Mini Review

Addictive potency

Abstract

Addictive potential of a substance may be predicted on the basis of a mathematical formula of A = P + R with A representing the addictive potency P representing punishment potency and R representing reward potency. The review suggests 2 principal influences reward and punishment play the crucial role of defining the addictive potency of a substance. This formula based upon fundamental psychobiological principles of reward and punishment may be of help to upgrade the current system of controlled substance regulations rooted in provincial information.

Addictive Potency: A = P + R

(A, Addictive Potency; R, Reward Potency; P, Punishment Potency)

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Introduction

Psychoactive substances are part of human existence since antiquity and have mood altering and addictive properties.[1] Many psychoactive substances such as nicotine, cocaine, marijuana, caffeine etc. are natural plant products and accessible to people. Reward and punishment represent fundamental psychobiological responses to external stimuli. The controlled substances act of 1970 established a system to classify substances for their abuse potential.[1] Heroine, mescaline and marijuana for instance are schedule[1] drugs with a high addictive potential whereas cocaine, morphine and amphetamines are classified as schedule.[2] In general many factors including latency before euphoric effect, elimination half life, speed amount and route of administration seem to be crucial for addictive potency of a. substance.[2] There have also been proposed mathematical models to calculate the addictive potency.[2] For public education it may be useful to have a consumer friendly method to predict the addictive potency of a substance.

Method

We searched the scientific literature of addiction medicine by identifying articles using keywords of addiction, addiction medicine, addictive substance, dependence, tolerance, withdrawal symptoms between 1970 and 2013. To measure the potency score we used a modified version of HENNINGFIELD-BENOWITZ ratings. They were based upon five categories

i. Withdrawal symptoms.

ii. The influence of the drugs reinforcing effects based on human and animal studies.

iii. The degree of tolerance produced by the drug.

iv. Degree of dependence produced by the drug based on difficulty quitting, relapse rates and the percentage of abusers who become dependent.

v. Degree of intoxication produced by the drug. Our rating system incorporated the fundamentals of HENNINGFIELD-BENOWITZ ratings but simplified it to a natural biological model of reward and punishment with severe and mild categories for both.

Results

Results are summarized in Table 1 & 2.

Table 1 Addictive Potency Score

Reward	Punishment	Score
Alcohol 2	2	24
Morphinepo2	2	4
Methadone po1	1	12
Fentanyl Patch1	1	2
Heroin iv2	2	24
Heroin im1 Long Acting	1	2
Marijuana Inhale 1	1	2
Cocaine Inhale 2	2	4
Tobacco Inhale	1	23
Caffeinepo 1	1	12
Benzodiazepines po	2	24
Methylphenidate po	2	13
Methylphenidate 1 Long-acting po	1	12
Amphetamines po 1	1	12
Barbiturates po2	2	4
Oxycodone 2	2	4
Oxycodone 1 Long acting	2	1
Oxymorphonepo 2	2	4
Oxymorphonepo 1 Long-acting	1	2

Table 2 Addictive potency

1)	Alcohol	++++
2)	Heroine iv	++++
3)	Cocaine inh	++++
4)	Barbiturates po	++++
5)	Benzodiazepines po	++++
6)	Oxycodone po	++++
7)	Oxymorphone po	++++
8)	Morphine po	++++
9)	Methylphenidate po	+++
10)	Tobacco inhale	+++
11)	Marijuana inhale	++
12)	Caffeine po	++
13)	Amphetamine po	++
14)	Oxycodone long-acting	++
15)	Morphine long-acting	++
16)	Oxymorphone long-acting	++
17)	Methadone	++
18)	Fentanyl patch	++
19)	Methylphenidate long-acting	++

Discussion

Review results are almost identical to classic HENNINGFIELD-BENOWITZ ratings and consistent with the scientific literature. Addictive substances share two predominant properties that define their addictive potency: short latency of euphoric influence and elimination half-life. This suggests the longer latency and elimination half-life correlate with less addictive potency with the opposite being true for greater addictive potency. The pace, method, amount of consumption and the euphoric potency seem to be important influences. However simply based upon the length of latency and the elimination half-life it is possible to accurately predict the addictive potency of a substance.

The results can be stated as $A = P + R$

with R: Reward Potency; P: Punishment Potency and A: Addictive Potency.

Reward potency and punishment potency are based upon a hypothetical scale of intensity with 2 representing strong 1 representing mild responses and zero no response.

Conclusion

$A = P + R$ may represent a practical and consumer friendly formula to predict addictive potency of a substance. The results match previous findings from other researchers. It needs further validation by double-blind prospective studies to ensure its reliability and validity.

$(A = P + R)$'s simplicity, consumer friendliness along with the compelling cumulative data consistent with the fundamental integrity of its design makes it worthy of further investigation. If confirmed it may invite further discussion about how to upgrade the current controlled substances guidelines rooted in provincial principles.

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Conflicts of interest

Author declares there are no conflicts of interest.

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