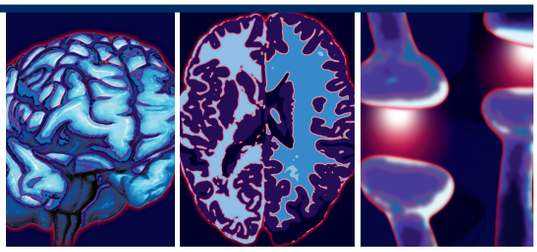
EDITORIAL



Should we be targeting potential addictive behaviors in tanning bed users?

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Is tanning addictive?

Concerns of too-frequent tanning have been provoked by the proliferation of tanning salons in tandem with rising rates of skin cancer [1]. The prevalence of melanoma, a skin cancer with alarming mortality rates, has been rising over the past three decades. This increase has occurred primarily in young, white women, the highest consumers of tanning salons [2]. Other consequences of frequent ultraviolet radiation (UVR) exposure are other skin cancers (basal and squamous cell) and an acceleration of the skin's aging process (wrinkles and/or leathery skin). Given that this latter outcome negates the short-term presumed beneficial effects on appearance, the heightened use of UVR is particularly puzzling (although the narcissism and short-sightedness of youth certainly plays a role). Significant efforts in education, regulation and taxation have been unsuccessful in stemming the tide of purposeful UVR exposure. Anecdotal reports from tanners expressing difficulty in cutting down or stopping their UVR exposure, coupled with an emerging scientific literature, has heightened interest in considering the addictive potential of tanning.

Addiction is increasingly being popularized to depict any excessive behavior. In addition to the use of substances such as cocaine, nicotine and alcohol, behaviors such as gambling, sex, shopping, eating chocolate, video gaming, internet/cell phone use and gasoline consumption have all been referred to as addictions [3]. Such widespread use threatens to weaken the power 'addiction' conveys when describing the compulsive, out-of-control behaviors associated with cocaine or heroin use. In many cases, the criteria describing these addictions have not been empirically derived, nor are the criteria subject to content and construct validity. Nevertheless, 'addiction' has received general acceptance in medicine and psychiatry, as well as the lay public, as the optimal term to describe the complex of behaviors manifested by a loss of control, compulsive use and continued use despite adverse consequences.

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Compulsive tanning, cleverly referred to by some as 'tanorexia', is one of the more recent behaviors to join the addiction manifest.

There are now several lines of evidence suggesting that UVR may be addictive. First are the studies confirming a positive, reinforcing effect of UVR. The ground-breaking work of Feldman *et al.* demonstrated that frequent tanners preferred tanning beds with UVR relative to those with no UVR [4]. In this paradigm, subjects were exposed to two tanning lamps in two different sessions. Filters covered each UVR lamp: one filter removed UVR (true filter resulting in sham UVR), whereas the other filter did not remove UVR (inactive filter resulting in active UVR). On the third session, subjects were allowed to choose either bed for their final UVR session. A total of 95% of the subjects chose the bed with the inactive filter. Harrington, a bright, insightful dermatology resident at UT Southwestern Medical Center (TX, USA), considered these findings. Coupled with her concerns of young adults with cancerous skin lesions persisting in their tanning regimen, she approached our laboratory and suggested that we assess the CNS response to UVR in these patients. Pushing through my initial qualms, we designed a study to measure brain activation during UVR in compulsive tanners. Using the UVR filters donated by Feldman, subjects were exposed to UVR and sham UVR in two sessions. Immediately after the tanning light was activated, subjects were administered a radioligand that measured regional cerebral blood flow (a measure of neuronal activity) over 1–3 min. We found that compulsive tanners exposed to the unfiltered UVR reported a significant decline in the 'desire to tan' during the 10-min active UVR exposure. By contrast, there was no decline in 'desire to tan' during the inactive UVR session. Importantly, regional cerebral blood flow was increased in the dorsal striatum, as well as the medial orbitofrontal cortex and anterior insula, during the active UVR compared with the inactive UVR. These findings suggested that the UVR session, relative to sham UVR, activates brain regions associated with reward [5].

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The Feldman *et al.* [4] and Harrington *et al.* [5] studies strongly suggest that UVR has centrally rewarding properties. Other evidence includes reports that 50–70% of frequent tanners endorse 'feel good' and 'relaxation' as two of their three top reasons for tanning (not surprisingly, 90% chose 'to look good') [6]. This is consistent with the positive sensation often experience when walking outside into the sun. Although the experience of reward may be a prerequisite for a behavior to develop into an addiction, it does not prove that the behavior is, in fact, additive. A number of surveys, however, reveal that many frequent tanners endorse signs and symptoms consistent with either problematic tanning behaviors (e.g., guilt over tanning or feeling annoyed at others commenting on their tanning) or an addiction (e.g., inability to cut down or stop tanning, avoiding other responsibilities in order to tan or continuing to tan despite skin cancer). Almost 75% of those who frequently sunbathe or use tanning salons report problematic use or addictive-like behaviors [6,7]. Similar to substance dependence, the age of tanning onset and tanning frequency are inversely associated with success in stopping [8].

Nevertheless, much work needs to be done before UVR use can be considered addictive. We are preparing to embark on studies to compare striatal dopamine receptors (which are decreased in nicotine-, cocaine-, alcohol- and methamphetamine-addicted patients, as well as in obesity) in compulsive and infrequent tanners, as well the UVR-induced dopamine efflux. As noted, content and construct validity must be determined for tanning addiction criteria, as well as their predictive validity. Our understanding of this behavior also requires the elucidation of the relevant dermato–neurobiologic pathways. Psychodermatology, or psychocutaneous medicine, focuses on the boundary between psychiatry and dermatology. The neuro–immuno–cutaneous–endocrine model posits an interplay between neurotransmitters, hormones and cytokines to explain the neuro–dermatologic connection [9]. Although this model has been used to describe the role of chronic stress in the evolution of a variety of skin diseases [10], the pathways involved in the rewarding effects of UVR are unknown. Possible mechanisms underlying UVR-mediated reward include pro-opiomelanocortin (and its downstream effectors α-melanocyte-stimulating hormone, β-endorphin and glucocorticoids), the p53 polymorphism and/or serotonergic/noradrenergic mechanisms [11,12].

What should we do?

While awaiting the outcome of this more definitive work, this editorial poses the question: 'Should we be targeting potential addictive

behaviors in tanning bed users?'. Given the morbidity and mortality resulting from excessive UVR, efforts to reduce behaviors heightening these potentially fatal outcomes must be attended to. So what should we do? Regulations, while providing some guidance, are limited in their reach. Similar to the restrictions placed on many potential dangers and/or toxins, most states limit access to tanning beds for minors. In addition, many US states place restrictions on exposure time and mandate eye protection. These laws are useful and should be unquestioningly enacted by all states. Further restrictions are not likely to be beneficial; as experienced with substance use, restricting use seldom decreases self-administration in those at greatest risk for addiction and typically results in unintended negative consequences [13,14]. It would also be difficult to significantly restrict an experience that can be replicated by stepping outside into the sun. Present regulations also offer the opportunity to provide UVR in a controlled environment (limited exposure time and mandated eye protection) that would not be available if salons were outlawed entirely. Finally, many users of tanning salons do not tan with sufficient frequency to heighten their cancer risk. Thus, these individuals should not be restricted in their use.

Some potentially useful approaches to target tanning addiction follow:

- Awareness of the possible addictive qualities of UVR will likely be useful. The extensive attention in the lay press given to recent scientific publications about UVR and reward/addiction may suggest a subliminal public awareness of this phenomenon [5,15]. Recognition of this potentially adverse consequence of frequent UVR use may cause individuals to limit their use. Persons experiencing a loss of control over their use may be more open to acknowledging a problem. Dermatologists may be willing to ask about tanning frequency and whether a patient, particularly one who persists in tanning despite a diagnosis of skin cancer, may be experiencing an inability to limit or cease their UVR use.
- To my knowledge, behavioral approaches for compulsive tanning behaviors have not been tested. Motivational enhancement techniques seem a reasonable approach that could be easily undertaken in the dermatologist's office [16]. Cognitive–behavioral approaches, which are useful in other additive behaviors [17], may also be adapted for this population.
- Similarly, pharmacological treatments for compulsive tanning have not been assessed. While targeted approaches must await a more thorough understanding of the biologic mechanisms underlying both UVR-induced reward and addiction, opioid antagonists may offer a useful starting point. Kaur *et al.* reported that naltrexone, an opioid antagonist, reduced UVR preference and induced withdrawal symptoms in frequent, but not infrequent, tanners [18]. The efficacy of naltrexone, particularly the long-acting injectable form, in both alcohol-dependent [19] and opioid-dependent [20] individuals, may therefore be a reasonable approach in compulsive tanners.

In summary, the potentially fatal outcome of frequent UVR administration requires a concerted effort to both understand the biologic mechanisms underlying this behavior, as well as treatment interventions that may assist compulsive tanners in lessening their UVR exposure.

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