Published in final edited form as:

J Addict Dis. 2014 ; 33(1): 53–64. doi:10.1080/10550887.2014.882717.

Joint Trajectories of Smoking and Depressive Mood: Associations with Later Low Perceived Self-Control and Low Well-Being

David W. Brook, M.D., Judith S. Brook, Ed.D., and Chenshu Zhang, Ph.D.

Department of Psychiatry, New York University School of Medicine, New York, New York, USA

Abstract

This longitudinal study examines comorbid trajectories of cigarette smoking and depressive mood from adolescence to adulthood and its association with low perceived self-control and low well-being in adulthood. Participants (N=607) were interviewed at six time waves. Growth mixture modeling (GMM) determined membership in joint trajectory groups of comorbid smoking and depressive mood from mean ages 14–32 years. Multivariate logistic regression was used to assess the associations between earlier trajectory group memberships and low perceived self-control and low well-being in adulthood. Trajectory groups characterized by earlier, comorbid chronic/heavy smoking and chronic/high depressive mood were most at risk for low perceived self-control and low well-being in adulthood. Counseling for adolescents and young adults with low perceived self-control and low well-being should address smoking and depressive mood. Interventions to reduce smoking and depressive mood may result in increased self-control and well-being.

Keywords

Smoking; Depression; Public Health; Longitudinal Studies; Psychopathology

INTRODUCTION

Smoking is associated with a number of adverse outcomes, across a range of personal risk attributes including low perceived self-control and well-being.¹ Likewise, depressive symptoms are also associated with these personal risk attributes.² Furthermore, cigarette smoking and depressive symptoms are often comorbid.³

At the present time, significant gaps remain in knowledge of the adverse outcomes of the comorbidity of smoking and depressive mood. The comorbidity of cigarette smoking and depressive mood may be due in part to common genetic and/or environmental factors.⁴ Moreover, some researchers maintain that smoking and depressive mood are related causally.⁵ For example, cigarette smoking has been found to increase depressive mood.⁵ On

Address correspondence and requests for reprints to Dr. Judith S. Brook, Department of Psychiatry, New York University School of Medicine, 215 Lexington Ave., 15th Floor, New York, NY 10016, USA; judith.brook@nyumc.org; Phone (212) 263-4662; Fax (212) 263-4660.

CONFLICT OF INTEREST NOTIFICATION PAGE

There are no conflicts of interest to report for any of the authors. A Conflict of Interest Form has been submitted for each author.

the other hand, smoking can result in several gains in functioning, such as temporary improvement in mood. Indeed, according to the self-medication theory, some individuals smoke cigarettes to improve their functioning and to alleviate internal stress.⁷ To our knowledge, there are no longitudinal studies that examine the associations between the joint developmental trajectories of smoking and depression and later self-control and well-being.

Current research indicates that smoking and depressive mood are each associated with important indicators of health,⁸ such as low self-control and low well-being. Perceived self-control in the present study includes measures of (1) ego-control and (2) impulse control. Ego-control refers to internal control of aspects of one's personality such as attitudes, drives and cognitive strategies. Low impulse control is characterized by a failure to resist impulses and drives or to commit acts that are harmful to oneself or others. Indicators of well-being⁸ include such attributes as self-esteem and coping. Self-esteem reflects the individual's self-image, view of his/her capabilities, and perceived success in living up to his/her goals. Coping refers to the use of strategies to deal with problems of life.

Given the negative consequences of both smoking and depressive symptoms, investigators have sought to determine the typical developmental patterns of smoking and depressive symptoms, as well as the outcomes associated with different patterns.⁹ In recent years, a number of studies have been published on smoking trajectories from adolescence to young adulthood.^{10–14} These trajectory groups are distinguished by different starting points and different growth rates of smoking, as well as by the intensity of smoking. Researchers have found between three and eight different smoking trajectories, typically including a continuous non-smoking group, an early-starting group of continuous heavy smokers, and a group of quitters.

Several studies of the trajectories of smoking have assessed the prospective outcomes of different trajectories.^{10,13} Orlando et al.¹³ identified six trajectory groups, including nonsmokers, stable highs, early increasers, late increasers, decreasers, and experimental users. These groups were marked by differences on a number of outcome measures, including mental health, physical health, problems with drugs and alcohol, and the likelihood of having graduated from college.

Likewise, there have been several recent studies identifying longitudinal trajectories of depressive symptoms.^{15–17} Researchers have found between three and four trajectory groups characterized by different initial points of depression and shifts of depressive symptoms over time, with each study finding a group demonstrating consistently low levels of depressive symptoms, and a group demonstrating consistently high levels of symptoms. A subset of these studies has also examined the outcomes associated with different trajectories of depressive symptoms.^{5,11} Such studies have typically found that trajectories of higher levels of depressive symptoms are related to poorer outcomes, and the converse.

This is the first research study that examines how joint trajectories of cigarette smoking and depressive mood beginning in adolescence are associated with aspects of perceived self-control and well-being in adulthood, even after control for confounding variables. To our knowledge, no existing studies have looked at the joint trajectories of smoking and

depressive symptoms beginning in adolescence and extending into adulthood controlling for a number of possible confounding variables. Such control variables include demographic variables, delinquency, self-drug use, early self-control and well-being. The current study, therefore, builds on and adds to the literature by identifying the joint developmental trajectories of smoking and depressive symptoms from adolescence to adulthood. This allows one to determine whether longitudinal patterns of continuous and heavy smoking co-occur with continuous and high levels of depressive symptoms.

Furthermore, we add to the literature by assessing the outcomes of the joint trajectories in five developmental periods. These developmental periods include early adolescence, late adolescence, early twenties, late twenties, and early thirties. In doing so, we are able to examine the joint trajectories of smoking and depressive symptoms as related to subsequent low perceived self-control and well-being.

We test two independent sets of hypotheses. The first relates to the comorbidity between smoking and depressive symptoms. We hypothesize that patterns of high and continuous levels of smoking are associated with high and continuous levels of depressive mood. We further hypothesize that there is one joint trajectory group, the at-risk group, which is characterized by chronic/heavy cigarette smoking and high depressive mood. Another group, the low-risk group, is characterized by infrequent or no cigarette smoking and low depressive mood. There are intermediate groups, which are characterized by either chronic/heavy cigarette smoking or high depressive mood, but not both. The second set of hypotheses relates to the outcomes of the joint trajectories of smoking and depressive symptoms. We hypothesize that participants with higher probability of being in the at-risk trajectory group, in comparison to the participants in the low-risk trajectory group, have a lower probability of perceived self-control and well-being. We also hypothesize that participants in the at-risk group report lower perceived self-control and well-being than the intermediate groups. Finally, participants in the intermediate groups will report lower perceived self-control and well-being than the low-risk group.

METHODS

Participants and Procedure

Data on the participants in this study came from a community-based random sample residing in one of two upstate New York counties in 1975 (T1). The mothers of the participants were interviewed at T1 to assess the participants' childhood behaviors. The sampled families were generally representative of the population of families living in Albany and Saratoga, two upstate New York counties, with respect to gender, family intactness, family income, and education. There was a close match of the participants on family income, maternal education, and family structure with the 1980 Census reported for the two counties.

Interviews of the participants were conducted in 1983 (T2, N=756), 1985–1986 (T3, N=739), 1992 (T4, N=750), 1997 (T5, N=749), 2002 (T6, N=673), and 2005–2006 (T7, N=607). The mean ages (SDs) of the participants at the follow-up interviews were 14.1 (2.8) at T2, 16.3 (2.8) at T3, 22.3 (2.8) at T4, 27.0 (2.8) at T5, 31.9 (2.8) at T6, and 36.6 (2.8) at T7.

The joint trajectory analyses of cigarette smoking and depressive mood (T2–T6) for the current study were based on those participants who participated in the study at least two points in time between T2 and T6 (N=806). We then examined the association between earlier joint trajectories of cigarette smoking and depressive mood (T2–T6) and adult low perceived self-control and low well-being at T7 using logistic regression analyses (N=607). The participants who did not take part in the T7 data collection (N=199) were excluded from the logistic regression analyses but not from the trajectory analysis.

There were no statistically significant differences between those included in the analyses of adult low perceived self-control and well-being (N=607) and those who were excluded (N=199), with respect to age ($t=-0.74$, $p\text{-value}=0.46$), parental educational level ($t=-1.66$, $p\text{-value}=0.10$), earlier delinquency ($t=1.92$, $p\text{-value}=0.06$), and earlier internalizing behavior ($t=0.14$, $p\text{-value}=0.89$). However, those who were included in the analyses, as compared to those who were excluded, had a greater percentage of female participants ($\chi^2(1)=28.24$, $p\text{-value}<0.001$) and had a greater mean score on earlier educational expectations and aspirations ($t=-2.28$, $p\text{-value}=0.02$).

Extensively trained and supervised lay interviewers administered personal interviews at T2–T4. Questionnaires were employed at T5–T7. Written informed consent was obtained from participants and their mothers from T2–T4, and from participants only from T5–T7. The Institutional Review Board of New York University School of Medicine approved of the procedures used in this research study. Additional information regarding the study methodology is available.¹⁸

Measures

Cigarette smoking (T2–T6)—At each follow-up wave (T2–T6), the questions asked about the lifetime quantity and frequency of cigarette smoking from childhood to the mid-thirties.^{19–21} We assessed the lifetime rate of cigarette smoking in childhood and early adolescence for T2 (the period prior to T2). The follow-up assessments at each time period (T3–T6) covered the interval that had elapsed since the last assessment (see Table 1).

Depressive symptoms (T2–T6)—We assessed the participants' depressive symptoms²² from T2–T6 (see Table 1). This measure has been found to be associated with cigarette smoking.²³ The measure of depressive symptoms has test-re-test reliability and predictive validity.²⁴ We used the mean score of the items as the depressive symptom variable at each point in time.

Adult perceived low self-control and low well-being (T7)—Perceived low self-control included measures of low ego-control²⁵ and impulse control.²⁶ Low well-being included scales of low self-esteem²⁷ and low coping²⁸ (see Table 1). These measures have been found to predict drug use, delinquency, and psychopathological conditions.^{25,29–31} The scales for low perceived self-control and low well-being were each dichotomized at one standard deviation above (or below) their respective mean values. The rates of participants who had low perceived self-control and low well-being follow: low ego-control (16%), low impulse control (14%), low self-esteem (21.9%), and low coping (21.4%).

Data Analysis

We used the Mplus software to identify the joint developmental trajectories of cigarette smoking and depressive mood (N=806). Our group-based, semi-parametric approach assumed that the population was composed of a mixture of distinct groups defined by their developmental trajectories.³² This approach enables one to examine the frequency, length of time, and initiation of smoking and depressive symptoms simultaneously and their associations with low self-control and low well-being in adulthood. We used the trajectory analyses to specify each of the groups of cigarette smoking and depressive mood. We treated cigarette smoking and depressive symptoms at each point in time as censored normal variables. We set each trajectory polynomial to be cubic. We applied the full information maximum likelihood (FIML) approach for missing data. We used 50 random sets of starting values to assure finding the global maximum of the likelihood function. We used the minimum Bayesian Information Criterion (BIC) to determine the number of trajectory groups (G). After extracting latent classes, we assigned each participant to the trajectory group with the largest Bayesian posterior probability (BPP). For each of the trajectory groups, we created an indicator variable that had a value of 1 if the participant had the largest BPP for that group and 0 otherwise. The observed trajectories for a group were the averages of cigarette smoking and depressive mood at each point in time for participants assigned to the group (see Supplementary Figure 1). For each group, we also reported the corresponding mean, minimum, and maximum BPPs.

We used SAS to conduct logistic regression analyses to assess the associations of the joint trajectory groups with both the measures of adult low perceived self-control and low well-being (see the Measurement Section for details).

We conducted the analyses separately for each dependent variable. In each logistic regression analysis, the following variables were statistically controlled: gender, age at T7, educational level at T7, T2 delinquency, T2 alcohol use, T2 marijuana use, and the T2 values of the dependent variable. Except for gender, these control variables were converted to standardized scores.

Since specifying which group an individual belongs to is prone to error, we used the BPPs (obtained in the trajectory analysis described above) of belonging to each trajectory group as the independent variables.³³ We considered two models. In each model, we used two of the BPPs as the independent variables. Model A separately compared participants in the at-risk group (i.e., the group of chronic/heavy cigarette smoking and chronic/high depressive mood) and participants in the intermediate groups (i.e., the groups of either chronic/heavy cigarette smoking or high depressive mood, but not both) to those in the low-risk group (i.e., the group of infrequent or no cigarette smoking/low depressive mood). We used the BPP of the at-risk group and the sum of the BPPs of the intermediate groups as independent variables, so that, the BPP of the low-risk group served as the reference group. Model B, which separately compared participants in the at-risk group and participants in the low-risk group to those in the intermediate groups, used the BPP of the at-risk group and BPP of the low-risk group as independent variables. The sum of the BPPs of the intermediate groups then served as the reference group. For each BPP variable, we reported the adjusted odds ratio (A.O.R) and its 95% confidence interval (C.I.).

RESULTS

Joint Trajectories of Cigarette Smoking and Depressive Mood

The mean (SD) cigarette smoking scores were 0.61 (1.11), 0.82 (1.33), 1.38 (1.62), 1.36 (1.62), and 1.24 (1.65) for T2–T6 respectively. The mean (SD) depressive symptom scores at each time point were 1.09 (0.68), 1.05 (0.65), 1.09 (0.72), 1.00 (0.73), and 0.88 (0.74) for T2–T6 respectively. The mean cigarette smoking score peaked at T4 (mean=1.38), when the participants were in their early twenties. The mean depressive symptoms were relatively stable during T2–T5 and went down between T5 and T6.

We calculated solutions for three trajectory groups (BIC = 17170; entropy=.893), four trajectory groups (BIC = 17042; entropy=.832), and five trajectory groups (BIC = 16889; entropy=.832). A five-group model was selected, based on the BIC criterion (see the Analysis Section). Supplementary Figure 1 presents the observed trajectory and prevalence for each of the five trajectory groups.

As hypothesized, there was an at-risk group, which had the pattern of chronic/heavy cigarette smoking and chronic/high depressive mood (noted as HH, 9.2% prevalence; mean BPP=84.3%, min BPP=40%, max BPP=100%). There was also a low-risk group, which was characterized by infrequent or no cigarette smoking and low depressive mood (noted as LL, 35.7% prevalence; mean BPP=92.3%, min BPP=38.4%, max BPP=100%). We identified three intermediate groups, which consisted of a group of moderate cigarette smoking and low depressive mood (noted as ML, 24.7% prevalence; mean BPP=86.7%, min BPP=43.4%, max BPP=99.9%), a group of chronic/heavy cigarette smoking and low depressive mood (noted as HL, 21.0% prevalence; mean BPP=90.2%, min BPP=39.5%, max BPP=100%), and a group of infrequent or no cigarette smoking and chronic/high depressive mood (noted as LH, 9.4% prevalence; mean BPP=87.9%, min BPP=46.9%, max BPP=100%).

As shown in Supplementary Figure 1, there were essentially three patterns of cigarette smoking: chronic/heavy (Groups HL and HH), moderate (Group ML), and infrequent or none (Groups LH and LL). There were two patterns of depressive mood: chronic/high (Group HH and LH) and low (Groups HL, ML, and LL). There was significant comorbidity between cigarette smoking and depressive mood over time. In the total sample, 30.2% were chronic/heavy smokers. Among those participants with chronic/high depressive mood (18.6% of the sample, i.e., either LH or HH), 49.5% were also chronic/heavy smokers (i.e., HH). Among those participants with low depressive mood (81.4% of the sample, i.e., either ML, HL, or LL), 25.8% were chronic/heavy smokers (i.e., HL). This two-fold difference in percentage of chronic/heavy smokers (49.3% vs. 25.8%) was statistically significant [$\chi^2(1)=32.2$, p -value<0.001].

Joint Trajectories of Cigarette Smoking and Depressive Mood as Predictors of Adult Low Perceived Self-control and Low Well-being

A description of the demographic characteristics of the T7 sample (N=607) appears in Table 2.

We computed the percentages of the participants who were assigned a score of 1 on each of the measures of adult low perceived self-control and low well-being for each of the joint trajectory groups. Chi-square analyses indicated that the trajectory group classifications were significantly associated with each of the four dependent variables (See Supplementary Table 1).

We conducted multivariate logistic regression analyses for the joint trajectory group memberships of the at-risk group, the low-risk group, and the intermediate groups as predictors of adult low perceived self-control and low well-being (N=607). Table 3 presents the results of the multivariate logistic regression analyses. The results indicated that, first, compared to the BPP of belonging to the low-risk group, the BPP of belonging to the at-risk group was associated with a greater probability of exhibiting adult low perceived self-control and low well-being: low ego-control (A.O.R.=3.9; $p<0.01$), low impulse control (A.O.R.=3.4; $p<0.01$), low self-esteem (A.O.R.=5.3; $p<0.001$), and low coping (A.O.R.=4.2; $p<0.001$). Second, compared to the BPP of belonging to each of the intermediate groups, the BPP of belonging to the at-risk group was associated with a greater probability of exhibiting adult low perceived self-control and low well-being: low ego-control (A.O.R.=3.0; $p<0.01$), low impulse control (A.O.R.=2.8; $p<0.05$), low self-esteem (A.O.R.=2.4; $p<0.05$), and low coping (A.O.R.=3.5; $p<0.001$). Third, with one exception (i.e., low self-esteem), compared to the BPP of belonging to the low-risk group, the BPP of belonging to any of the intermediate groups was not associated with the probability of lower perceived self-control and low well-being (See Table 3).

DISCUSSION

This longitudinal study contributes to the research literature on the development of comorbidity between cigarette smoking and depressive mood. First, we have identified five different joint trajectories of cigarette smoking and depressive mood across a wide age range extending from age 14 to 32. This is the first longitudinal study to examine the joint trajectories of cigarette smoking and depressive mood spanning so many important developmental periods. Second, we investigated the joint trajectories of cigarette smoking and depressive mood beginning in adolescence and young adulthood as predictors of low perceived self-control and low well-being at mean age 37.

We found significant comorbidity between cigarette smoking and depressive mood from age 14 to 32. These results are consistent with research that has found that cigarette smoking and depressive mood are interrelated both concurrently and prospectively.⁵ Comorbidity of tobacco use and depressive mood may be due to a number of factors. Many of the risk factors for cigarette smoking are also risk factors for depressive mood. Such risk factors include behavioral disorders, emotional dysregulation, and low parental educational level, which, in our research, were used as control variables. However, the relation between cigarette smoking and depressive mood remained after control on these confounding variables. Smoking can also lead to negative life events which may precipitate depressive mood and later smoking.²⁹ The comorbidity of smoking and depressive mood may be due to the impact of nicotine on neurotransmitter activity that takes place in the brain. This activity may result in an increase in depressive mood.

As regards the association between the joint trajectories of cigarette smoking and depressive mood and adult low perceived self-control, the findings provide partial support for our hypotheses. Our findings indicated that the comorbidity of chronic/heavy cigarette smoking and chronic/high depressive mood, as compared with the intermediate and low risk groups, was associated with lower perceived self-control and well-being. The results are in accord with several investigators who have demonstrated that negative affect interferes with the individual's ability to engage in self-control practices.³⁴

Our findings regarding the joint trajectories of smoking and depressive mood and low well-being are in accord with those of Seeman and colleagues,³⁵ who reported that symptoms of depressive mood correlated with declines in self-efficacy and coping. As noted by Lyubomirsky, King, and Diener,³⁶ perception that one's behavior is beneficial in achieving one's goals is correlated with increased feelings of well-being. A possible explanation is that individuals who have symptoms of depression and smoke may have smaller social networks, resulting in their withdrawing from others and increasing their smoking. They may not be able to meet the major goals of emerging adulthood and young adulthood. Such goals include marriage, parenthood, and obtaining and maintaining steady employment. Not feeling able to meet such developmental tasks may result in lower self-esteem and difficulty coping with life's developmental tasks. With the exception of low self-esteem, there were no significant differences between the intermediate groups and the low-risk group on the dependent variables.

One limitation of the research is its lack of representation of ethnic minorities. We can only generalize our findings to a population of primarily white adolescents and adults. Future research with diverse samples may enhance the generalizability of the findings. Second, caution must be exercised in the interpretation of the results. We may have missed trajectory patterns (or periods) of smoking cessation or depressive mood shorter than the time interval between waves of data collection. Future research should include a larger sample observed with shorter intervals between waves. Third, although we included a number of confounding factors in the analyses, we were not able to include life events.

Despite these limitations, the present study contributes to the literature. Future research is needed to identify the mechanisms that serve to mediate the relationship between the joint trajectories of cigarette smoking and depressive mood beginning in adolescence and extending to adulthood and low perceived self-control and low well-being in adulthood. Detailed information concerning these developmental processes will better inform prevention and intervention strategies for high-risk individuals.

The findings of the present study provide important information for clinicians. First, the finding of high chronic comorbidity of smoking and depressive mood suggests that smoking prevention and cessation programs should include repeated assessments and treatment of depressive mood. At the same time, the treatment of depressive mood should address smoking cessation in individuals who smoke. Second, adolescents with high levels of both smoking cigarettes and depressive mood should be referred for counseling or treatment, as they may be at-risk for developing chronic comorbidity of smoking and depressive mood and ultimately lower perceived self-control and low well-being in adulthood. Reduction in

smoking and in depressive mood may help adolescents and adults function more adaptively and have more positive views of themselves, as well as utilize more adaptive techniques of coping. Further, the quit cigarette smoking treatment plan should consider attention to individuals' perceived self-control and well-being. Finally, these results emphasize the need for federal, state, and local policies designed to reduce cigarette smoking and depressive mood in adolescence, emerging adulthood, and adulthood.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

This research was supported by the following grants from the NIH, all awarded to Dr. Judith S. Brook: research grant CA094845 from the National Cancer Institute; research grant DA003188 and Research Career Award DA000244, both from the National Institute on Drug Abuse. The authors wish to thank Dr. Stephen J. Finch for his critical review of this manuscript.

References

1. Brook JS, Balka EB, Ning Y, Whiteman M, Finch SJ. Smoking involvement during adolescence among African Americans and Puerto Ricans: risks to psychological physical well-being in young adulthood. *Psychol Rep.* 2006; 99:421–38. [PubMed: 17153811]
2. Zimmer-Gembeck MJ, Waters AM, Kindermann T. A social relations analysis of liking for and by peers: associations with gender, depression, peer perception, and worry. *J Adolesc.* 2010; 33:69–81. [PubMed: 19539359]
3. Windle M, Windle RC. Depressive symptoms and cigarette smoking among middle adolescents: prospective associations and intrapersonal and interpersonal influences. *J Consult Clin Psychol.* 2001; 69:215–26. [PubMed: 11393599]
4. Mykletun A, Overland S, Aaro LE, Liabo H, Stewart R. Smoking in relation to anxiety and depression: evidence from a large population survey: the HUNT study. *Eur Psychiatry.* 2008; 23:77–84. [PubMed: 18082377]
5. Boden JM, Fergusson DM, Horwood LJ. Cigarette smoking and depression: tests of causal linkages using a longitudinal birth cohort. *Br J Psychiatry.* 2010; 196:440–6. [PubMed: 20513853]
6. Steuber TL, Danner F. Adolescent smoking and depression: which comes first? *Addict Behav.* 2006; 31:133–6. [PubMed: 15922514]
7. Khantzian, EJ.; Albanese, MJ. Blue Ridge Summit. PA: Rowman & Littlefield Publishers; 2008. Understanding addictions as self medication: finding hope behind the pain.
8. Rodin J. Aging and health effects of the sense of control. *Science.* 1986; 233:1271–6. [PubMed: 3749877]
9. Jackson KM, Sher KJ, Schulenberg JE. Conjoint developmental trajectories of young adult alcohol and tobacco use. *J Abnorm Psychol.* 2005; 114:612–26. [PubMed: 16351384]
10. Brook JS, Balka EB, Ning Y, Brook DW. Trajectories of cigarette smoking among African Americans and Puerto Ricans from adolescence to young adulthood: associations with dependence on alcohol and illegal drugs. *Am J Addict.* 2007; 16:195–201. [PubMed: 17612823]
11. Brook JS, Ning Y, Brook DW. Personality risk factors associated with trajectories of tobacco use. *Am J Addict.* 2006; 15:426–33. [PubMed: 17182444]
12. Costello DM, Dierker LC, Jones BL, Rose JS. Trajectories of smoking from adolescence to early adulthood and their psychosocial risk factors. *Health Psychol.* 2008; 27:811–18. [PubMed: 19025277]
13. Orlando M, Tucker JS, Ellickson PL, Klein DJ. Developmental trajectories of cigarette smoking and their correlates from early adolescence to young adulthood. *J Consult Clin Psychol.* 2004; 72:400–10. [PubMed: 15279524]

14. White HR, Nagin D, Replogle E, Stouthamer-Loeber M. Racial differences in trajectories of cigarette use. *Drug Alcohol Depend.* 2004; 76:219–27. [PubMed: 15561473]
15. Repetto PB, Caldwell CH, Zimmerman MA. Trajectories of depressive symptoms among high risk African-American adolescents. *J Adolesc Health.* 2004; 35:468–77. [PubMed: 15581526]
16. Salmela-Aro K, Aunola K, Nurmi JE. Trajectories of depressive symptoms during emerging adulthood: antecedents and consequences. *Eur J Dev Psychol.* 2008; 27:439–65.
17. Wickrama KAS, Wickrama T, Lott R. Heterogeneity in youth depressive symptom trajectories: social stratification and implications for young adult physical health. *J Adolesc Health.* 2009; 45:335–43. [PubMed: 19766937]
18. Cohen, P.; Cohen, J. Life values and adolescent mental health. Mahwah, NJ: Lawrence Erlbaum Associates; 1996.
19. Johnston, LD.; O'Malley, PM.; Bachman, JG.; Schulenberg, JE. Monitoring the Future national survey results on drug use, 1975–2005: Volume I, secondary school students. Bethesda, MD: National Institute on Drug Abuse; 2006. NIH Publication No. 06-5883
20. Brook DW, Brook JS, Zhang C, Cohen P, Whiteman M. Drug use and the risk of major depressive disorder, alcohol dependence, and substance use disorders. *Arch Gen Psychiatry.* 2002; 59:1039–44. [PubMed: 12418937]
21. Brook JS, Brook DW, Zhang C, Cohen P. Tobacco use and health in young adulthood. *J Genet Psychol.* 2004; 165:310–23. [PubMed: 15382819]
22. Derogatis LR, Lipman RS, Richels K, Uhlenhuth EH, Covi L. The Hopkins Symptom Checklist (HSCL): a self-report symptom inventory. *Behav Sci.* 1974; 20:1–15. [PubMed: 4808738]
23. Brook JS, Schuster E, Zhang C. Cigarette smoking and depressive symptoms: a longitudinal study of adolescents and young adults. *Psychol Rep.* 2004; 95:159–66. [PubMed: 15460371]
24. Müller JM, Postert C, Beyer T, Furniss T, Achtergarde S. Comparison of eleven short versions of the Symptom Checklist 90-Revised (SCL-90-R) for use in the assessment of general psychopathology. *J Psychopathol Behav Assess.* 2010; 32:246–54.
25. Brook JS, Brook DW, Gordon AS, Whiteman M, Cohen P. The psychosocial etiology of adolescent drug use: a family interactional approach. *Genet Soc Gen Psychol Monogr.* 1990; 116:111–267. [PubMed: 2376323]
26. Gough, HG. The California psychological inventory. Palo Alto, CA: Consulting Psychologists Press; 1957.
27. Rosenberg, M. Society and the adolescent self-image. Princeton University Press; 1965.
28. Pearlin LI, Menghan EG, Lieberman MA, Mullan JT. The stress process. *J Health Soc Behav.* 1981; 23:337–56. [PubMed: 7320473]
29. Brook, JS.; Pahl, K.; Brook, DW. Tobacco use and dependence. In: Essau, CA., editor. Adolescent addiction: epidemiology, assessment, and treatment. New York: Elsevier; 2008. p. 149-77.
30. Bynner JM, O'Malley PM, Bachman JG. Self-esteem and delinquency revisited. *J Youth Adolesc.* 1981; 10:407–41. [PubMed: 24310536]
31. Wills TA, Sandy JM, Yaeger AM, Cleary SD, Shinar O. Coping dimensions, life stress, and adolescent substance use: a latent growth analysis. *J Abnorm Psychol.* 200; 110:309–23. [PubMed: 11358025]
32. Nagin DS, Tremblay RE. Trajectories of boys' physical aggression, opposition, and hyperactivity on the path to physically violent and nonviolent juvenile delinquency. *Child Devel.* 1999; 70:1181–96. [PubMed: 10546339]
33. Datta S, Satten GA. Estimating future stage entry and occupation probabilities in a multistage model based on randomly right-censored data. *Stat Probabil Lett.* 2000; 50:89–95.
34. Schultz, R.; Heckhausen, J. Health-specific optimization in primary and secondary control scales. Pittsburgh, PA: University of Pittsburgh; 1998.
35. Seeman TE, Bruce ML, McAvay GJ. Social network characteristics and onset of ADL disability: MacArthur studies of successful aging. *J Gerontol B Psychol Sci Soc Sci.* 1996; 51:S191–200. [PubMed: 8673648]
36. Lyubomirsky S, King L, Diener E. The benefit of frequent positive affect: does happiness lead to success? *Psychol Bull.* 2005; 131:803–55. [PubMed: 16351326]

Table 1

Psychosocial Scales, Number of Items, Sample Items, and Cronbach's Alphas

Scale	Number of Items	Sample Item and Source	Cronbach's Alpha
Depressive symptoms (T2-T6) ^a	5	Over the last few years, how much were you bothered by 1) feeling low in energy or slowed down? 2) feeling no interest in things? 3) feeling lonely? 4) feeling blue? 5) feeling hopeless about the future? ²²	$\alpha = .75, .74, .78, .82$, and $.95$ for T2-T6, respectively
Adult perceived low self-control (T7)			
Low ego-control ^b	7	1) I rarely rely on careful reasoning in making up my mind; 2) I feel like losing my temper at people; 3) I feel like swearing; 4) I have met problems so full of possibilities that I have been unable to make up my mind about them; 5) I sometimes feel that I am about to go to pieces or fall apart; 6) I am distracted by romantic or sexual thoughts; 7) I'm never satisfied with anything I do. ²⁵	$\alpha = .71$
Impulse control ^b	12	I often act on the spur of the moment without stopping to think; I am one of those people who blurt out things without thinking; 3) I am often said to be hot headed or bad tempered; 4) When I go to the store, I often come home with things I had not intended to buy; 5) When rules (and regulations) get in my way, I sometimes ignore them; 6) I do not feel guilty when I break a rule; 6) (see Note). ²⁶	$\alpha = .75$
Adult low well-being (T7)			
Low self-esteem ^b	4	1) I feel I do not have much to be proud of; 2) I feel my life is not very useful; 3) I am not a useful person to have around; 4) I do not feel that I have a number of good qualities. ²⁷	$\alpha = .80$ $\alpha = .68$
Low coping ^c	4	1) I often feel helpless in dealing with the problems of life; 2) There is really no way I can solve some of the problems I have; 3) What happens to me in the future mostly do not depend on me; 4) I just can't do anything I set my mind to. ²⁸	
Cigarette smoking (T2-T6) ^d	1	During the past five years, how many cigarettes did you smoke? ²⁹	

^a Response range: Not at all (0) to Extremely (4).

^b Response range: False (1) to True (4)

^c Response range: Strongly disagree (1) to Strongly agree (4)

^d Response range: 0=none, 1=less than daily, 2=1-5 cigarettes a day, 3=about half a pack a day, 4=about 1.5 packs a day or more.

The remaining 6 items for impulse control are available upon request.

Table 2

Demographic Characteristics of the Sample (N = 607)

Ethnicity	
White	94.9%
Others	5.1%
Gender	
Male	45.6%
Female	54.4%
Age at T7	
Mean age at T7	36.6 years (SD=2.8)
Educational Level at T7	
Lower than high school	5.6%
High school or equivalent	28.5%
Some college or greater	65.9%
Marital Status at T7	
Single (never married)	22.2%
Married	66.4%
Divorced	10.4%
Widowed	1.0%
Employment Status at T7	
Employed (full time)	78.1 %
Working part time for pay	11.7%
Unemployed	3.1%
Full time homemaker	7.1%

Separate Logistic Regression Analyses of Joint Trajectories of Cigarette Smoking and Depressive Mood as Predictors of Low Perceived Self-control and Well-being (N=607)

Table 3

Joint Trajectories	Low Self-Control			Low Well-being		
	Low Ego-Control (16%) A.O.R. (95% C.I.)	Low Impulse Control (14%) A.O.R. (95% C.I.)	Low Self-Esteem (21.9%) A.O.R. (95% C.I.)	Low Coping (21.4%) A.O.R. (95% C.I.)		
At-risk group (HH) vs. Low-risk group (LL) ^a	3.9 ^{**} (1.6-9.3)	3.4 ^{**} (1.4-8.5)	5.3 ^{***} (2.3-12.2)	4.2 ^{***} (1.9-9.3)		
At-risk group (HH) vs. Intermediate group (ML, HL, or LH) ^b	3.0 ^{**} (1.4-6.6)	2.8 [*] (1.2-6.3)	2.4 [*] (1.2-5.1)	3.5 ^{***} (1.7-7.2)		
Intermediate group (ML, HL, or LH) vs. Low-risk group (LL) ^a	1.3 (0.7-2.4)	1.2 (0.6-2.4)	2.2 ^{**} (1.3-3.8)	1.2 (0.7-2.0)		

Gender, age, adult educational level, adolescence delinquency, alcohol use, marijuana use, ego-control, impulse control, self-esteem, and coping were statistically controlled.

* p<.05;
** p<.01;
*** p<.0001;

A.O.R.=adjusted odds ratio; C.I.=confidence interval.

HH= chronic and heavy cigarette smoking/chronic and high depressive mood; LH=infrequent or no cigarette smoking/chronic and high depressive mood; HL=chronic and heavy cigarette smoking/low depressive mood; ML =moderate cigarette smoking/low depressive mood; LL=infrequent or no cigarette smoking/low depressive mood.

^aThe BPP of belonging to the HH group, the BPP of belonging to the ML, HL, or LH group, and the control variables were used as the independent variables, and the BPP of belonging to the LL group was used as the reference distribution.

^bThe BPP of belonging to the HH group, the BPP of belonging to the LL group, and the control variables were used as the independent variables, and the BPP of belonging to the ML, HL, or LH group was used as the reference distribution.