

Exercise Facilitates Smoking Cessation Indirectly via Intention to Quit Smoking: Prospective Cohort Study Among a National Sample of Young Smokers

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Abstract

Introduction: We evaluated the specific association between exercise and smoking cessation via smoking-mediated intentions to quit smoking among a national sample of young daily smokers in the United States.

Design: Prospective cohort study over a 2-year period, with daily smokers assessed across all 50 states in the United States.

Setting: Data from the 2003 to 2005 National Youth Smoking Cessation Survey were used.

Participants: A total of 1175 young adult smokers aged between 18 and 24 years.

Measures: Baseline exercise and intent to quit smoking were assessed via validated survey measures. Smoking status at the 2-year follow-up period was assessed via survey assessment.

Results: After adjustments, meeting exercise guidelines at baseline was associated with an increased baseline intent to quit smoking among this national sample of daily smokers (OR = 1.49; 95% confidence interval [CI]: 1.07-2.07; $P = .01$). After adjustments, those with a baseline intent to quit smoking had a 71% increased odds ratio (OR) of being a nonsmoker at the 2-year follow-up (OR = 1.71; 95% CI: 1.20-2.44; $P = .003$). Baseline exercise was not associated with 2-year follow-up smoking status (OR = 0.87; 95% CI: 0.60-1.28; $P = .50$).

Conclusion: In this nationally representative sample of young daily smokers, there was a positive association between exercise participation and intention to quit smoking. Baseline intent to quit smoking was independently associated with nonsmoking status at a 2-year follow-up. Thus, this indirect link between exercise and smoking status may be partially explained by the influence of exercise engagement on smoking-specific intentions.

Keywords

addiction, behavior change, chronic disease, epidemiology, health promotion, physical activity, tobacco use

Introduction

Smoking cessation strategies aimed at nicotine replacement and behavioral counseling are marginally effective.¹ Innovative approaches tailored to specific populations must also be designed to motivate lasting behavior change. For smoking cessation efforts to be maintained, the desire to quit smoking must exceed the desire to continue the behavior, despite severe cigarette cravings and withdrawal symptoms evidenced in addicted individuals trying to discontinue tobacco use.² Initiation and maintenance of an exercise routine may introduce a potent alternative reinforcement³ and augment inclination to adopt healthful behaviors. In fact, a growing body of research has corroborated the inverse link between physical activity participation and smoking.^{4,5}

The physiological mechanisms of action that may explain the preventative effects of exercise on smoking cessation are equivocal.⁶ Although, it has been postulated that both exercise

and smoking may competitively stimulate the central nervous system⁷ and associated neurocognitive function.⁸ Existing research suggests smoking initiates an acute increase in

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neurotransmitter activity known to positively affect mood state. Specifically, dopamine and opioid release is augmented following smoking behavior.⁹ Intentional abstinence from habitual tobacco use may deplete circulating cortisol concentrations, leading to withdrawal symptomology and intensified desire to smoke.¹⁰ Although heavy exercise protocols are considered superior to moderate-intensity physical activity in facilitating cortisol balance,¹¹ vigorous-intensity exercise may negatively affect mood in the general population.¹² Thus, moderate-intensity exercise participation may be preferably advantageous for current smokers as such activity potentially curtails acute desire to smoke and ameliorates psychological distress, withdrawal symptoms, and contributes to enhanced perceived well-being.^{13,14} Evidence suggests the act of exercising may also facilitate intention to quit smoking.¹⁵ Therefore, the purpose of this study was to evaluate the potential for physical activity to build intentions for smoking cessation among a national sample of young adult smokers. To our knowledge, this has yet to be specifically evaluated. That is, and although plausible, it is unknown whether exercise can facilitate smoking cessation among smokers via changes in smoking-specific intentions to quit. This plausibility stems from the inverse association between exercise and smoking,^{16,17} intervention studies demonstrating that exercise may be an effective treatment strategy to facilitate smoking cessation,^{6,13,14,18-20} research demonstrating that changing exercise patterns can help to facilitate change in other health behaviors via neurocognitive effects,²¹ and emerging work showing that, among smokers, exercise is associated with smoking-specific self-efficacy.²²

Methods

Design and Participants

Data from the 2003 to 2005 National Youth Smoking Cessation Survey (NYSCS) were used, which is a 2-year prospective epidemiological study of young smokers, with sampling (via telephone) occurring across all 50 states in the United States. Details of the NYSCS can be found elsewhere.²³ Participants in the NYSCS included those aged 16 to 24 years. Herein, only the young adults (18-24 years) were included. All participants provided consent prior to participation. Young adult (18-24 years) participants with complete data on the study variables across the 2-year time period constituted the analytic sample ($n = 1175$).

Exercise

Participants were asked, "How many hours per week on average do you exercise? This includes playing sports, working out, aerobics, running, swimming, brisk walking, and other exercise activities." This item has demonstrated some evidence of construct validity, as it has been shown to associate with nicotine dependence.²⁴ Those self-reporting at least 3 hours/wk of exercise were considered to be meeting exercise guidelines.

Intention to Quit Smoking

Baseline intention to quit smoking was assessed from a survey question asking participants whether they planned to quit smoking in the next 30 days. Those self-reporting this plan were considered those with an intention to quit smoking; otherwise, classified as not having an intention to quit smoking. Thirty days has been established as an accurate self-report measure regarding intention to quit smoking.²⁵

Smoking Status at 2-Year Follow-Up

At the 2-year follow-up, current smoking was defined as self-reported smoking within the last 30 days, with no longer smoking defined as not smoking within the last 30 days. Although biochemical verification (eg, urinary cotinine) of smoking status is the gold standard for determination of smoking status, self-report smoking status has demonstrated evidence of validity.^{26,27}

Covariates

Demographic-related parameters included self-report of age category (18-20, 21-24 years), sex (male/female), race-ethnicity (non-Hispanic white; non-Hispanic black; Hispanic; non-Hispanic other), education (less than 12th grade, high school graduate, or some college/college degree), smoking-specific self-efficacy, and nicotine dependence.

With regard to smoking-specific self-efficacy, participants were asked, "Overall, on a scale from 0 to 10, where '0' is 'not at all confident,' and '10' is 'extremely confident,' how confident are you right now that you can quit smoking if you decide to?" Similar smoking-cessation self-efficacy scales have demonstrated evidence of validity.^{28,29}

Nicotine dependence was established using a modified Heaviness of Smoking Index, calculated as the numeric sum of 2 coded questions: (1) "In the past 30 days, how many cigarettes did you smoke per day?" (responses of *10 or less*, *11-20*, and *21+*, respectively, were coded as 0, 1, and 2) and "How soon after you wake up do you smoke?" (responses: *within 5 minutes*, *from 6 to 30 minutes*, *from more than 30 minutes to 1 hour*, and *more than 1 hour*, respectively, were coded as 3, 2, 1, and 0).^{23,30} Heaviness of Smoking Index has been reported as a valid indicator of dependence, having utility as a predictor of quit attempt maintenance.³¹

Analysis

All statistical analyses were computed using procedures from sample survey data (Stata, version 12.0). Survey sample weights were used to adjust for the complex survey design and to represent a national sample of young US adult smokers. Weighted multivariable logistic regression analyses were computed. The first model evaluated the weighted adjusted association between meeting exercise guidelines (independent variable) at baseline and baseline intention to quit smoking; this model was adjusted for age, gender, race-ethnicity,

Table 1. Weighted Characteristics of the Study Variables.

Variables	Point Estimate	95% CI
Smoking-specific self-efficacy, mean	6.7	6.5-6.9
Exercise, mean hours/wk	5.5	5.2-5.8
Nicotine dependence, mean	1.2	1.1-1.3
Intention to quit smoking, %	27.1	
Nonsmoking at 2-year follow-up, %	18.3	
Education, %		
Less than high school	17.8	
High school	37.0	
More than high school	45.2	
Race-ethnicity, %		
Non-Hispanic white	70.4	
Non-Hispanic black	9.3	
Hispanic	15.0	
Non-Hispanic other	5.3	
Sex, %		
Male	55.8	
Female	44.2	
Age category, %		
18-20 years	37.9	
21-24 years	62.1	

Abbreviation: CI, confidence interval.

education, smoking-specific self-efficacy, and baseline nicotine dependence. The next weighted adjusted model evaluated the association of intention (independent variable) on smoking status at the 2-year follow-up period; this model was adjusted for age, gender, race-ethnicity, education, smoking-specific self-efficacy, baseline nicotine dependence, and meeting exercise guidelines at baseline. Statistical significance was established as an α of .05.

Results

Weighted characteristics of the study variables are shown in Table 1. The sample was fairly equally distributed across sex (55.8% male), the majority (45.2%) of the sample had more than a high school diploma, 27.1% of the sample had an intention to quit smoking at baseline, and 18.3% of the sample at baseline ended up quitting smoking at the 2-year follow-up period.

With regard to the main findings, and after adjustments, smokers meeting exercise guidelines at baseline had a 49% increased odds ratios (OR) of having a baseline intent to quit smoking (OR = 1.49; 95% confidence interval [CI]: 1.07-2.07; $P = .01$).

After adjustments (including exercise), those with a baseline intent to quit smoking had a 71% increased odds of being a nonsmoker at the 2-year follow-up (OR = 1.71; 95% CI: 1.20-2.44; $P = .003$); notably, in this model, baseline exercise was not associated with 2-year follow-up smoking status (OR = 0.87; 95% CI: 0.60-1.28; $P = .50$). Collectively, these findings suggest that exercise is indirectly associated with future smoking status via its influence on smoking-specific intentions.

Discussion

Current smokers, who have established goal-directed intentions to quit, may be more likely to engage in physical activity and healthy lifestyle behaviors.³² Further, higher levels of physical activity among former smokers are thought to substantively reduce the likelihood for future smoking relapse.³³ Although, physical activity is often recommended as a complementary replacement activity for current smokers attempting to quit,¹⁸ the influences of physical activity on facilitating the initial development of behavioral intentions to discontinue smoking are underinvestigated. Thus, the purpose of this study was to explore the potential for such a relationship to exist within a large sample of young adult smokers.

Our findings demonstrate that meeting physical activity guidelines is associated with initial intent to quit smoking and that exercise is indirectly associated with future smoking status via its influence on smoking-specific intentions. Specifically, smokers meeting exercise guidelines at baseline had a 49% increased odds of having a baseline intent to quit smoking. Additionally, current smokers with a baseline intent to quit smoking had a 71% increased odds of being a nonsmoker at the 2-year follow-up, suggesting behavioral intentions track over time. However, baseline exercise was not associated with 2-year follow-up smoking status, which may indicate short-term intentions to engage in physical activity may not be strong enough to persist across time. The temporal significance of this intention-behavior relationship was explicitly demonstrated in Sheeran's 2002 review of various health behaviors, wherein nearly half of the included individuals were unsuccessful initiating health behaviors, despite claiming to have positive intentions to change.³⁴ Although, recent work suggests smokers who maintain high levels of exercise over time are more likely to quit smoking in the future.¹⁹

Possible justifications for our findings are multifactorial. Exercise profoundly impacts health status, via interactive moderations of physical, mental, and emotional adaptations, both acutely and chronically.^{22,35} The benefits of physical activity are not limited to physiological domains but extend to psychological and affective wellness. Exercise has been shown to increase self-efficacy and ability to cope when exposed to negatively perceived stimuli,^{36,37} as well as exercise-related reductions in anxiety and depression,³⁸ which may weaken an individual's vulnerability to smoking relapse. Exercise may also minimize weight gain following smoking cessation.³⁹ Exercise is a superlative alternative to weight control than dependency on nicotine. This awareness is especially crucial among smokers who are less motivated to discontinue smoking, for fear of unwanted weight gain.

In conclusion, we found an indirect link between exercise and smoking status. This association may be explained by the utility of habitual physical activity interest and engagement on smoking-specific intentions. We specifically observed that smokers who were more physically active at baseline had greater intentions to quit smoking, and smokers with greater intentions to quit indeed had an increased odds of not being a

SO WHAT?

What is already known on this topic?

Research demonstrates that those with greater intentions to change a behavior (eg, smoking) may be more likely to initiate and maintain behavior change. Intentions are particularly salient when individuals perceive themselves as capable of removing negative habits and behaviors over time.⁴¹

What does this article add?

This prospective study among a national sample of daily smokers demonstrates that regular exercise among daily smokers may help to translate those intentions into smoking behavior change. Past research suggests first prioritizing a single health behavior change may be more efficacious than attempting to initiate multiple behavior changes simultaneously.^{42,43} Thus, beginning a physical activity program may influence intentions to adopt and maintain healthier behaviors.

What are the implications for health promotion practice or research?

These findings highlight the importance of regular exercise promotion among daily smokers.

smoker at the 2-year follow-up period. Previous work has shown health behavior during young adulthood is predictive of future health outcomes later in life.⁴⁰ To this end, access to a variety of opportunities promoting enjoyable physical activity experiences must be available and socially encouraged for young adult smokers to intentionally increase their likelihood of long-term exercise participation.

Declaration of Conflicting Interests

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