

Review

# Tobacco-induced neurotoxicity of adolescent cognitive development (TINACD): A proposed model for the development of impulsivity in nicotine dependence

Spencer C. deBry, Stephen T. Tiffany

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**Early initiation of cigarette use is associated with higher levels of nicotine dependence. This paper provides a theory to explain this finding based on the neurotoxic effects of cigarettes on a developing system. The tobacco-induced neurotoxicity of adolescent cognitive development (TINACD) theory postulates that alterations in executive functioning, particularly evident under stressful or emotionally intense states, lead to higher levels of dependence. The model proposes that the neurotoxic effects of tobacco are most pronounced when smoking begins during early adolescence, a period of major neurodevelopment subserving inhibitory control.**

## Introduction

Cigarette use is the leading cause of preventable death in the United States (Centers for Disease Control and Prevention [CDC], 2003). Some 92% of current smokers began use before the age of 20 (U.S. Department of Health and Human Services [USDHHS], 2004). Initiation of use during the early teenage years is associated with longer, more extensive use and more difficulty quitting as an adult than if use is initiated later (Breslau & Peterson, 1996; Ershler, Leventhal, Flemming, & Glynn, 1989; Taioli & Wynder, 1991). Understanding the mechanisms by which stronger dependence develops as a result of early use will be instructive, not only from an etiological standpoint but also in terms of developing more effective prevention and treatment interventions. This article presents a hypothesis titled

the tobacco-induced neurotoxicity of adolescent cognitive development (TINACD) theory based on the neurodevelopmental processes occurring during early adolescence and the neurotoxic effects of cigarettes in this developing system. TINACD postulates that continued cigarette use during adulthood is fostered by poor impulse control expressed during cessation attempts. This relative lack of impulse control may result from nicotine-induced damage to the prefrontal cortex and its connections, which are still actively developing during adolescence and are sensitive to the neurotoxic effects of cigarettes. The theory is not a comprehensive model of tobacco dependence but rather explains one mechanism whereby early initiators of smoking may develop higher levels of nicotine dependence. It also describes how deficits in executive functioning brought about by early use may be maximally expressed under intense affective states.

Spencer C. deBry, M.D., Stephen T. Tiffany, Ph.D., University of Utah Department of Psychiatry, Salt Lake City, UT; Dr. Tiffany is now at the Department of Psychology, University of Buffalo, New York.

Correspondence: Spencer C. deBry, M.D., University of Utah Department of Psychiatry, 50 North Medical Drive, Salt Lake City, UT 84132, USA. Tel: +1 (801) 581-2121; Fax: +1 (801) 581-5604; E-mail: spencer.debry@hsc.utah.edu

## *Adolescence and the initiation of early smoking*

The period of adolescence does not have critically defined boundaries. Some authors consider it to