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Short communication

Early emerging nicotine dependence symptoms in adolescence predict daily smoking in young adulthood

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ABSTRACT

Purpose: The present study evaluated the predictive validity of individual early emerging nicotine dependence symptoms in adolescence on smoking behavior in young adulthood.
Methods: A total of 492 adolescents who, at baseline, had not smoked more than 100 cigarettes in their lifetime and 123 adolescents who smoked more than 100 cigarettes lifetime, and who participated in the 6-year follow-up assessment were included in the present analyses. Predictive validity of 10 nicotine dependence items administered at baseline was evaluated at the 6 year follow-up when the sample had entered young adulthood (mean age = 21.6).
Results: Among adolescents who had smoked fewer than 100 cigarettes, experiencing higher levels of overall nicotine dependence as well as individual symptoms at baseline longitudinally predicted an increase in risk for daily smoking in young adulthood, after controlling for baseline smoking and other tobacco use. For adolescents who had smoked more than 100 cigarettes at baseline, level of nicotine dependence and individual symptom endorsement did not predict smoking behavior in young adulthood.
Conclusions: These findings add to accumulating evidence that early emerging dependence symptoms reported at low levels of smoking exposure signal a greater propensity for continued smoking behavior. Screening for these early emerging symptoms among novice adolescent smokers represents an important and unused tool in tobacco control efforts aimed at preventing the development of chronic smoking patterns.

1. Introduction

Over the past several decades, public health interventions have been very successful in reducing smoking in the United States by encouraging higher rates of quitting and decreased uptake. This has largely been achieved through "universal" approaches that have increased knowledge of deleterious effects of smoking and exposure to second hand smoke, and influenced major anti-smoking legislation that has increased prices, reduced access and limited smoking in both public and private areas (Nagelhout et al., 2012; Grucza et al., 2013). Given the heavy public health burden associated with smoking, despite substantial environmental restrictions, a "hardening hypothesis" has been posited in which largely hardcore smokers, that is, those with a greater propensity for heavy, dependent smoking, remain in the wake of population-based intervention (Hughes, 2011; Smith et al., 2014). Based on the belief that new smokers who progress beyond initiation and experimentation may possess a propensity for heavy dependent use, recent work has begun to focus on identifying individual differences in patterns of early smoking behavior and emerging dependence symptoms.

To date, there have been 6 prospective studies that have evaluated the development of smoking and nicotine dependence among novice adolescent smokers, and despite their use of different measures of dependence and different lags between follow-up assessment, each has clearly demonstrated that for some youth, symptoms of nicotine dependence emerge soon after smoking initiation, at relatively low levels of smoking exposure and well before the establishment of daily smoking patterns (DiFranza et al., 2000, 2002; O'Loughlin et al., 2003; Audrain-McGovern et al., 2004; DiFranza et al., 2007; Kandel et al., 2007; Dierker and Mermelstein, 2010). Although this and other accumulating evidence based on cross-sectional reports of novice smokers have clearly documented

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individual differences in the number and type of nicotine dependence symptoms experienced (Rose et al., 2010), to date, less evidence is available evaluating whether these early emerging symptoms represent substantial risk for sustained, chronic smoking behavior and if so, whether that risk may be better accounted for by individual differences in smoking exposure (e.g., lifetime cigarettes) than by the presence of nicotine dependence symptoms per se.

In an earlier report based on the present sample, early emerging nicotine dependence symptoms predicted smoking behavior 2-years later, during adolescence, when the sample was still in high school (Dierker and Mermelstein, 2010). The present study extends this work by evaluating the predictive validity of early emerging nicotine dependence symptoms between baseline assessment and a 6 year follow-up, when the cohort has entered young adulthood.

2. Method

2.1. Participants

The sample was drawn from the Social and Emotional Contexts of Adolescent Smoking Patterns (SECASP) Study, which has been described elsewhere (Dierker and Mermelstein, 2010). All 9th and 10th grade students at 16 Chicago-area high schools completed a brief screener survey of smoking behavior ($N = 12{,}970$). All students who reported (1) smoking in the past 90 days and smoking <100 cigarettes/lifetime, (2) smoking in the past 30 days and smoking >100 cigarettes/lifetime, or (3) smoking <100 cigarettes/lifetime, but not smoking in the past 90 days, were invited to participate, as were random samples of never-smokers. Of the 3654 students invited, 1263 agreed to participate and completed the baseline measurement wave 2 months after screening. All procedures received approval from the University of Illinois at Chicago IRB. Written informed consent was obtained from the parents or guardians of the adolescents. For assessment following each participant's 18th birthday, informed consent was directly obtained.

Base-line assessment occurred in 2005–2006, and the 6 year follow-up in 2012. Retention at the 6 year follow-up was 84.6% ($N = 1068$). The mean age of this sample when recruited for the study was 15.7 years (s.d. 0.62). Fifty-five percent ($n = 521$) were male, 57.4% ($n = 540$) White, 15.2% ($n = 143$), Black and 18.5% ($n = 174$) were Hispanic. Participants and nonparticipants at the 6 year follow-up did not differ by age, race/ethnicity or number of days smoked in the past 30 at baseline. However, nonparticipation was significantly higher among males (19.7%) than females (12.2%), $p = 0.0002$. Compared to completers at the 6 year follow-up, non-completers reported a greater number of cigarettes smoked per day in the past 30 days at baseline ($M = 0.90$ cigarettes per day, $SD = 2.06$ vs. $M = 0.85$, $SD = 1.45$), $p = 0.0001$. A total of a) 492 adolescents who had not smoked more than 100 cigarettes in their lifetime at baseline and b) 123 adolescents who smoked more than 100 cigarettes lifetime at baseline, but less than 5 cigarettes per day, and who also participated in the 6-year follow-up assessment were included in the present analyses. Demographic and smoking characteristics for each group are presented in Table 1.

2.2. Measures

Baseline smoking: Current smoking was assessed with two items at the baseline assessment administered approximately two months following screening. Participants were asked how many days they smoked cigarettes in the past 30 days (frequency) and how many cigarettes they smoked in the past 30 days (quantity). Age of initiation was assessed with the question "How old were you the very first time you smoked even a puff of a cigarette?", and any lifetime daily smoking was assessed with the question "Have you ever smoked cigarettes on a daily basis? (At least 30 days when you smoked every day or nearly every day)?"

Smoking at 6 year follow-up: These same quantity and frequency questions were used to assess current cigarette smoking at the 6 year follow-up. Number of days smoked in the past 30 was dichotomized to daily (30 days) vs. non daily (less than 30 days) and number of cigarettes smoked in the past 30 days was dichotomized to any smoking in the past 30 days (yes/no).

Nicotine dependence: Nicotine dependence at baseline was assessed with a shortened version of Nicotine Dependence Syndrome Scale (NDSS; Shiffman et al., 2004), modified for use with adolescents. The full NDSS scale was reduced to 10 items based on psychometric analyses conducted on an adolescent sample (Sterling et al., 2009), retaining those items reflecting mainly Drive and Tolerance from the original NDSS. Research supports the reliability, stability, construct validity, and predictive validity of the NDSS for use with adolescents (Clark et al., 2005; Sledjeski et al., 2007), and the modified version demonstrated strong internal consistency with the current sample (coefficient alpha = 0.93). Items in the current study were answered on a four-point Likert-type scale, ranging from 0 (not at all true) to 3 (very true). A nicotine dependence total score was obtained by averaging responses to all items. Individual symptoms were included in the analyses, the three response options of "sometimes true" to "very true" were collapsed into a single category to generate a dichotomous variable for symptom endorsement (No–not at all true vs. Yes–any of the three positive responses).

Other tobacco use: Other tobacco use at baseline was measured with the questions. During the past 30 days, on how many days did you (a) use chewing tobacco, snuff or dip; (b) smoke cigars, cigarillos or little cigars; (c) smoked bidis or (d) smoked kreteks. Reports were dichotomized into any other tobacco use vs. no other tobacco use.

2.3. Analyses

We used SAS 9.2 to conduct logistic regression analyses testing the association between nicotine dependence (both the NDSS total score and endorsement of individual symptoms) measured at baseline and smoking behavior (any past month smoking and past month daily smoking) measured at the 6 year follow-up for each baseline smoking group. Covariates added to the model included baseline smoking exposure indices (i.e. number of days smoked in the past 30 and number of cigarettes smoked in the past 30 days), and other tobacco use in the past 30 days. These covariates were chosen to evaluate the association between nicotine dependence symptoms and future smoking that cannot be accounted for by tobacco exposure. Due to differences in the association between smoking and nicotine dependence previously demonstrated, gender was also included as a covariate in each model (Kandel and Chen, 2000).

3. Results

When examining the bivariate association between smoking behavior at the 6-year follow-up assessment and nicotine dependence symptoms scores at baseline among those smoking fewer than 100 cigarettes when entering the study, logistic regression revealed that those smoking daily at the 6 year follow-up reported higher NDSS total scores at baseline (Mean 5.3, s.d. = 6.05) compared to those who were not smoking daily at the 6 year follow-up (Mean 2.8, s.d. = 3.99). The NDSS total score at baseline did not predict any past month smoking. Logistic regression analysis including covariates again showed that higher levels of nicotine dependence

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