Published in final edited form as:

Addict Behav. 2007 July ; 32(7): 1451–1460.

Relationship between self-reported task persistence and history of quitting smoking, plans for quitting smoking, and current smoking status in adolescents[☆]

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Abstract

The task persistence construct has previously been measured primarily behaviorally (e.g., with a mirror-tracing task, or breath holding), and only in adults. It has been shown to differentiate between adult smokers and non-smokers and to predict smoking cessation in adult smokers trying to quit. This theory-based analysis is the first to examine task persistence in adolescent smokers and to examine a two-item, internally consistent, self-report measure of task persistence. Results indicate that task persistence is greater among adolescent non-smokers as compared to adolescent current smokers, and those planning to quit smoking as compared to those with no plans to quit. Contrary to hypotheses, task persistence was not found to be related to prior successful attempts to quit smoking. Our results suggest that a brief, self-report measure of task persistence may be a methodologically sound, practical clinical tool for this population.

Keywords

Task persistence; Tobacco; Cigarette; Adolescent; Smoking cessation; Motivation

1. Introduction

1.1. Adolescent smoking

Cigarette smoking is the leading preventable cause of death and disability in the United States (Center for Disease Control and Prevention, 1999) with over 440,000 people dying from smoking-related causes each year (Center for Disease Control and Prevention, 2002). Despite

[☆]Degrees of freedom were adjusted when Levene's Tests for Homogeneity indicated that the variance associated with the dependent variable was heterogeneous.

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these figures, it is estimated that over 3000 young people begin smoking regularly each day (An, O'Malley, Schulenberg, Bachman, & Johnston, 1999) with almost 10% of adolescent smokers currently smoking cigarettes on at least 20 days per month (Center for Disease Control and Prevention, 2004). Furthermore, approximately 20% of adolescent smokers meet criteria for nicotine dependence (Kandel, Chen, Warner, Kessler, & Grant, 1997). The importance of these figures is highlighted by the fact that smoking in early adolescence appears to be a strong predictor of smoking as an adult (Chassin, Presson, Sherman, & Edwards, 1990; Taioli & Wydner, 1991). Most adult smokers begin smoking as adolescents with 88% of adults reporting first trying a cigarette before the age of 18. If young people can get through their adolescence without smoking, they are unlikely to become smokers as adults. Additionally, half of those who quit smoking as teenagers were still not smoking as adults (Chassin et al., 1990). It is important to find predictors of who will initiate smoking and which smokers will eventually quit.

1.2. Task persistence

Task persistence is a theoretical construct that may contribute to the understanding of why some adolescents initiate or quit smoking while others do not. Task persistence describes the tendency to persist in an effortful behavior. One theory that accounts for the development of task persistence is the Learned Industriousness (LI) Theory (Eisenberger, 1992), which proposes a learning-based model of motivation whereby people with a history of gaining rewards for effortful behaviors are more likely to persist in behaviors requiring high effort than those without such a learning history. Human (Boyagian, & Nation, 1981; Eisenberger, 1992; Eisenberger, Heerdt, Hamdi, Zimet, & Bruckmeir, 1979) and animal (McCuller, Wong, & Amsel, 1976; Wenrich, Eckman, & Moore, 1967) laboratory studies support the hypothesis that organisms receiving rewards for high effort show greater persistence than organisms receiving rewards for low efforts.

To date, few studies have examined task persistence (Brandon et al., 2003; Quinn, Brandon, & Copeland, 1996) or similar concepts (Brown, Lejuez, Kahler, & Strong, 2002; Etter, Pelissolo, Pomerleau, & De SaintHilaire, 2003; Hajek, Belcher, & Stapleton, 1987; Sabol et al., 1999) within the context of nicotine dependence. An early study of the relationship between tolerance for discomfort and nicotine dependence treatment outcome evaluated the ability of breath-holding endurance as a measure of task persistence to predict success in quitting smoking (Hajek et al., 1987). Different cut-off points were determined for males and females, but high pre-treatment breath-holding endurance was associated with 7-day abstinence as validated by carbon monoxide at treatment-endpoint. Brown et al. (2002) also found that breath-holding endurance was significantly longer for those with a history of at least one period of 3 or more months of abstinence from cigarettes as compared to those who were unable to sustain abstinence for more than 24-hours. These results were replicated by measuring persistence on a stress-inducing mental arithmetic task (Brown et al., 2002). Additionally, early relapsers were more likely to terminate a carbon dioxide inhalation task when given the opportunity than were delayed relapsers (Brown et al., 2002). The influence of task persistence or distress tolerance is made even more striking by the fact that early relapsers did not differ from delayed relapsers on measures of tobacco use or dependence. Most recently, these findings led Brown, Lejuez, Kahler, Strong, and Zvolensky (2005) to propose a treatment designed to avoid early smoking relapse in part, by addressing tolerance for affective discomfort caused by nicotine withdrawal.

In contrast, Sabol et al. (1999) found no differences in persistence between current and former smokers. Additionally, Etter et al. (2003) found no differences in persistence between ever and never smokers and no relationship between intention to quit smoking and persistence. Surprisingly, Etter et al. (2003) found that current smokers scored higher than ex-smokers on

a self-report persistence scale and Pomerleau, Pomerleau, Flessland, and Basson (1992) found higher self-reported persistence scale scores in smokers as compared to normative data.

Brandon et al. (1996, 2003) have more directly assessed the relationship between LI and smoking by using a behavioral task persistence paradigm. Using a cross-sectional design Quinn, Brandon, and Copeland (1996) found that cigarette smokers were less persistent than non-smokers on a mirror-tracing task. The follow-up study (Brandon et al., 2003) used a prospective design to show that baseline task persistence predicted nicotine dependence treatment outcome even when statistically controlling for more traditional predictors, such as gender, nicotine dependence, negative affect, and self-efficacy for quitting. Task persistence as measured by time spent on a mentally challenging anagram task was not predictive of tobacco dependence treatment outcome.

We are unaware of any studies that have examined the relationship between task persistence and smoking in adolescents. We hypothesized that because quitting smoking involves persisting in an effortful behavior (i.e., resisting a desire to smoke), individuals scoring higher in task persistence would be more likely to be motivated to quit smoking and to be successful in quitting smoking. We also hypothesized that individuals with lower task persistence (possibly due to a lack of history of being rewarded for high-effort behaviors or a positive history of being rewarded for low-effort behaviors) may be at greater risk for abusing substances such as tobacco. Should these hypotheses be supported by the data, this brief, self-report instrument may provide a quicker and more practical clinical strategy for predicting tobacco dependence treatment outcome as compared to more cumbersome, behavioral measures of task persistence.

2. Method

2.1. Design

Archival data were obtained from a larger study of 1936 adolescents completing a survey on substance use, personality characteristics, mood, and attitudes. Various analyses were conducted with the full dataset ($N=1936$), a subset of participants reporting smoking at least 100 cigarettes in their lifetime ($N=245$), and a subset of participants reporting being current smokers ($N=409$). These three samples were evaluated to examine differences in task persistence between smokers and non-smokers, those who have and those who have not quit smoking for at least 3 months, and those who plan or do not plan to quit smoking, respectively.

2.2. Participants

Participants were 8th to 12th graders from 12 public high schools in New Jersey providing active parental consent and student personal assent. Each student received \$5 payment for his/her participation upon completion of the questionnaire. The schools varied in size from 245 to 1436 students (with a mean of approximately 700). While the response rates varied by schools (37% to 65%), they were well within the range of 30% to 67% typically observed in drug-related school surveys requiring active parental consent (Esbensen et al., 1996; Jessor, Van Den Bos, Vanderryn, & Costa, 1995; Severson & Biglan, 1989). Despite three attempts to inform parents about the study, only about 60% of the parents from the target sample returned a signed consent form. Seventy-five percent of the invited students submitted their signed assent forms prior to the study. Among the completed surveys, the surveys of 57 respondents were eliminated from the final data analysis due to obviously careless or erroneous answers and/or lack of basic demographic information resulting in 1936 surveys used in these analyses.

Participants in the full sample ($N=1936$) were 40.4% male, 40.8% Caucasian, 34.8% African American, 11.1% Hispanic/Latino, 8.7% Asian, and 4.7% Other. Most (64.4%) lived with both

parents, 24.5% lived with their mother, and 2.3% lived with their father. With the exception of two 8th grade participants, the sample was divided approximately equally between the 9th, 10th, 11th, and 12th grades. The mean age was 15.93 (1.27) and the mean grade level currently attending was 10.5 (1.11). Participants in the subset of lifetime smokers ($N=245$) were 58.8% male, 61.2% Caucasian, 17.6% African American, 10.6% Hispanic/Latino, 6.9% Asian, and 3.7% Other. Most (71.4%) lived with both parents, 19.2% lived with their mother, and 2.9% lived with their father. The mean age was 16.54 (1.17) and the mean school grade was 10.92 (1.02). Participants in the subset of current smokers ($N=409$) were 48.7% male, 60.6% Caucasian, 19.1% African American, 10.5% Hispanic/Latino, 5.6% Asian, and 4.2% Other. Most (70.9%) lived with both parents, 18.8% lived with their mother, and 2.2% lived with their father. The mean age was 16.22 (1.25) and the mean school grade was 10.70 (1.08).

2.3. Measures

Participants completed the New Jersey Youth Survey described in greater detail in Chen, Sheth, Elliott, and Yeager (2004). The survey consisted of predominantly close-ended questions and was administered in the school cafeteria or library, usually during a health or physical education class period. To ensure confidentiality, no school personnel were allowed in the study room during the survey. Students had one class period (43 to 50 min) to complete the questionnaire.

All questionnaires were checked and evaluated by members of the research staff before double data entry to assess the quality of responses and identify obvious mistakes. Participants reported on demographic characteristics, smoking status, cigarettes per day (measured as a categorical variable), plans to quit smoking (measured as yes, no, or maybe), history of quitting smoking for at least 3 months, and length of time smoking (more than vs. less than 1 year).

Selected items from the Tridimensional Personality Questionnaire (TPQ; Cloninger, 1987) were modified from a True/False to a 4-choice format and were included in the larger survey. Two items appeared to be consistent with LI Theory's conceptualization of task persistence and we hypothesized that the sum of these two items would predict history of quitting smoking because they appeared to draw upon the same task persistence construct—heretofore measured behaviorally—that has predicted abstinence from cigarettes in previous studies (e.g., Brandon et al., 2003; Brown et al. 2002; Quinn et al., 1996). The items were: "I will keep trying the same thing over again even when I have not had success the first time" and "I will often continue to work on something, even after other people have given up."

3. Results

3.1. Reliability of task persistence scale

Internal consistency reliability of the 2-item measure was $\alpha=.726$. This is an acceptable level of reliability for a 2-item measure and indicates that the two items are measuring the same construct.

3.2. Demographics and task persistence — full sample

Task persistence as measured by the 2-item self-report measure was unrelated to participant age, $r(1932)=-.025$, $p=.264$, or gender, $t(1930)=1.916$, $p=.056$. Additionally, planned comparisons with a Bonferroni correction following a significant main effect, $F(4,1931)=14.469$, $p<.001$, indicated that Caucasian smokers had lower task persistence scores than African American ($p<.001$), or Hispanic ($p=.016$) smokers. African American smokers scored higher than Asian smokers ($p<.001$).

3.3. Smoking status and task persistence —full sample

We divided the full sample of 1936 adolescents into daily (11.7%), occasional (9.6%), and non-smokers (78.7%) to evaluate differences in task persistence based on smoking status. Because there may be racial and gender effects on task persistence based on previous analyses, we included these variables in the ANOVA designed to evaluate the relationship between task persistence and smoking status. We detected a main effect for smoker status, $F(2,1919)=3.822$, $p=.022$, and race, $F(4,1919)=9.121$, $p<.001$, though not for gender, $F(1,1919)=3.728$, $p=.052$, with no significant two- or three-way interaction effects. Planned comparisons with Bonferroni corrections indicated that daily smokers scored significantly lower than non- ($p<.001$) or occasional ($p=.036$) smokers (see Table 1). We did not detect differences between occasional and non-smokers ($p=.153$).

3.4. Quitting behavior

The subset of 245 lifetime smokers (those who smoked at least 100 cigarettes in their lifetime) was divided into those who had and those who had not quit smoking for at least 3 months. As before, race and gender were included in the ANOVA model examining differences between quitters and non-quitters on task persistence. Contrary to hypotheses, we did not detect a main effect for quit status ($p=.537$). In addition, we did not detect a main effect for gender ($p=.108$) or race ($p=.325$).

3.5. Motivation to quit among smokers

We hypothesized that task persistence would differentiate between those with and without plans for quitting smoking among current (daily or occasional) smokers. We were unable to test this hypothesis as originally planned, however, as only 20 (4.9%) of the 409 current smokers reported no plans of quitting smoking. Almost half (41.1%) reported that they were motivated to quit smoking, whereas 29.1% said they were “maybe” motivated to quit smoking. Because there were so few stating that they did not plan on quitting, we dichotomized the trichotomous variable so as to compare those saying they planned on quitting vs. those who were either ambivalent or more decisively stated they did not plan on quitting.

As before, we included gender and race in the ANOVA model to control for these potentially confounding variables. As hypothesized, those reporting being motivated to quit smoking scored significantly higher on task persistence than those not motivated to quit, $F(1,307)=5.868$, $p=.016$ (see Table 2). Neither gender ($p=.559$), nor race ($p=.076$) was related to task persistence.

4. Discussion

This study is noteworthy for three reasons. First, in contrast to most studies of task persistence, which used behavioral measures, this study used a brief, internally consistent, theory-driven self-report measure. A reliable and brief self-report measure of task persistence is desirable as it is more time efficient and easy to administer than behavioral measures such as a mirror-tracing task or a breath-holding procedure. Second, this is the first evaluation of task persistence in adolescent rather than adult smokers. This is important because adolescent smokers are likely to develop into adult smokers (Chassin et al., 1990; Taioli & Wyder, 1991) and identifying risk factors for smoking may inform future prevention efforts. Third, these data provide additional support for the theoretical construct of task persistence as linked to motivation to quit smoking.

We hypothesized that scores on this brief, self-report measure of task persistence would relate to smoking status, history of quitting smoking, and plans for quitting smoking. Data confirmed two of the three hypotheses. Non-smokers scored higher than smokers, and those planning on

quitting smoking scored higher than those who reported no such plans or ambivalence about quitting. These relationships persisted even after controlling for relevant demographic and smoking-related variables.

The lack of support for the hypothesis that history of quitting smoking would be related to task persistence may be due to one of two reasons. First, it is possible that the hypothesis was incorrect, and there is no relationship. Second, smokers in this sample were adolescents and therefore had a relatively short smoking career as compared to adult smokers. Given that many participants were smoking for less than 1 year, the likelihood of a quit attempt was reduced as compared to their adult counterparts who may have been smoking for many years and therefore had many years in which to make quit attempts.

These relationships between task persistence and smoking-related variables can be explained by Eisenberger's Industriousness theory (1992) which hypothesizes that task persistence will be higher in those with a learning history of being rewarded for effortful behavior (Boyagian & Nation, 1981; Eisenberger, 1992; Eisenberger et al., 1979; McCuller et al., 1976; Wenrich et al., 1967). This fact is relevant in that quitting smoking involves persisting in an effortful behavior (i.e., resisting a desire to smoke) in the face of physical discomfort or psychological stress. It should follow then, that individuals scoring high in task persistence would be more likely to be successful in quitting smoking. As described in Quinn et al. (1996), the lack of history of being rewarded for high-effort behaviors (or, alternatively, a history of being rewarded for low-effort behaviors), which is hypothesized to contribute to reduced task persistence, may also increase risk for abusing substances such as tobacco. This would explain our finding among adolescents and finding by Quinn et al. (1996) among adults that smokers scored lower than non-smokers on task persistence. We cannot conclude, however, from these correlational data that a causal relationship exists between task persistence and tobacco smoking, nor can we determine the direction of any causal effect. Low task persistence may increase the likelihood of smoking cigarettes, or smoking cigarettes may reduce task persistence. Indeed, Brandon et al. (1996, 2003) proposed that the relationship may be reciprocal. Whereas a history of being rewarded for low-effort behaviors may increase the likelihood of smoking as a low-effort way to cope with stress, the act of smoking may itself contribute to the smokers' learning history of being rewarded for low-effort behaviors, and thus make high-effort behaviors such as quitting smoking less likely to occur.

It is noteworthy that while our finding that non-smokers scored higher than smokers is consistent with that of the mirror-tracing task employed by Brandon et al. (1996, 2003) and the breath-holding and mental arithmetic task employed by Brown et al. (2002) (all behavioral measures), our results were inconsistent with the results reported by those using self-report measures (i.e., Etter et al., 2003; Pomerleau et al., 1992; and Sabol et al., 1999). This discrepancy highlights the different conceptualizations of task persistence measured in the aforementioned studies. While the behavioral measures assessed task persistence in a manner consistent with the LI Theory, the previous self-report measures conceptualized task persistence as a personality trait. Although the measure described within this report was based on a self-report measure of personality traits, we selected two items that appeared to tap specifically into the task persistence construct as explained in the LI Theory.

There are several limitations that should be considered when evaluating the findings. First, although a priori, theory-driven hypotheses were tested, we used archival data from a survey that had not been designed with these hypotheses in mind. There are several questionnaire items that we would have added or altered had the current hypotheses been formulated at the time of questionnaire development. Most notably, we would have preferred to use more sensitive and continuous measures of adolescent smoking behavior, quitting behavior, motivation to quit smoking, and self-reported task persistence. It is nonetheless encouraging

that hypotheses were supported despite the less-than-ideal measures available to us. The additional limitations are common to all school-based surveys. First, the generalizability of the study is limited by the fact that only 60% of parents returned a signed consent form for their children to participate, and only public high school students were invited to participate. Secondly, because this study used a cross-sectional design, we were unable to prospectively examine the relationship between task persistence and smoking-related variables as did Brandon et al. (2003).

We are currently evaluating task persistence in adult smokers seeking treatment for tobacco dependence and will assess the relative utility of the task persistence questions used in this study with a mirror-tracing and a breath-holding task. It will be important to examine—in the same sample—the concurrent and comparative validity of the self-report measure and the behavioral measures with respect to smoking initiation and motivation to quit smoking. Given equivalent validity of the measures, a brief self-report measure of task persistence would be more desirable than a longer, more stressful, behavioral task, but the relative validities must first be determined for both adults and adolescents. It would also be important to test whether the two methods each contributed unique variance to the outcome. If so, it may be useful to include behavioral and self-report measures. Future studies should also attempt to differentiate task persistence from similar constructs. As noted by Quinn et al. (1996) and Brandon et al. (2003), although the findings are consistent with the predictions of the Learned Industriousness Theory, they provide no direct support for this particular theory. Degree of task persistence may develop through an individual's learning history, as specified by the theory, or it may develop through other routes, or reflect genetic or temperamental predispositions. It is also possible that task persistence reflects other personality traits. Previous research with adults has shown that traits such as impulsivity (Gilbert, 1995; Mitchell, 1999), sensation seeking (Zuckerman, 1994), extraversion and risk taking (Gilbert, 1995) have all been linked with smoking in adults. Although less extensive, there is also a growing literature documenting the relationship between some of these variables and adolescent smoking (e.g., Crawford, Pentz, Chou, Li, & Dwyer, 2003; Wills, Vaccaro, & McNamara, 1994). Future studies should attempt to differentiate task persistence from these other personality traits and should more directly test the specific role of the Learned Industriousness Theory.

In conclusion, the present study found that two items based on the Reward Dependence Scale of the TPQ (Cloninger, 1987) formed an internally consistent measure of task persistence among adolescents. This 2-item measure differentiated between smokers and non-smokers, and between those planning on quitting smoking and those feeling ambivalent or not planning on quitting. This study adds to the existing literature in that it shows that task persistence can be measured via self-report, can be evaluated in adolescents, and relates not just to smoking status, but also to motivation to quit smoking.

Acknowledgements

This research was supported in part by 1 K23 DA18203-01 from the National Institute on Drug Abuse awarded to Marc L. Steinberg. Data collection was supported by a research grant (R29DA12257) from the National Institute on Drug Abuse at the National Institutes of Health, to Kevin W Chen.

References

- An LC, O'Malley PM, Schulenberg JE, Bachman JG, Johnston LD. Changes at the high end of risk in cigarette smoking among US high school seniors, 1976–1995. *American Journal of Public Health* 1999;89:699–705. [PubMed: 10224981]
- Boyagian LG, Nation JR. The effects of force training and reinforcement schedules on human performance. *American Journal of Psychology* 1981;94:619–632.

- Brandon TH, Herzog TA, Juliano LM, Irvin JE, Lazev AB, Simmons V. Pretreatment task persistence predicts smoking cessation outcome. *Journal of Abnormal Psychology* 2003;112:448–456. [PubMed: 12943023]
- Brandon TH, Wetter DW, Baker TB. Cigarette smoking, major depression, and other psychiatric disorders among adolescents. *Journal of the American Academy of Child Adolescent Psychiatry* 1996;35:1602–1610.
- Brown RA, Lejuez CW, Kahler CW, Strong DR. Distress tolerance and duration of past smoking cessation attempts. *Journal of Abnormal Psychology* 2002;111:180–185. [PubMed: 11866171]
- Brown RA, Lejuez CW, Kahler CW, Strong DR, Zvolensky MJ. Distress tolerance and early smoking lapse. *Clinical Psychology Review* 2005;25:713–733. [PubMed: 16023275]
- Center for Disease Control and Prevention. Tobacco use —United States 1900–1999. Morbidity and Mortality Weekly Report 1999;48:986–993. [PubMed: 10577492]
- Center for Disease Control and Prevention. Annual smoking-attributable mortality, years of potential life lost, and economic costs — United States 1995–1999. Morbidity and Mortality Weekly Report 2002;51:427–431.
- Center for Disease Control and Prevention. Cigarette use among high school students — United States, 1991–2003. Morbidity and Mortality Weekly Report 2004;53:499–502. [PubMed: 15201841]
- Chassin L, Presson CC, Sherman SJ, Edwards DA. The natural history of cigarette smoking: Predicting young-adult smoking outcomes from adolescent smoking patterns. *Health Psychology* 1990;9:701–716. [PubMed: 2286181]
- Chen K, Sheth AJ, Elliot DK, Yeager A. Prevalence and correlates of past-year substance use, abuse, and dependence in a suburban community sample of high-school students. *Addictive Behaviors* 2004;29:413–423. [PubMed: 14732431]
- Cloninger CR. A systematic method for clinical description and classification of personality variants: A proposal. *Archives of General Psychiatry* 1987;44:573–588. [PubMed: 3579504]
- Crawford AM, Pentz MA, Chou CP, Li C, Dwyer JH. Parallel developmental trajectories of sensation seeking and regular substance use in adolescents. *Psychology of Addictive Behaviors* 2003;17(3):179–192. [PubMed: 14498812]
- Eisenberger R. Learned industriousness. *Psychological Review* 1992;99:248–267. [PubMed: 1594725]
- Eisenberger R, Heerdts WA, Hamdi M, Zimet S, Bruckmeier G. Transfer of persistence across behaviors. *Journal of Experimental Psychology. Human Learning and Memory* 1979;5:522–530. [PubMed: 528917]
- Esbensen FA, Deschenes EP, Vogel RE, West J, Arboit K, Harris L. Active parental consent in school-based research. An examination of ethical and methodological issues. *Evaluation Review* 1996;20:737–753. [PubMed: 10183266]
- Etter JF, Pelissolo A, Pomerleau C, De Saint-Hilaire Z. Associations between smoking and heritable temperament traits. *Nicotine Tob Res* 2003;5(3):401–409. [PubMed: 12791536]
- Gilbert, DG. *Smoking: Individual differences, psychopathology, and emotion*. Washington, DC: Taylor & Francis; 1995.
- Hajek P, Belcher M, Stapleton J. Breath-holding endurance as a predictor of success in smoking cessation. *Addictive Behaviors* 1987;12:285–288. [PubMed: 3661283]
- Jessor R, Van Den Bos J, Vanderryn J, Costa FM, Turbin MS. Protective factors in adolescent problem behaviours: Moderator effects and developmental change. *Developmental Psychology* 1995;31:923–933.
- Kandel D, Chen K, Warner LA, Kessler RC, Grant B. Prevalence and demographic correlates of symptoms of last year dependence on alcohol, nicotine, marijuana and cocaine in the U.S. population. *Drug and Alcohol Dependence* 1997;44:11–29. [PubMed: 9031816]
- McCuller T, Wong PT, Amsel A. Transfer of persistence from fixed-ratio barpress training to runway extinction. *Animal Learning and Behavior* 1976;4:53–57.
- Mitchell SH. Measures of impulsivity in cigarette smokers and non-smokers. *Psychopharmacology* 1999;146:455–464. [PubMed: 10550496]
- Pomerleau CS, Pomerleau OF, Flessland KA, Basson SM. Relationship of Tridimensional Personality Questionnaire scores and smoking variables in female and male smokers. *Journal of Substance Abuse* 1992;4:143–154. [PubMed: 1504639]

- Quinn EP, Brandon TH, Copeland AL. Is task persistence related to smoking and substance abuse? The application of learned industriousness theory to addictive behaviors. *Experimental and Clinical Psychopharmacology* 1996;4:186–190.
- Sabol SZ, Nelson ML, Fisher C, Gunzerath L, Brody CL, Hu S, et al. A genetic association for cigarette smoking behavior. *Health Psychology* 1999;18:7–13. [PubMed: 9925040]
- Severson H, Biglan A. Rationale for the use of passive consent in smoking prevention research: Politics, policy, and pragmatics. *Preventive Medicine* 1989;18:267–279. [PubMed: 2740296]
- Taioli E, Wynder EL. Effect of the age at which smoking begins on frequency of smoking in adulthood. *New England Journal of Medicine* 1991;325:968–969. [PubMed: 1881424]
- Wenrich WW, Eckman GE, Moore MJ. A trans-response effect of partial reinforcement. *Psychonomic Science* 1967;9:247–248.
- Wills TA, Vaccaro D, McNamara G. Novelty seeking, risk taking, and related constructs as predictors of adolescent substance abuse: An application of Cloninger's theory. *Journal of Substance Abuse* 1994;6:1–20. [PubMed: 8081104]
- Zuckerman, M. Behavioral expressions and biosocial basis of sensation seeking. Cambridge, UK: Cambridge University Press; 1994. Smoking, drinking, drugs and eating.

Table 1

Task persistence

	M	SD
Smoking status ***		
Daily smoker (<i>N</i> =224) ^{<i>a,b</i>}	5.84	1.47
Occasional smoker (<i>N</i> =185) ^{<i>a</i>}	6.18	1.42
Non-smoker (<i>N</i> =1510) ^{<i>b</i>}	6.38	1.35
Sex		
Male (<i>N</i> =781)	9.31	1.88
Female (<i>N</i> =1151)	9.21	1.91
Race ***		
Caucasian (<i>N</i> =789)	8.94	1.86
Not Caucasian (<i>N</i> =1143)	9.46	1.89

Note:

 $p < .001$;^{*a, b*} same superscripts indicate significant differences between groups.

Table 2

Plans for quitting smoking

	Plans to quit (N=168)			No plans or ambivalent About quitting (N=139)		
	M	SD	%	M	SD	%
Age**	16.42	1.23		16.09	1.18	
Sex						
Male			58.1%			41.9%
Female			51.3%			48.7%
Race						
Caucasian			53.1%			46.9%
Not Caucasian			56.8%			43.2%
Smoking frequency						
Less than 1-pack/day			55.5%			44.5%
Pack or more/day			40.0%			60.0%
Years smoking						
Less than 1 year			52.6%			47.4%
One year or more**			56.5%			43.5%
Task persistence	6.18	1.45		5.76	1.46	

Note:
*** $p < .05$.