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Thirty-day smoking in adolescence is a strong predictor of smoking in young adulthood

Lauren M. Dutra[a,*], Stanton A. Glantz[b,c]

[a] RTI International, 2150 Shattuck Avenue, Suite 800, Berkeley, CA 94704, USA
[b] Center for Tobacco Control Research and Education, University of California, San Francisco, 530 Parnassus Avenue, Suite 366, San Francisco, CA 94143-1390, USA
[c] Department of Medicine, University of California, San Francisco, 530 Parnassus Avenue, Suite 366, San Francisco, CA 94143-1390, USA

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ABSTRACT

Thirty-day smoking, although a widely used measure of adolescent smoking (age 12–16), has been questioned as an accurate measure of young adult (age 26–30) smoking behavior, particularly when critiquing studies linking use of e-cigarettes with subsequent cigarette smoking. We used logistic regression to test two measures of 30-day adolescent smoking as predictors of young adult smoking in the National Longitudinal Survey of Youth 1997. Adjusting for psychosocial covariates, compared to those who smoked zero days in the past 30 days in adolescence, odds of any past-30-day smoking in young adulthood ranged from 2.85 (95% CI: 1.85–4.37) for those who smoked 1 day to 4.81 (3.50–6.59) for those who smoked daily as adolescents, and adjusted odds of daily smoking in young adulthood ranged from 1.99 (1.24–3.18) to 4.69 (3.42–6.43). Compared with adolescent never smokers, adjusted odds of any past-30-day smoking in young adulthood among adolescent former smokers was 2.11 (1.77–2.53), and among adolescent current smokers, ranged from 3.03 (2.22–4.14) for those who smoked 1–5 cigarettes per month to 8.19 (5.80–11.55) for those who smoked daily. Adjusted odds of daily smoking in young adulthood were 2.49 (2.12–2.91) for adolescent former smokers and, among adolescent current smokers, ranged from 2.54 (1.92–3.37) for those who smoked 1–5 cigarettes per month to 8.65 (6.06–12.35) for those who smoked daily. There is a strong dose-response relationship between 30-day smoking in adolescence—even a single day in the month—and 30-day and daily smoking in young adulthood.

1. Introduction

Understanding the evolution of cigarette smoking behavior over time is important to understand initiation, relapse, and transition from cigarettes to other products, such as e-cigarettes, and the potential impact of e-cigarettes on these transitions (Amato et al., 2016). The most widely used measure of adolescent cigarette smoking is any use within the past 30 days (Arrazola et al., 2015; Johnston et al., 2016; Singh et al., 2016; U.S. Department of Health and Human Services, 2014). In response to studies that have linked e-cigarette use with subsequent cigarette smoking, some researchers have suggested that past 30-day tobacco use is not an appropriate measure of current use for either youth or adults (Amato et al., 2016; Warner, 2016). Some have proposed that, because of the increasing prevalence of light smoking, the most useful definition of smoking would be daily versus nondaily use (Husten, 2009). There are also several different trajectories of cigarette smoking over time, including several in which daily smoking is rare (Costello et al., 2008; Dutra et al., 2017; Fuemmeler et al., 2013; Pollard et al., 2010).

However, evidence suggests that 30-day smoking in adolescence is an important measure because it accurately predicts smoking in young adulthood. Saddleson et al. (2016) demonstrated that 30-day smoking between the ages of 12 and 21, in combination with ever smoking (smoking history), accurately predicted monthly and daily smoking between the ages of 25 and 34, with heavier baseline smoking associated with heavier smoking at follow-up. Using the National Longitudinal Study of Adolescent to Adult Health (AddHealth), Saddleson et al. (2016) validated a complex measure of 30-day smoking that combined smoking history (former versus current smoking), days smoked per month, and cigarettes smoked per day in adolescence to predict smoking in young adulthood. Similarly, using a longitudinal random-digit-dialing sample of 10 to 14 year old adolescents, Sargent et al. found that ever smoking in adolescence predicted significantly higher odds of future adolescent daily smoking (Sargent et al., 2017).

Abbreviations: AIC, Akaike Information Criterion; AOR, adjusted odds ratio; BIC, Bayesian Information Criterion; BLS, Bureau of Labor Statistics; CI, confidence interval; NLSY97, National Longitudinal Survey of Youth 1997; OR, odds ratio

* Corresponding author.
E-mail address: ldutra@rti.org (L.M. Dutra).

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Compared to never smokers at baseline, even adolescents who reported only having ever smoked a few puffs of a cigarette at baseline were significantly more likely to report daily cigarette smoking two years later (OR = 3.8, 95%CI: 1.9–7.6).

The purpose of this analysis was to provide additional information about the utility of adolescent cigarette smoking for predicting young adult smoking behavior. To achieve this goal, we used data from the National Longitudinal Survey of Youth 1997 (NLSY97) to test the ability of days smoked in the past 30 days in adolescence to predict any past-30-day (1 or more days smoked in the past 30 days versus none) and daily smoking in young adulthood. We also tested a second, more complex measure of adolescent smoking status. This measure, developed by Saddleson et al. (2016), categorizes individuals as never smokers or former smokers or, among current smokers, into one of several categories based on the number of days smoked and cigarettes smoked per day in the past 30 days. We hypothesized that one or more days smoked in the past 30 days (versus zero) would predict significantly higher odds of any past-30-day and daily smoking in young adulthood. We hypothesized that, similarly, all categories of adolescent smoking defined by Saddleson et al. (2016) would predict significantly higher odds of any past-30-day and daily smoking in young adulthood. We expected that, when regressed on young adult smoking, adolescent days smoked per month would produce model fit equivalent or superior to the Saddleson et al. (2016) measure. Both measures of adolescent smoking similarly predicted significantly higher odds of smoking in young adulthood. Like the more complex measure, the simpler measure of 30-day adolescent smoking was a strong predictor of both any past-30-day and daily smoking in young adulthood. Fit statistics for the two measures were almost identical.

2. Methods

2.1. Sample

The NLSY97, managed by the Bureau of Labor Statistics (BLS), is a longitudinal cohort of individuals who were aged 12 to 16 in 1997 and who were sampled yearly until 2011, then bienially thereafter (U.S. Bureau of Labor Statistics, 2013). At baseline, the NLSY had 8984 respondents; in 2011 (most recent year of smoking data available at the time of analysis), 7243 (80.6%) remained. The NLSY97 consists of a nationally representative sample (6748) and an oversample of black and Hispanic respondents (2236). Using the full range of the data, we used data obtained in 1997 to represent adolescent behavior (participants were 12 to 16 years old) and data obtained in 2011 to represent young adult behavior (participants were 26 to 30 years old). After dropping individuals with missing values for ever smoking in 1997, days smoked and cigarettes smoked per day in 1997 and 2011, and covariates, the analytic sample was 5240 (58.3% of the 1997 sample).

2.2. Variables

Thirty-day smoking status in 1997 was the predictor variable, and 30-day and daily smoking in 2011 were the outcome variables. We used two categorical measures of 30-day smoking in 1997 (adolescence) as our predictor variables. The first (days only measure) relied only on the number of days smoked in the past 30 and was divided into the following categories based on the distribution of the data in 1997: 0 days (reference), 1 day, 2 days, 3–7 days, 8–14 days, 15–29 days, and 30 days smoked in the past 30. Days smoked per month (Kozlowski and Giovino, 2014) was used for this measure instead of cigarettes per day because the latter is less stable over time (Husten, 2009). We also used the Saddleson et al. (2016) composite measure of adolescent 30-day smoking that combined data on ever smoking with a quantity-frequency measure created by multiplying days smoked per month by cigarettes smoked per day on the days smoked in 1997. Unlike Saddleson et al. (2016), who used daily smoking as the reference category, we used former smoking as the reference category for all analyses because we were interested in the predictive ability of any and all amounts of 30-day smoking. We used two dichotomous measures of smoking in 2011 (young adulthood) as our outcome variables. The first outcome variable was any past-30-day smoking and was defined as reporting smoking cigarettes 1 or more days (versus zero) in the past 30 days. The second outcome variable was daily smoking and was defined as reporting smoking cigarettes 30 (versus less than 30) of the past 30 days.

2.3. Analysis

We used logistic regression to examine smoking in 1997 as a predictor of smoking in 2011. First, we examined the association unadjusted for covariates and then, consistent with previous analyses of the NLSY97 (Dutra et al., 2017; Song et al., 2015), examined the association adjusted for psychosocial covariates collected in 1997, including male gender (reference female); non-Hispanic black, non-Hispanic other, and Hispanic race/ethnicity (reference non-Hispanic white); household income adjusted for poverty status (coded as below the poverty line [the reference category], at the poverty line to 199% of the poverty line, 200% to 299% of the poverty line, and 300% or greater of the poverty line); age; perceived peer smoking (coded as five categories treated as continuous, ranging from less than 10% [the reference category] to more than 90%); growing up in a non-two-parent family (reference two-parent family); ever alcohol use (reference never use); ever marijuana use (reference never use); and employment and education status (coded as in school but not working [the reference category], in school and working, not in school but working, and neither in school nor working). The model fit of the two different measures of adolescent smoking was compared using AIC and BIC.

We used the Stata 14 svy logistic command to adjust all analyses by BLS-provided weights that adjust for sampling techniques and make the sample representative of the U.S. population (U.S. Bureau of Labor Statistics, 2015). AIC and BIC were computed using the estat ic (information criterion) command after running the logistic regression with the pweight command to adjust for survey weights.

Analyses of the publicly available NLSY97 have been ruled exempt by the University of California San Francisco Institutional Review Board.

3. Results

Thirty-day smoking status in adolescence significantly predicted smoking status in young adulthood regardless of how 30-day smoking status was defined. Both coding schemes for 30-day smoking in 1997 (days only and the composite measure) had dose-response relationships with smoking in young adulthood.

3.1. Days only measure

Unadjusted for covariates, compared to those who smoked 0 days in the past month, adolescents who smoked 1 day had significantly higher odds of any past-30-day smoking (2.75, 95% CI: 1.94–3.90) and daily smoking in young adulthood (2.16, 1.45–3.20; Table 1). Adolescent daily smokers had significantly higher odds of any past-30-day smoking (7.26, 5.73–9.20) and daily smoking (7.28, 5.84–9.08) in young adulthood compared to those who smoked 0 of the past 30 days. Adjusting for covariates had little effect on the relationship between smoking 1 day in adolescence and any past-30-day smoking (2.85, 1.85–4.37) and daily smoking (1.99, 1.24–3.18) in young adulthood (Table 1, Fig. 1). The relationship between adolescent daily smoking and smoking in young adulthood (any past-30-day smoking: 4.81, 3.50–6.59; daily smoking: 4.69, 3.42–6.43) was attenuated but still significant after adjusting for covariates. In adjusted models, the only nonsignificant result was the relationship between smoking 2 days per month in adolescence (versus none) and daily smoking in young