



Ultra-violet indoor tanning addiction: A reinforcer pathology interpretation



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HIGHLIGHTS

- Ultra-violet indoor tanning (UVIT) is a major public health concern.
- Dermatological and public health research suggests that UVIT is an addictive behavior.
- The reinforcement pathology model seems to account for UVIT addiction.
- The reinforcement pathology model of UVIT may inform novel treatments/approaches.

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ABSTRACT

Ultra-violet indoor tanning (UVIT) is a pervasive issue that is increasing at record rates, despite obvious and well-publicized links to skin cancer. Recent studies on UVIT have found that frequent users face difficulty quitting and report symptomatology similar to substance-related disorders, causing the medical field to begin classifying excessive UVIT use as an addicting behavior. Despite calls for research, relatively little behavioral research has been aimed at determining the psychology of UVIT. This mini-review reinterprets the existing dermatology literature in light of the reinforcer pathology model of addiction. The relevancy of this model, in conjunction with the similarities between UVIT addiction and other substance-related addiction, suggests that behavioral economic research on UVIT is overdue. This mini-review concludes with directions for future research in this area.

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1. Introduction

More than 1,000,000 Americans will expose their skin to dangerous levels of ultra-violet radiation via ultra-violet indoor tanning (UVIT) in the next 24 h (Whitmore, Morison, Potten, & Chadwick, 2001), with nearly 30,000,000 Americans engaging in UVIT over the course of the year (Kwon et al., 2002). Seventy percent of these users will be Caucasian females between 16 and 29 years old (Dellavalle, Schilling, Chen, & Hester, 2003). For individuals under the age of 35, their melanoma risk will increase by 75% with their first UVIT use (Boniol, Autier, Boyle, & Gandini, 2012); for users under the age of 25 – more than 50% of all UVIT users (Wehner et al., 2014) – their melanoma risk will increase by up to 102% (Wehner et al., 2012). Each additional use will increase the risk of melanoma by nearly 2% (Boniol et al., 2012). Recent estimates now suggest that the number of melanoma diagnoses attributable to UVIT outweighs the number of lung cancer diagnoses attributable to smoking (Wehner et al., 2014). These staggering numbers have resulted in the International Agency for Research on Cancer group of the World Health Organization classifying UVIT as a Group 1 known carcinogen (International Agency for Research on Cancer, 2012) in the same category as plutonium and tobacco.

Despite increased awareness of the risks associated with UVIT, its use has been increasing (Robinson, Rigel, & Amonette, 1996) for decades and continues to persist as a common practice in the United States, Europe, and Australia (Wehner et al., 2014). As such, the sunless tanning industry is experiencing record profits (up to \$5,000,000,000 annually, from \$1,000,000,000 in 1992; Levine, Sorace, Spencer, & Siegel, 2005). It seems counterintuitive that something so publicly advertised as dangerous and carcinogenic can feature increasing levels of demand. The persistent and increased demand may be attributable to the reinforcing qualities associated with UVIT. Tanning darkens the skin, which its users find attractive (e.g., Cafri et al., 2006; Cafri, Thomson, Jacobsen, & Hillhouse, 2009; Hillhouse & Turrissi, 2012; Schneider et al., 2013; Young & Walker, 1998). However, surveys of UVIT users have also demonstrated that tanning is relaxing (Beasley & Kittel, 1997; Dougherty & Hawkins, 1988; Mawn & Fleischer, 1993; Hillhouse & Turrissi, 2012; Schneider et al., 2013) and improves one's mood (Feldman et al., 2004; Poorsatter & Hornung, 2007). These rewarding aspects of UVIT, coupled with UVIT users who reported difficulty in quitting, have led health experts to speculate whether excessive UVIT is best categorized as an addictive behavior (Nolan & Feldman, 2009; Warthan, Uchida, & Wagner, 2005; Mosher & Danoff-Burg, 2010; Kourosh, Harrington, & Adinoff, 2010; Nolan, Taylor, Liguori, & Feldman, 2009).

In 2005, Warthan and colleagues surveyed 145 beachgoers on Galveston Island regarding their motivations for UVIT. As part of the survey, the researchers modified the CAGE Questionnaire (Mayfield, McLeod, & Hall, 1974) and items from the American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* (DSM-IVTR) associated with substance-related disorders to examine whether UVIT use could yield patterns of responding similar to those obtained with other commodities with abuse liabilities. Their results indicated that 26% of respondents met CAGE criteria for addiction, with 53% of respondents meeting substance-related disorder classification status on the DSM-IVTR-type items. A replication study using 229 participants yielded similar results by Mosher and Danoff-Burg (2010); interestingly, these researchers found that those with possible UVIT addiction also reported greater tendencies to use alcohol and marijuana, compatible with Bickel and Mueller's (2009) trans-disease process theory of addiction. Recent evidence from the Youth Risk Behavior Surveillance systems corroborates this trans-disease process notion, given that UVIT has been linked to a cluster of other risky decisions, such as smoking, binge drinking, illicit drug use, unhealthy weight control practices, steroid use, and more sexual partners (Guy et al., 2014). Finally, evidence of UVIT dependence was reported by Zeller, Lazovich, Forster, and Widome (2006) who phone-

surveyed nearly 1300 adolescents about UVIT and found that over 20% of their sample reported difficulty quitting UVIT.

2. Reinforcer pathology model

Leading experts on behavioral addiction propose that such issues arise due to reinforcer pathologies (Bickel, Jarmolowicz, Mueller, & Gatchalian, 2011; Bickel, Johnson, Koffarnus, MacKillop, & Murphy, 2014) wherein commodities with abuse liability are (a) highly valued (i.e., excessive demand) by clinical populations relative to controls and (b) excessively valued in terms of immediacy (i.e., delay discounting). This reinforcer pathology model emanates from the field of behavioral economics (Higgins, 1996; Hursh, 1980, 1984) and has been successfully applied to public policy (see Hursh & Roma, 2013) and behavioral pharmacology (see Jarmolowicz, Reed, & Bickel, 2014). Central to the repair of reinforcer pathologies are behavioral economic approaches to (a) constraining unhealthy/drug choices, (b) reducing constraint of healthy choices, and (c) improving impulse control (see Bickel et al., 2014). Given the success that behavioral economics has had in predicting the use and treatment response of opioids, alcohol, and tobacco (Bickel et al., 2014; Bickel & Vuchinich, 2000; Hursh, Madden, Spiga, DeLeon, & Francisco, 2013), the methods and approaches from behavioral pharmacology have significant potential to revolutionize our understanding and treatment of UVIT addiction. The goal of this paper is to reinterpret the existing literature on UVIT within the reinforcer pathology model and to introduce this problem as a significant area of potential for addiction specialists. In doing so, the reinforcer pathology model can provide novel insight into the development and treatment of UVIT addiction. Similar to tobacco control policies, information garnered from a reinforcer pathology model of UVIT addiction may have implications for public policy and preventative approaches (Sinclair & Makin, 2013).

2.1. Extreme valuation of UVIT

As described above, one component of the reinforcer pathology model of addiction is high valuation of a commodity. Addiction researchers have frequently relied on behavioral economic approaches such as the self-administration tasks (e.g., Bickel, Marsch, & Carroll, 2000, Johnson & Bickel, 2006) or purchase tasks where participants are provided a series of escalating hypothetical prices for a commodity and asked to report how much they would purchase (e.g., Bidwell, MacKillop, Tidey, Brazil, & Colby, 2012; Murphy & MacKillop, 2006) to evaluate demand for substances of abuse. The degree to which consumption is inelastic to price, as well as the intensity of demand at low prices (how much is consumed when there is little constraint) is considered indicative of demand, which speaks to the relative reinforcing efficacy of that commodity. To date, no such study has been conducted with UVIT. However, interesting studies from the field of academic dermatology provide some preliminary support that UVIT users find UV exposure reinforcing. For example, Feldman et al. (2004) asked 12 participants to visit the laboratory on Mondays, Wednesdays, and Fridays over the course of six weeks. On Mondays and Wednesdays, the participants were exposed to one of two UV sunbeds, such that both were experienced across the two days. One of the two beds each week featured a UV-filter that blocked the emission of UV rays; all other aspects of the sunbeds (e.g., sunbed look/features, intensity of ambient light, temperature) were identical. Participants used each bed over the course of the two days, but were blind to which bed blocked UV rays. On Friday visits, both sunbeds were concurrently available and the participants were asked to choose which bed they preferred, with the hypothesis that frequent UVIT users would be able to detect and prefer the bed emitting UV rays. Results indicated that frequent UVIT users did indeed prefer the UV emitting sunbeds (preference in the absence of constraint), suggesting that UV exposure is an efficacious reinforcer for this population.

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