Psychopharmacology (1992) 108:408–410

Psychopharmacology

Commentary

Nicotine addiction: a re-analysis of the arguments

Robert West

Psychology Department, St. George's Hospital Medical School, London University, London SW17 0RE, UK

Received February 21, 1992 / Final version March 19, 1992

Abstract. This paper evaluates the arguments put forward by Robinson and Pritchard (R&P, this volume) that the conclusions of the US Surgeon General (USDHHS 1988) that nicotine is addictive were ill founded. R&P state that nicotine does not cause intoxication, that many smokers do not exhibit compulsive use, that nicotine is not a euphoriant, that nicotine is a weak reinforcer in other species, that non-pharmacological aspects of smoking are important and that negative affect control accounts for more of the variance in questionnaire measures of smoking motives than does habit. This paper points out that intoxication and a euphoriant effect are not normally considered to be central to dependence potential, that no addictive drug results in compulsive use in all users in all situations, that animals do reliably self-administer nicotine, that evidence concerning the apparent importance of non-pharmacological components of smoking do not diminish the importance of pharmacological aspects and that "variance accounted for" of self-report measures of smoking motivation do not bear on the issue of the importance of those motives. The paper concludes with a summary of the essence of the argument that cigarettes are addictive and that nicotine is the primary focus of that addiction.

Key words: Smoking – Nicotine – Dependence – Addiction

Robinson and Pritchard (R&P) in this issue have claimed that the conclusion of the US Surgeon General's (USDHHS 1988) report that nicotine is addictive in the same sense as is used for drugs such as cocaine and heroin is incorrect and idealogically motivated.

Whether or not a drug or activity is judged to be addictive depends as much on one's definition of addiction as the evidence. The issue is more than academic. Official recognition that a product is addictive may place individuals who use it in a stronger position when making claims for damages against the supplier. It may also influence public policy for controlling supply and use of the product. Therefore it is important that experts in the field conduct the debate honestly and with sound reasoning. Robinson and Pritchard have taken the view that the authors of the 1988 Surgeon General's report failed to do this. This commentary evaluates the arguments used by Robinson and Pritchard. It then represents the essentials of the argument that nicotine is addictive in a form which should minimise confusion about exactly what is being claimed.

Robinson and Pritchard's arguments against nicotine addiction

Argument 1

Nicotine does not cause intoxication, and intoxication is considered by many to be an essential feature of an addictive drug. Therefore nicotine is not an addictive drug.

Nicotine does create feelings of lightheadedness/dizziness in the absence of acute tolerance (West and Russell 1987). However, there is no good evidence that it impairs psychomotor performance (USDHHS 1988). Smokers are more likely to be involved in traffic accidents than are non-smokers, but this may be because of differences in the personality characteristics of smokers rather than impaired performance (DiFranza et al. 1986; Bradstock et al. 1987). Therefore, if one holds the view that intoxication must involve psychomotor impairment and that intoxication is essential to addiction, it would be inconsistent to regard nicotine as addictive.

However, most experts do not consider intoxication to be central to dependence because by that token many drugs which promote compulsive use, especially stimulants, would not be considered addictive.

Argument 2

Many smokers can go for extended periods without cigarettes. Therefore nicotine use is not highly controlled or

compulsive. Highly controlled or compulsive use is essential for a drug to be addictive. Therefore, nicotine is not addictive.

The problem with this argument stems from amguity in the word "many", and the scope of the phrase "controlled or compulsive use". Many smokers can go for extended periods without cigarettes, but many cannot! Those that cannot certainly fulfil this particular criterion for addiction. Those that can may still be addicted if they show highly controlled or compulsive use in most situations. If a smoker can easily manage without cigarettes for a day or more then it is unlikely that he or she could be classed as addicted. However, the evidence is that most smokers experience urges to smoke when they have to go without cigarettes for more than a few hours (Russell 1978). For a significant minority, these urges are powerful (Russell 1978) and are not necessarily related to anticipated benefits which smoking might confer (e.g. stress reduction or improved concentration).

Thus, whereas it is correct to say that not all smokers experience powerful urges to smoke all the time, this seems an unreasonable test of whether nicotine is addictive and indeed it would exclude from the definition all other forms of drug use or behavioural addictions.

Argument 3

Nicotine is not a euphoriant in humans.

It is not clear from R&P's paper whether they believe that a euphoriant action is a defining criterion for an addictive drug and therefore whether this statement is cited against the view that nicotine is addictive, or whether they are merely noting that claims that nicotine does induce euphoria are incorrect and therefore fail to support the argument that nicotine is addictive.

Nicotine in the form of injection or nose drop has been shown to produce a light-headed/dizzy feeling in non-smokers and deprived smokers, although the extent to which this is regarded as pleasurable is not clear (Russell 1991). Nicotine chewing gum is normally considered unpleasant by naive users, although local irritation in the mouth and throat is the most likely reason for this. The liking scales used for liability testing by the US National Institute on Drug Addiction may well obscure differences between drugs because of difficulties in anchoring the scales and inadequacy of direct comparisons (Vocci 1991). Therefore, R&P are correct in saying that there is no good evidence that nicotine given in a form other than cigarettes has a strong euphoriant effect. On the other hand, many smokers report that they find smoking highly pleasurable. As R&P point out, pleasurable relaxation is an important feature of smoker's self-reported smoking motives (Russell et al. 1974). It remains possible, therefore, that nicotine taken through cigarette smoke does have euphoriant effects when smokers are permitted to choose their dose and in situations conducive to relaxation. In this respect it would be similar to some other drugs which are widely regarded as addictive, such as alcohol.

In any event, euphoriant action of a drug is not widely regarded as important in defining it as addicting. The US Surgeon General's report chose to concentrate on "psychoactivity" instead. That nicotine has psychoactivity is not disputed by R&P. Although the importance of this broader criterion is disputed by R&P, the reason for adopting it is merely that any drug which was not psychoactive could not reasonably be considered addictive. To my knowledge, no-one is claiming that any drug that is psychoactive is addictive.

Argument 4

Nicotine is a weak reinforcer in other species.

It is not clear whether R&P are arguing that nicotine is not addictive because it is a weak reinforcer or whether they are arguing that nicotine self-administration in other species does not support the argument that nicotine is addictive.

Whether animal self-administration of nicotine is less robust than that of cocaine and opiates is currently a matter of debate. However, there is no doubt that nicotine self-administration is readily established and is indeed robust (Goldberg and Stolerman 1986). The same cannot be said of caffeine, to which R&P liken nicotine (Goldberg and Stolerman 1986). Incidentally, neither can it be said of alcohol and benzodiazepines both of which are widely regarded as having addictive potential (Goldberg and Stolerman 1986).

One factor which needs to be taken into account is the fact that nicotine toxicity occurs at doses only slightly above those required to maintain responding. The schedules of reinforcement alluded to by R&P are designed to enable high rates of responding without toxicity. This is very different from the kind of schedule-induced responding for electric shocks which R&P mention by way of comparison. Therefore, it is incorrect to state that in this respect nicotine is similar to caffeine and unlike classically addictive drugs.

The issue of whether self-administration is an appropriate model for human addiction is another matter. In general, animal self-administration should be regarded as no more than an indicator of possible addictive potential and not a defining attribute of an addictive drug. This is because species differ, and occurrence of addiction in humans results from an interaction of mode of drug delivery, personal characteristics, personal circumstances and drug effects.

Argument 5

The scratch of smoke in the throat is important in smoking so non-pharmacological aspects of smoking are important.

The implicit implication appears to be that pharmacological aspects of smoking are not important (otherwise the issue is not relevant to the thrust of their paper). Rose et al. (1984) showed that anaesthetising the upper airways reduced desire to smoke and concluded that the sensation of smoke in this region was important for

smokers. This cannot be taken to imply that pharmacological factors are not important. First of all, it is possible that smokers experienced less desire to smoke because they could not titrate their nicotine intake using this particular cue and were concerned about receiving a toxic dose. It is also possible that the scratch in the throat is a conditioned reinforcer by being paired with the effect of nicotine which immediately follows it.

Argument 6

Spielberger (1986) reported that an automatic/habitual factor accounted for less variance in a self-report questionnaire of smoking motives than did a factor labelled "negative affect control". Therefore negative affect control is a more important smoking motive than is automatic/habitual smoking.

This argument is based on a misunderstanding of factor analysis. The fact that a factor accounts for more variance merely indicates that *variation* between individuals is greater on questions that collectively load on that factor. It says nothing about the absolute values of scores. Therefore, this study shows that there is greater consistency in subjects' reports of automatic/habitual smoking than in their ratings of negative affect control smoking.

Besides this, the study only bears weakly on the issue of whether nicotine is addictive. Smokers' attributions about why they smoke may be incorrect and the importance of one smoking motive does not imply the unimportance of another.

Conclusion

To summarise the problems with R&P's arguments: on the one hand, they involve claiming unrealistic criteria for addiction (impaired psychomotor performance, compulsive use in all users at all times, and euphoriant effect) which do not apply to other drugs that are generally regarded as addictive. On the other hand, they make incorrect statements about items of evidence (confusing variances and means as evidence of the importance of ratings of smoking motives, and understating the evidence for nicotine self-administration in other species).

The argument about whether or not nicotine is addictive can be stated simply and in terms which make the position clear:

- In the US and UK, surveys consistently report that more than two thirds of smokers express an earnest desire to quit (Glass 1990; ASH 1991).
- Fewer than 40% of those who have ever smoked regularly do quit by the time they reach 60 years of age (Jarvis 1991). On average it is lighter smokers who succeed in becoming ex-smokers (Cox et al. 1987).
- Therefore, there is a significant porportion of smokers who say they would like to quit but do not do so. Either these people are not telling the truth when they say they would like to quit, or their smoking is not fully under their voluntary control.
- As evidence of the good faith of smokers when they claim that they would like to quit, the majority make serious attempts to quit (Cox et al. 1987). The chances of success of any given attempt are less than 1 in 10 (Sachs 1990).
- As further evidence of the reality of the phenomenon of compulsive use and loss of control, smokers who make the (often considerable) effort to attend intensive smoking cessation clinics generally have a less than 40% chance of maintaining abstinence even for a few weeks (Sachs 1990).
- Nicotine is the only psychoactive substance in tobacco smoke which is a plausible candidate for the cause of the addiction and nicotine replacement improves the success rates of smokers clinics by comparison with a placebo (Fagerstrom 1988).

The US Surgeon General's 1988 report which R&P criticise no doubt could have rehearsed these arguments without elaboration and made the case for nicotine addiction more simply. However, the purpose of the exercise was to document the wealth of evidence relating directly and indirectly to the issue of whether nicotine was addictive and the possible mechanisms of addiction. In this task, I believe it succeeded admirably and it serves as the most important single reference on smoking behaviour yet published.

References

Action on Smoking and Health (1991) NOP Omnibus survey 11 March

Bradstock MK, Marks JS, Forman MR et al. (1987) Drink Driving and health life-style in the United States: behavioural risk factor surveys. J Stud Alcohol 48:147–152

Cox BD, Blaxter M, Buckle ALJ et al. (1987) The Health and Lifestyle Survey. The Health Promotion Research Trust, London

Di Franza JR, Winters TH, Goldberg RJ, Cirillo L, Biloursi T (1986) The relationship of smoking to motor vehicle accidents and traffic violations. NY State J Med 86:464–467

Fagerstrom KO (1988) Efficacy of nicotine chewing gum: a review. In: Pomerleau OF , Pomerleau CS (eds) Nicotine replacement: a critical evaluation. Liss, New York

Glass A (1990) Blue mood, blackened lungs: depression and smoking. JAMA 264:1583–1584

Goldberg SR, Stolerman IP (1986) Behavioural analysis of drug dependence. Academic Press, Orlando

Jarvis MJ (1991) A time for a conceptual stocktaking. Br J Addict 86:643–648

Rose JE, Zinser MC, Tashkin DP, Newcomb R, Ertle A (1984) Subjective response to cigarette smoking following airway anesthetization. Addict Behav 9:211–215

Russell MAH (1978) Smoking addiction: some implications for cessation. In: Schwartz IL (ed) Progress in smoking cessation. American Cancer Society, New York

Russell MAH (1991) The future of nicotine replacement. Br J Addict 86:653–658

Russell MAH, Peto J, Patel UA (1974) The classification of smoking by factorial structure of motives. J R Statist Soc Series A: General 137:313–346

Sachs DPL (1990) Advances in smoking cessation treatment: state of the art. Curr Pulmonol 12:1–48

Spielberger CD (1986) Psychological determinance of smoking behavior. In: Tollison RD (ed) Smoking and society: toward a more balanced assessment. D.C. Heath, Lexington MA, pp 89–134

US Department of Health and Human Services (1988) The health consequences of smoking: nicotine addiction. A report of the Surgeon General. Office on Smoking and Health, Maryland

Vocci FJ (1991) The necessity and utility of abuse liability evaluations in human subjects. Br J Addict 86:1537–1542

West R, Russell M (1987) Cardiovascular and subjective effects of smoking before and after 24 hours of abstinence from cigarettes. Psychopharmacology 92:118–121