target countries, suggesting that there was at least some search volume occurring throughout the entire duration of the analysis window. At the aggregate level, there were no measurable search volumes for “spray tan” until the year that the under-18 UVIT ban was implemented. For England, relative search indices for “spray tan” were measurable but relatively low and stable until 2011 when the under-18 UVIT ban was enacted. Following the Sunbeds (Regulation) Act 2010 in England, a clear change in level of search volume was noted; specifically, the volume nearly doubled from 25.85 in 2010 to 48.48 in 2011.

From a behavioral economic perspective the increase in searches for spray tanning provides preliminary support for the notion that spray tans may serve as a substitute for UVIT (see review of behavioral economic concepts by Hursh, Madden, Spiga, DeLeon, & Francisco, 2013). These data corroborate previous accounts of vanity serving as the primary function of tanning in young adults (Cafri, Thompson, Jacobsen, & Hillhouse, 2009). The unfortunate flipside of this interpretation is that natural UV sunbathing is likely a cheaper, but func-

tionally equivalent, substitute to UVIT in many regions of the UK and US. A strictly supply-side public policy approach – such as outright bans – are thereby likely to fail. As reported by Hursh and Roma (2013), such circumstances are better served by demand-side approaches grounded in the science of human behavior.

Our data support Foxall's BPM approach (1998) by demonstrating that public policy efforts reducing access to a preferred commodity may serve as a motivating augmental for informational reinforcement for a substitutable commodity (within the behavioral economics framework outlined above), potentially increasing the relative reinforcing value of safe-UVIT alternatives. Future studies should expand on this concept with UVIT to determine whether utilitarian reinforcement changes as a function of the bans. The Google Trends approach described in this article should also be used to evaluate the effects of informational reinforcement for other commodities under other conditions/contexts.

Large-scale naturalistic behavioral demonstrations such as ours are helpful in communicating with the public regarding the effectiveness of policies and laws (e.g., see Seekins et al., 1988). Such data are also of interest to policy makers and legislators interested in understanding how regulations manifest themselves in everyday situations, rather than in highly controlled laboratory simulations or statistical models of prediction. Of course, the benefits of broad naturalistic analyses such as this must be weighed against the limitations inherent in such research. We have no record of whether searches for "spray tans" resulted in actual purchases of spray tanning amongst minors in the UK, or whether the under-18 population subsequently increased outdoor sunbathing (another risk factor for skin cancer) as a function of the UVIT ban. Despite this, past research demonstrates that Google Trends provides useful predictive capabilities (Schmidt & Vosen, 2009; Goel,

et al., 2010; Preis, et al., 2013) suggesting that relative search volume may result in actual increases in behaviors associated with Google searches. Nevertheless, we maintain that Google searches constitute important consumer behavior that *should* be examined and appreciated. Moreover, Google Trends provides only relative – rather than absolute – indices of search volume, restricting an interpretation of the social or clinical significance in the behavior change. A final limitation is that Google Trends does not track the demographics of consumers using Google searches; thus, we do not know whether the affected population (minors in the UK) actually accounts for the increase in foraging for informational reinforcement concerning spray tans. Conducting an experimentally controlled functional analysis would be extremely difficult given the complexity of the environmental conditions that support the increases in relative search volume for UVIT alternatives. In the absence of researcher control over the various reinforcers associated with UVIT, the complexity of the consumer marketplace prohibits any definitive results. Despite this, the naturalistic data obtained from Google Trends suggests that the UVIT ban may have contributed to the relative increase in search volume for safe alternatives. Of course, it is certainly possible that other factors (e.g. advertisements, education about spray tans, improvements in spray tan technologies) may have contributed to increases in search, as well.

In summary, we used a novel approach to measuring public health policies via a natural multiple baseline design in Google Trends and found that Google searches for spray tans immediately followed implementation of UVIT bans for minors in the UK. Our findings may be applied to future research investigating the effects of supplementing the US UVIT tanning tax and/or UVIT bans for minors with subsidies for safe substitutable reinforcers, such as spray tans. The alarming statistics on UVIT use in the US and the potential for UVIT addiction (see review by

Kourosh et al., 2010) should also serve as a call for research within the behavior analytic community. Furthermore, the current research demonstrates the capabilities of large data sets and suggests that Google Trends may be a useful tool in analyzing more molar indices of behavior related to policy changes.

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