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RUNNING HEAD: SMOKING AND PERSONALITY CHANGE

Cigarette Smoking and Personality Change Across Adulthood: Findings from Five Longitudinal Samples

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Authors contribution
Yannick Stephan, Angelina Sutin and Antonio Terracciano contributed to study conceptualization. Yannick Stephan, Pauline Caille and Antonio Terracciano contributed to data preparation. Yannick Stephan, Angelina Sutin, Martina Luchetti and Antonio Terracciano contributed to data analysis and interpretation. All authors contributed to report writing

Abstract

Personality traits are related to cigarette smoking. However, little is known about the link between smoking and change in personality. Therefore, the present study examined whether current cigarette smoking and smoking cessation are associated with personality change across adulthood. Participants (n=15,572) aged from 20 to 92 years were drawn from five longitudinal cohorts with follow-ups that ranged from 4 to 20 years. Compared to non-smokers, current smokers were more likely to increase on neuroticism and to decline on extraversion, openness, agreeableness and conscientiousness over time. Compared to the persistent smokers, those who quit had a steeper decline in agreeableness. Cigarette smoking is related to detrimental personality changes across adulthood, and the pattern was not improved by smoking cessation.

Keywords: cigarette smoking; personality change; longitudinal study.

1. Introduction

Cigarette smoking is one of the leading behavioral risk factors for death and disability across the world (Forouzanfar et al., 2015). Cigarette smoking increases the risk of disease burden (Lim et al., 2012), including cardiovascular disease (Huxley & Woodward, 2011), cancer (Danaei, Vander Hoorn, Lopez, Murray, & Ezzati, 2005), and ultimately contributes to all-cause mortality (Gellert, Schöttker, & Brenner, 2012). Smoking is also associated with multiple mental health conditions, including depression and anxiety (Mojtabai & Crum, 2013; Payne, Ma, Crews, & Li, 2013) and increases risk of Alzheimer's disease (Anstey, Von Sanden, Salim, & O'Kearney, 2007; Zhong, Wang, Zhang, Guo, & Zhao, 2015). However, there is limited knowledge on the relation between cigarette smoking and change in personality traits, an individuals' characteristic patterns of thinking, feeling, and behaving (McCrae & Costa, 2003).

The objective of this study was to examine whether cigarette smoking is associated with individual differences in personality change across multiple longitudinal studies of personality. Several mechanistic pathways provide indirect support for the hypothesis that cigarette smoking might be associated with personality change in adulthood. For example, there are robust associations between smoking and respiratory disease (Liu et al., 2015), depressive symptoms (Payne et al., 2013), and frailty (Kojima, Iliffe, Jivraj, Liljas, & Walters, 2018). These health-related conditions, in turn, have been related to an increase in emotional instability and decline in extraversion, openness, agreeableness, and conscientiousness (Hakulinen et al., 2015; Jokela, Hakulinen, Singh-Manoux, & Kivimaki, 2014; Stephan, Sutin, Canada, & Terracciano, 2017). Smokers are more likely to experience insomnia (Brook, Rubenstone, Zhang, & Brook, 2012) which has been related to increased emotional instability and decreased extraversion, agreeableness, and conscientiousness over 4 to 10 years (Stephan, Sutin, Bayard, Krizan, & Terracciano, 2018). Smoking is also related to

cognitive impairment (Sabia et al., 2012), which challenges personality stability (Terracciano, Stephan, Luchetti, & Sutin, 2018) and leads to higher neuroticism, and lower extraversion, and conscientiousness (Donati et al., 2013). Biological pathways may explain part of this association. For example, smoking is accompanied by higher allostatic load (Doan, Dich, & Evans, 2014), which is associated with lower conscientiousness, extraversion, agreeableness and openness over time (Stephan, Sutin, Luchetti, & Terracciano, 2016).

Changes in smoking status over time could be associated with patterns of personality change in adulthood. Smoking cessation, for example, is related to beneficial health outcomes, including reduced depression, anxiety, and stress (Taylor et al., 2014) and lowered risk of all-cause mortality in adulthood (Kenfield, Stampfer, Rosner, & Colditz, 2008; Mons et al., 2015). Furthermore, quitting smoking is related to cognitive benefits (Almeida et al., 2011). Similarly, these findings suggest that smoking cessation may be associated with beneficial personality changes.

However, despite the potential links between cigarette smoking and personality change, past research has focused on personality traits as predictors of smoking status (Graham et al., 2015; Hakulinen et al., 2015; Terracciano & Costa, 2004). There is fairly consistent evidence that higher extraversion and neuroticism and lower conscientiousness are related to current smoking in cross-sectional studies (Graham et al., 2015; Hakulinen et al., 2015; Terracciano & Costa, 2004). Longitudinal studies further indicate that higher extraversion and lower conscientiousness are related to smoking initiation and higher neuroticism is associated with smoking relapse (Hakulinen et al., 2015). However, only a few studies have considered the relation between smoking and personality changes. One study found that a higher number of cigarettes smoked each week was related to declines in agreeableness and conscientiousness over a four-year period (Allen, Vella, & Laborde, 2015). Furthermore, increases in the number of cigarette smoked was related to a decline in

extraversion but was unrelated to neuroticism, openness, agreeableness and conscientiousness. The number of cigarettes smoked in a typical week focuses on dose-response effects, not the central question of whether there are differences between smokers and nonsmokers in long-term patterns of personality change. Other studies have examined only neuroticism-related personality traits in young adults. These studies have found that quitting smoking is related to declines in neuroticism and impulsivity over time in this population (Littlefield & Sher, 2012; Welch & Poulton, 2009).

The present study examines the association between cigarette smoking and personality changes across adulthood. This association was examined across five longitudinal samples, including four US samples and one Japanese sample, with follow-ups spanning from four to almost twenty years. In line with existing evidence on the poor outcomes associated with smoking, we tested the hypothesis that current smoking is related to detrimental personality changes: relative increases in neuroticism and relative declines in extraversion, openness, agreeableness and conscientiousness over time. Individuals who quit smoking, compared to persistent smokers, were expected to become more emotionally stable, extraverted, open, agreeable and conscientious. In additional analysis, we tested whether age or sex moderates these associations and whether depressive symptoms and disease burden mediate the link between smoking and changes in personality traits.

2. Methods

2.1.Participants

Participants were drawn from the Wisconsin Longitudinal Study graduate (WLSG) and sibling (WLSS) samples, the Midlife in the United State Survey (MIDUS), the Midlife in Japan survey (MIDJA), and the Health and Retirement Study (HRS). Informed consent was obtained from participants in the five samples. Descriptive statistics for the five samples are presented in Table 1.

The Wisconsin Longitudinal Study (WLS) is a long-term study of a random sample of 10,317 men and women who graduated from Wisconsin high schools in 1957 (WLSG). The WLS also includes selected siblings of some of the graduates (WLSS). Baseline smoking, personality and demographic information were obtained in 1992-1993 from the WLSG, and in 1993-1994 from the WLSS. Follow-up personality and smoking were obtained in 2011 in both samples. A total of 6567 participants provided complete data at baseline in the WLSG and 3366 participants had complete data in the WLSS. Of these participants, 4279 individuals in the WLSG and 1951 in the WLSS had complete personality data at follow-up, including 4175 and 1901 individuals who had also smoking data at follow-up in the WLSG and the WLSS respectively. In the WLSG, participants without personality data at follow-up were older, $t(6565)= 5.90$, $p < .001$, less educated, $t(6565)= 8.67$, $p < .001$, and were more likely to be smokers, $\chi^2(1, 6567)= 53.33$, $p <.001$ and male at baseline, $\chi^2(1, 6567)= 7.70$, $p <.01$. In addition, they had higher neuroticism, $t(6565)= 4.77$, $p < .001$, lower extraversion, $t(6565)= 2.49$, $p < .001$, and lower openness, $t(6565)= 3.99$, $p < .001$. No differences were found for agreeableness, $t(6565)= 1.82$, $p =.07$ or conscientiousness, $t(6565)= 1.80$, $p =.07$. In the WLSS, participants without personality data at follow-up were older, $t(3364)= 8.63$, $p < .001$, less educated, $t(3364)= 7.91$, $p < .001$, more likely to be smokers, $\chi^2(1, 3366)= 24.04$, $p <.001$, and had lower openness, $t(3364)= 2.68$, $p < .01$ and agreeableness, $t(3364)= 2.76$, $p < .01$. No differences were found for extraversion, $t(3364)= 0.29$, $p=.77$, neuroticism, $t(3364)= 1.68$, $p=.09$, or conscientiousness, $t(3364)= 0.11$, $p =.91$, and sex, $\chi^2(1, 3366)= 1.36$, $p =.24$.

The MIDUS is a US sample of non-institutionalized adults. Data were drawn from the first (1995-1996, MIDUS I) and third waves (2013-2014, MIDUS III). Complete data on personality, smoking and demographic information at baseline were obtained from 6072 participants. Of the baseline participants, 2590 had personality data and 2589 participants also

had smoking data at follow-up. Participants without personality data at follow-up were less educated, $t(6070)= 12.89$, $p < .001$, less likely to be white, $\chi^2(1, 6072)= 71.38$, $p <.001$, more likely to be male, $\chi^2(1, 6072)= 9.63$, $p <.01$, and smokers, $\chi^2(1, 6072)= 61.74$, $p <.001$ and had higher neuroticism, $t(6070)= 2.10$, $p < .05$ and lower conscientiousness, $t(6070)= 7.05$, $p < .001$. No differences were found for age, $t(6070)= 1.60$, $p =.11$, openness, $t(6070)= 0.65$, $p=.51$, agreeableness, $t(6070)= 1.89$, $p=.06$, or extraversion, $t(6070)= 0.28$, $p =.78$.

The MIDJA study is a probability sample of Japanese adults aged 30 to 79 from the Tokyo metropolitan area, which parallels the MIDUS. Data were collected in 2008 and 2012. A total of 955 participants had complete baseline demographic, personality and smoking data. Of these participants, 609 had personality data and 603 had both personality and smoking data in 2012. Participants without personality data at follow-up were less conscientious, $t(953)= 2.72$, $p < .01$ and less agreeable, $t(953)= 2.43$, $p < .05$. No differences were found for neuroticism, $t(953)= 1.75$, $p = .08$, extraversion, $t(953)= 0.45$, $p =.65$, openness, $t(953)= 0.51$, $p =.61$, age, $t(953)= 1.84$, $p =.06$, education, $t(953)= 1.32$, $p = .19$, sex, $\chi^2(1, 955)= 2.86$, $p = .09$, or smoking, $\chi^2(1, 955)= 3.74$, $p = .05$.

The HRS is a national longitudinal study of Americans older than 50 years and their spouses, conducted by the University of Michigan. HRS implemented an enhanced face-to-face interview starting in 2006 that included a psychosocial questionnaire with personality items for a random half the sample. The other random half answered it in 2008. With data from both waves pooled, a total of 12,545 participants provided complete personality, smoking, and demographic data at baseline. Follow-up data were obtained from the 2014 (for the 2006 sample) and the 2016 (for the 2008 sample) waves respectively. Of the total baseline sample, 6143 participants had complete personality data eight years later, including 6140 participants also had smoking data at follow-up. Participants without personality data at

follow-up were older, $t(12543)= 36.57$, $p < .001$, less educated, $t(12543)= 19.17$, $p < .001$, more likely to be male, $\chi^2(1, 12545)= 6.70$, $p <.05$, smokers, $\chi^2(1, 12545)= 31.62$, $p <.001$, and less likely to be white, $\chi^2(1, 12545)= 57.16$, $p <.001$. In addition, they had higher neuroticism, $t(12543)= 4.70$, $p < .001$, lower extraversion, $t(12543)= 7.08$, $p < .001$, openness, $t(12543)= 10.43$, $p < .001$, agreeableness, $t(12543)= 4.27$, $p < .001$, and conscientiousness, $t(12543)= 14.38$, $p < .001$.

2.2.Measures

2.2.1. Personality

The Midlife Development Inventory (MIDI) (Zimprich, Allemand, & Lachman, 2012) was used to assess personality traits in the MIDUS, the MIDJA, and the HRS. In the three samples, participants were asked how much 26 adjectives that assessed neuroticism, conscientiousness, extraversion, openness, and agreeableness described them on a scale ranging from 1 (*not at all*) to 4 (*a lot*). A Japanese version of the MIDI was used in the MIDJA. A short form of the Big Five Inventory (BFI) (John, Donahue, & Kentle, 1991) was used in the WLSG and the WLSS. Participants were asked whether they agreed or disagreed with 29 descriptive statements using a 6-point rating scale, ranging from 1 (*disagree strongly*) to 6 (*agree strongly*). Test retest reliability ranged from .57 to .73 across scales and samples.

2.2.2. Smoking

In the five samples, participants were asked whether they ever smoked cigarettes. Individuals who reported that they ever smoked were asked whether they smoked cigarettes now. Current smoking was coded as 1 and former/never smokers was coded as 0. The same questions were asked at follow-up. Individuals who smoked at baseline but not at follow-up were classified in the smoking cessation group, and those who reported smoking both at baseline and follow-up were categorized as persistent smokers.

2.2.3. Covariates

Age, sex, and education were controlled for in the five samples. Race was controlled for in the MIDUS and the HRS.

2.3. Data Analysis

Regression analyses were conducted in the five samples to test for the association between baseline smoking and personality changes. Each personality trait at follow-up was predicted from baseline smoking (1 for current smokers vs. 0 for non-current smokers), controlling for demographic factors (i.e. age, sex, and education) and baseline personality. Race was controlled in the HRS and the MIDUS. In sensitivity analyses, we tested whether the association differed when former smokers were excluded.

Regression analyses were also conducted in the five samples with change in smoking status as the predictor. In these analyses, smoking cessation between baseline and follow-up was coded as 1 and smoking persistence was coded as 0, and those who were not current smokers at baseline were excluded from the analysis. In additional analysis, we examined whether age and gender moderated the link between baseline smoking and change in smoking status and personality change. Supplementary analysis using Latent Growth Curve Models were conducted for a sub-set of samples that had three waves of personality assessment (WLSG, WLSS, MIDUS, and HRS) (see supplementary material).

The effect estimates from each sample were combined in a random-effects meta-analysis to provide a quantitative synthesis of the findings and to evaluate heterogeneity (I^2) of effects across samples. For the meta-analyses we used the Comprehensive Meta-Analysis software.

3. Results

Consistent with the hypothesis, compared to the never/former smokers, the current smoker group at baseline was associated with relative increases in neuroticism and steeper declines in extraversion, openness, agreeableness, and conscientiousness (Table 2). The association between smoking and changes in neuroticism and extraversion were the most

consistent across the five samples; the relation for neuroticism was found in the WLSG, WLSS, MIDUS, and HRS and the relation for extraversion was found in the WLSG, MIDUS and HRS. Change in agreeableness and conscientiousness were found in the WLSG and the HRS. The association between smoking and openness was significant only in the HRS. Smoking was unrelated to personality change in the MIDJA. The meta-analysis confirmed the overall pattern of relations (Table 2). The extent of personality change associated with smoking was quantified using the d statistic. Specifically, personality change between baseline and follow-up was first computed, and this difference was compared between groups using the d statistic. Across samples, the difference in personality change ranged from d=0.07 to d= 0.14 for neuroticism, from d= 0.09 to d=0.22 for extraversion, from d= 0.13 to d= 0.19 for agreeableness, and from d= 0.11 to d= 0.14 for conscientiousness, and the difference for openness change was d= 0.15 in the HRS. Figure 1 provides a graphical representation of the significant personality changes associated with baseline smoking. The overall pattern of relations was the same in the sensitivity analysis that excluded former smokers. The only exception was the association between smoking and change in neuroticism in the WLSS was non significant (β= .04, p=.11).

There were 62%, 53%, 58%, 37%, and 29% of participants who stopped smoking between baseline and follow-up respectively in the WLSG, WLSS, MIDUS, HRS, and MIDJA. Contrary to our hypothesis, there was little evidence for an association between change in smoking status and change in personality change. The only exception was an association between smoking cessation and steeper decline in agreeableness in the WLSG (Table 3, Figure 2) and the meta-analysis (Table 3). No other association was found across the five samples for the other four traits.

Analysis that examined three waves of data using Latent Growth Curve Models found a similar overall pattern of results, with a meta-analytic synthesis indicating significant

associations between baseline smoking and changes in all traits, except for extraversion and conscientiousness (see supplementary material, Tables S1-S5). However, there was substantial heterogeneity, and results were somewhat inconsistent across studies. Specifically, significant relationships between smoking and personality change were found in the older and larger cohorts, such as HRS and WLSG. In addition, the overall pattern of relationship between change in smoking status and personality change was also relatively similar to regression analysis (see supplementary material, Tables S1-S4). There was little evidence for an association between changes in smoking status and personality change, except a relationship between smoking cessation and steeper decline in agreeableness in the MIDUS and with higher openness in the WLSS.

There was little evidence for replicable moderation by age and sex. Among older adults, smoking was related to higher agreeableness over time in the WLSS ($\beta_{interaction}$ = .05, p<.05), to lower extraversion in the HRS ($\beta_{interaction}$ = -.03, p<.01), and to lower openness in the HRS ($\beta_{interaction}$ = -.02, p<.05) and the MIDJA ($\beta_{interaction}$ = -.09, p<.05). Smoking cessation was related to a steeper decline in extraversion in the WLSS ($\beta_{interaction}$ = -.12, p<.05) and in conscientiousness in the HRS ($\beta_{interaction}$ = -.08, p<.05) among older adults. In both the MIDUS and the WLSG, there was no moderating role of age.

Male smokers presented higher neuroticism over time in the MIDUS ($\beta_{interaction}$ = .05, p<.05), and lower agreeableness in the WLSG ($\beta_{interaction}$ = -.03, p<.05). Male who stopped smoking had a steeper decline in openness in both the WLSS ($\beta_{interaction}$ = -.32, p<.001) and the HRS ($\beta_{interaction}$ = -.12, p<.05).

4. Discussion

Based upon five large longitudinal samples, the present study found evidence of an association between current smoking and detrimental personality changes, with relative declines in emotional stability, extraversion, openness, agreeableness, and conscientiousness.

This association was observed over follow-up periods that ranged from four to twenty years, and among both middle-aged and older adults. In contrast, there was little support for an association between smoking cessation and personality change. The only exception was an association between smoking cessation and lower agreeableness over time. Taken as a whole, this study provides the largest and the longest longitudinal examination of the association between smoking and personality change in adulthood. It adds to existing knowledge on the implications of smoking by showing that this behavior is also likely to alter individuals' characteristic ways of thinking, feeling, and behaving over time. More broadly, these findings advance personality development field by pointing to a specific behavioral factor that is associated with individual differences in personality change (Costa, McCrae, & Löckenhoff, in press).

Consistent with the first hypothesis, the results revealed a relation between baseline smoking and change in neuroticism, extraversion, openness, agreeableness and conscientiousness. This finding parallels the evidence for the relation between personality and current smoking (Hakulinen et al., 2015; Graham et al., 2017; Terracciano & Costa, 2004). The most consistent relations were found between smoking and the relative maintenance of neuroticism (rather than the normative decline) and the decline of extraversion. These traits are recognized as the stronger personality correlates of smoking (Graham et al., 2017), and the results shows that they are the traits that are the most likely to change in response to this behavior across the samples. Smoking was also related to a decline in openness to experience over 8 years in the HRS, and in the meta-analysis. There is little evidence for a link between openness to experience and the likelihood of current and/or future smoking (Graham et al., 2017; Hakulinen et al., 2015). However, the present study revealed that lower openness to experience could be a correlate of smoking.

There are several mechanisms that may explain the association between smoking and personality changes. In particular, health-related pathways may operate. Indeed, smoking is related to higher likelihood of depressive symptoms (Payne et al., 2013) and declines in physical health (Lim et al., 2012), which are also associated with higher neuroticism, and lower extraversion, openness, agreeableness, and conscientiousness over time (Hakulinen et al., 2015; Jokela et al., 2014). From a biological perspective, smoking is related to higher physiological dysregulation (Doan et al., 2014), which has been related to maladaptive personality changes (Stephan et al., 2016). Furthermore, smoking may alter the energetic capacities needed to maintain emotional stability, the tendency to be exploratory, cooperative and altruistic, self-disciplined and planful, and enthusiastic and active (Terracciano et al., 2013). Cognitive and physical functioning may also explain part of this association. Smokers are exposed to higher risk of cognitive impairment (Sabia et al., 2012) and functional limitations (Kojima et al., 2018) that lead to higher neuroticism, and lower extraversion, openness, agreeableness, and conscientiousness (Stephan et al., 2017). Lower sleep quality is also a feature of smoking (Brook et al., 2012) that plays a role in these personality changes (Stephan et al., 2018). Finally, the link between smoking and personality change could also be explained by shared genetics. Indeed, a recent study found that higher polygenic risk for smoking is related to higher neuroticism (Gale et al., 2016). This genetic overlap could explain the consistent association between smoking and the maintenance of neuroticism.

Across the analysis, significant associations between smoking and personality changes were more likely to be observed in the older and larger samples, such as the HRS and the WLSG. In addition, the association between smoking and personality change was observed only in the US samples and not in the sample from Japan. This latter finding is consistent with report of a Japanese smoking paradox (Takahashi et al., 2008). Specifically, the prevalence of smokers is higher in Japan compared to the USA, but the risk of lung cancer and related

mortality is lower in Japan (Stellman et al., 2001). Recent research further found that smoking is more strongly related to mortality risk in US samples than in non US samples (Graham et al., 2017). The present study suggests that this smoking paradox may extend to personality. Indeed, despite a higher prevalence of smokers compared to US samples, smoking was not related to personality changes in the MIDJA. There are also methodological reasons, such as the smaller sample and the shorter follow-up of the MIDJA, which may account for the lack of significant association between smoking and personality change.

The results provided little support for our second hypothesis. Of the five traits, smoking cessation was only related to a steeper decrease in agreeableness. In contrast to previous reports that younger adults who stopped smoking decreased in neuroticism (Littlefield & Sher, 2012; Welch & Poulton, 2009), smoking cessation was unrelated to changes in this trait in this research. Smoking cessation may be accompanied by a restriction of smoking-related social interactions that results in lower pro-social orientations over time. However, despite this association, the present study found little support for an association between smoking cessation and personality changes. The benefits of cessation are less pronounced in older compared to younger adulthood and may manifest more slowly among older individuals than among younger individuals (Burns, 2000). Furthermore, there may be a residual effect of smoking among those individuals who stopped smoking between baseline and follow-up in the present study. Indeed, recent ex-smokers still experience significant cognitive decline and such effects wear off around a decade after smoking cessation (Sabia et al., 2012). Furthermore, smoking cessation can cause weight gain and heightened risk of obesity and type 2 diabetes (Bush, Lovejoy, Deprey, & Carpenter, 2016). These poor outcomes may counteract the potential health-related benefits, resulting in personality changes comparable to persistent smoking. Finally, it is also likely that smoking cessation *per se* may not be sufficient to promote personality change if it is not accompanied by complementary

behavioral changes, such as physical activity or weight management programs. Smoking cessation does not appear to compensate for the detrimental personality changes associated with baseline smoking. Moreover, the lack of personality change resulting from smoking cessation could be one potential factor leading to a higher risk of relapse. In particular, the higher neuroticism and lower conscientiousness over time, despite cessation, may expose individuals to higher risk of smoking relapse.

The present study has several strengths, including the use of five large samples of middle-aged and older adults over a follow-up period extending up to twenty years, and a meta-analysis. However, there are also some limitations to consider. First, the samples are characterized by a positive selection effect that raises the issue of generalizability of the findings. Furthermore, this study cannot rule out the possibility that a third variable, such as exposure to stressful life event, interpersonal issues, or changes in mental health, may cause both smoking and personality change. In addition, earlier levels of personality traits may be associated with both smoking initiation and later personality change. For example, individuals with higher neuroticism are more likely to smoke and to be more emotionally unstable over time. The present study focused on the link between smoking and personality change. However, the relationship between smoking and personality is reciprocal, such that personality traits level and change may lead to smoking (Hakulinen et al., 2015), which in turn may foster personality change. The present study tested the role of smoking status but not quantity of cigarettes smoked. In addition, this study was focused only on current smoking at baseline and at follow-up. Thus, it does not take into account the number of past attempts to quit or intermittent smoking cessation between baseline and follow-up. Further research may include smoking duration as an additional, moderating factor of the association between smoking and personality change. The five samples we examined included mostly middle age and older adults, and while we did not find consistent evidence for a moderating effect of age,

it remains to be tested whether a similar pattern is found in samples of younger adults. Finally, prospective studies that use observer ratings are needed to confirm the changes observed in self-reports (Costa et al., in press).

Despite these limitations, this study provides novel evidence for an association between smoking and personality change across adulthood. In particular, this research reveals that the deleterious implications of smoking may extend to detrimental personality changes. This study paves the way for future interventional research examining whether smoking cessation results in changes in personality traits.

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Figure 1. Changes in Personality Traits in the WLSG (Panel A), WLSS (Panel B) MIDUS (Panel C), and HRS (Panel D) for Smokers and Non-smokers at Baseline

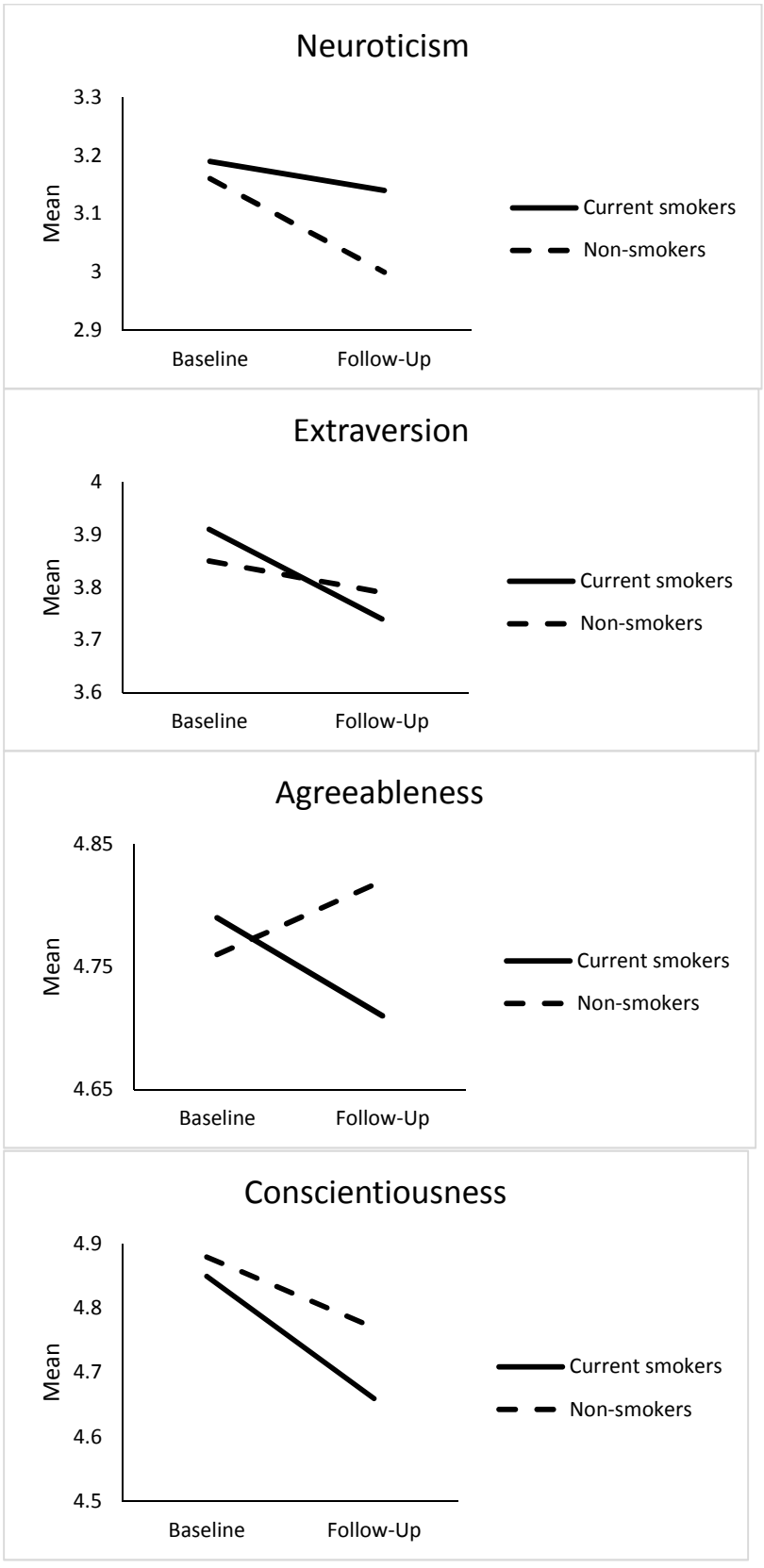
Note. Means are adjusted for age, sex, education and race (for MIDUS and HRS).

Figure 2. Changes in Agreebleness in the WLSG for Smoking Persistence and Smoking Cessation

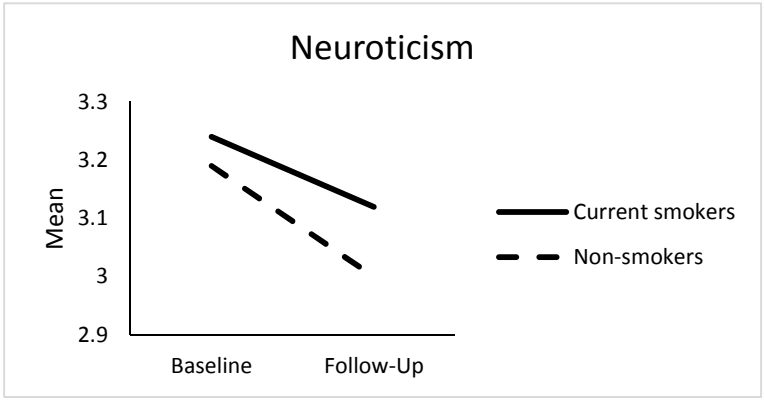
Note. Means are adjusted for age, sex, and education

Figure 1

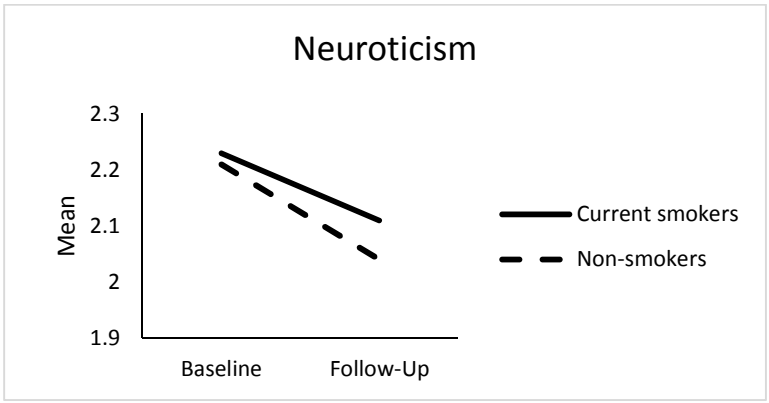
A.

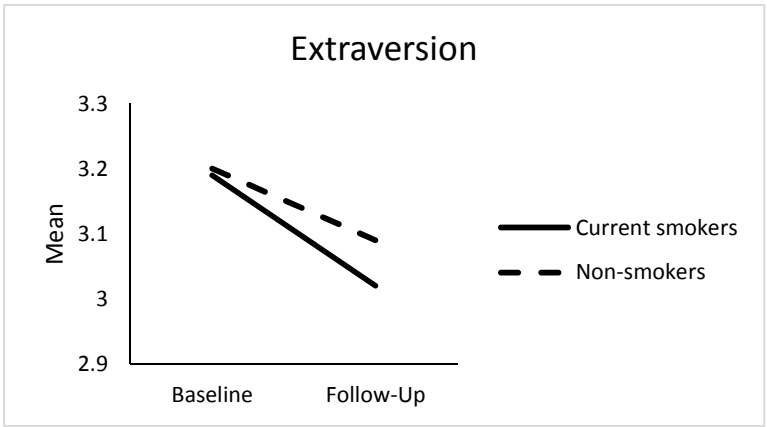

Neuroticism
3.3
3.2
3.1
3
2.9
Mean
Baseline
Follow-Up
Current smokers
Non-smokers
Extraversion
4
3.9
3.8
3.7
3.6
Mean
Baseline
Follow-Up
Current smokers
Non-smokers
Agreeableness
4.85
4.75
4.65
Mean
Baseline
Follow-Up
Current smokers
Non-smokers
Conscientiousness
4.9
4.8
4.7
4.6
4.5
Mean
Baseline
Follow-Up
Current smokers
Non-smokers

B

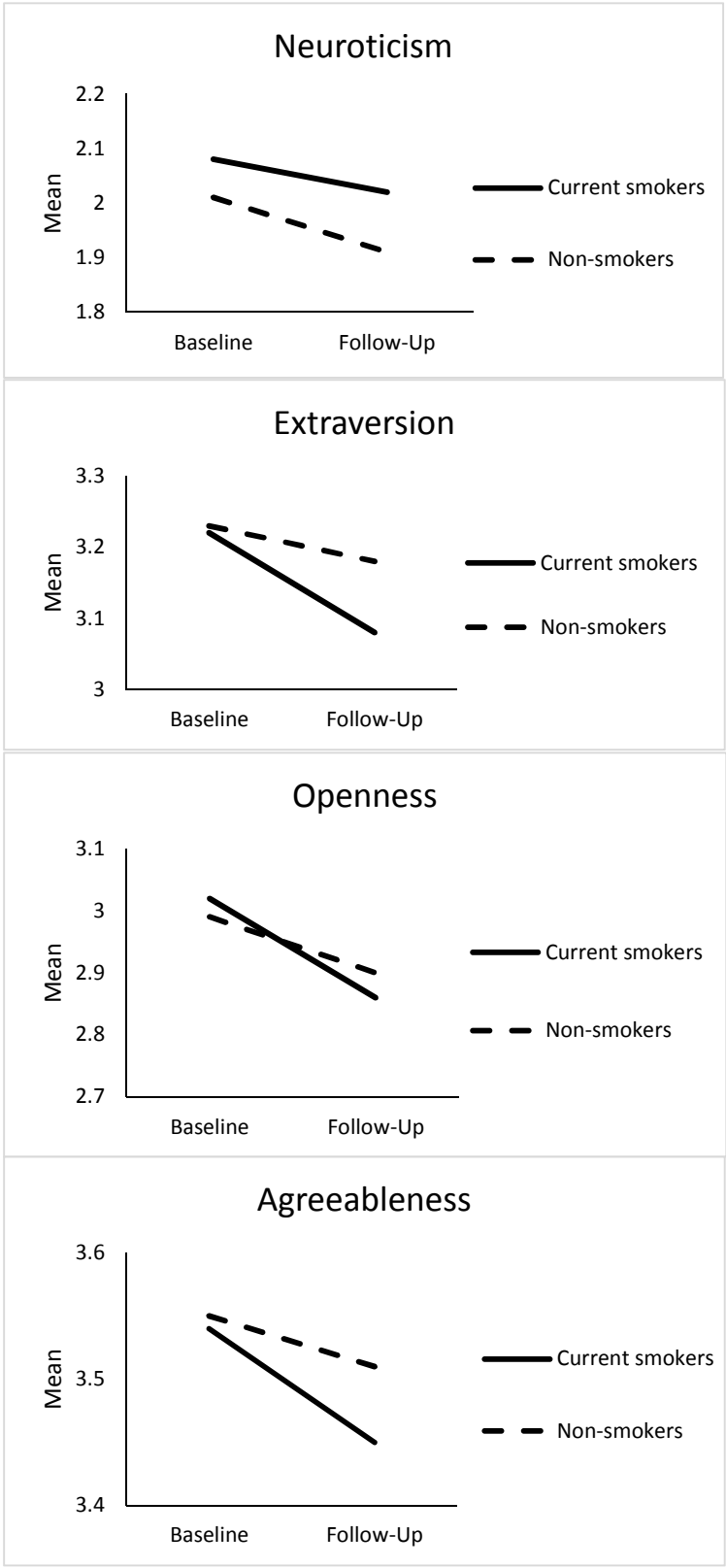

Neuroticism
3.3
3.2
3.1
3
2.9
Mean
Baseline
Follow-Up
Current smokers
Non-smokers

C


Neuroticism
2.3
2.2
2.1
2
1.9
Mean
Baseline
Follow-Up
Current smokers
Non-smokers


Extraversion
3.3
3.2
3.1
3
2.9
Mean
Baseline
Follow-Up
Current smokers
Non-smokers

D.


Neuroticism
2.2
2.1
2
1.9
1.8
Mean
Baseline
Follow-Up
Current smokers
Non-smokers
Extraversion
3.3
3.2
3.1
3
Mean
Baseline
Follow-Up
Current smokers
Non-smokers
Openness
3.1
3
2.9
2.8
2.7
Mean
Baseline
Follow-Up
Current smokers
Non-smokers
Agreeableness
3.6
3.5
3.4
Mean
Baseline
Follow-Up
Current smokers
Non-smokers

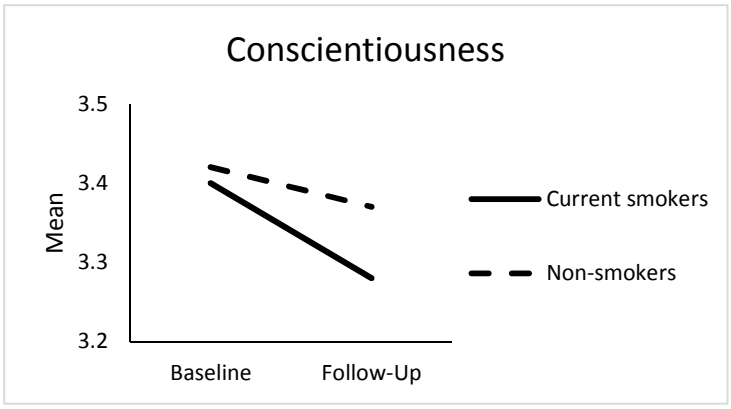

Conscientiousness
3.5
3.4
3.3
3.2
Mean
Baseline
Follow-Up
Current smokers
Non-smokers

Figure 2.

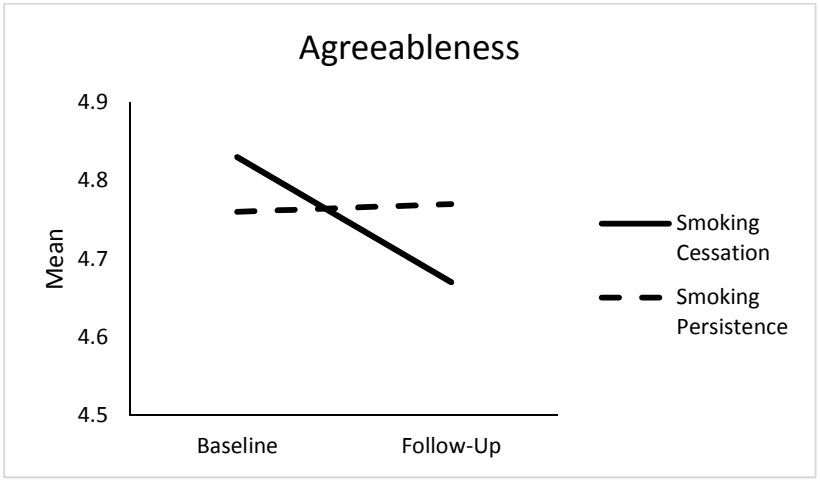

Agreeableness
4.9
4.8
4.7
4.6
4.5
Mean
Baseline
Follow-Up
Smoking Cessation
Smoking Persistence

Table 1.
Characteristics of the Samples

	WLSG		WLSS		MIDUS		HRS		MIDJA	
Variables	*M/%*	*SD*	*M/%*	*SD*	*M/%*	*SD*	*M/%*	*SD*	*M/%*	*SD*
Age (Years) at baseline	53.18	0.61	52.62	6.73	46.53	11.24	65.51	8.29	54.32	13.56
Sex (% women)	55%	-	54%	-	55%	-	59%	-	51%	-
Race (% White)	100%	-	100%	-	95%	-	87%	-	0%	-
Education at baseline	13.89	2.38	14.07	2.55	7.34	2.43	13.31	2.72	4.59	2.07
Baseline Smoking (% current smokers)	15%	-	14%	-	17%	-	11%	-	26%	-
Baseline Neuroticism	3.16	0.98	3.20	0.95	2.22	0.66	2.02	0.59	2.09	0.56
Baseline Extraversion	3.86	0.89	3.76	0.91	3.20	0.55	3.23	0.54	2.44	0.65
Baseline Openness	3.67	0.79	3.63	0.76	3.02	0.51	2.99	0.53	2.20	0.60
Baseline Agreeableness	4.76	0.73	4.72	0.73	3.48	0.49	3.55	0.46	2.67	0.62
Baseline Conscientiousness	4.88	0.67	4.78	0.71	3.47	0.43	3.42	0.44	2.72	0.53
Follow-up Neuroticism	3.02	0.92	3.02	0.92	2.05	0.62	1.93	0.59	2.06	0.52
Follow-up Extraversion	3.78	0.88	3.76	0.89	3.07	0.58	3.17	0.58	2.39	0.66
Follow-up Openness	3.47	0.76	3.45	0.75	3.02	0.51	2.89	0.57	2.14	0.58
Follow-up Agreeableness	4.81	0.71	4.79	0.72	3.43	0.50	3.50	0.50	2.59	0.61
Follow-up Conscientiousness	4.75	0.71	4.73	0.71	3.47	0.45	3.36	0.49	2.67	0.51

Note. WLSG: N= 4279; WLSG: N= 1951; MIDUS: N= 2590; HRS: N= 6143; MIDJA: N= 609
See method section for differences in the assessment and coding of smoking, personality, and education in each sample.

Table 2

Summary of Analysis Predicting Follow-up Personality Traits from Baseline Smoking (Current Smoking vs. Not Current Smoking)

	Neuroticism	Extraversion	Openness	Agreeableness	Conscientiousness
WLSG[a]	.04*** [.023;.068]	-.04*** [-.058;-.016]	-.01 [-.033;.010]	-.07*** [-.094;-.045]	-.04*** [-.067;-.019]
WLSS[a]	.03* [.001;.070]	-.01 [-.046;.016]	-.03 [-.060;.004]	-.03 [-.063;.01]	-.01 [-.050; .022]
MIDUS[b]	.04* [.005;.068]	-.04* [-.065;-.007]	-.02 [-.051;.009]	-.02 [-.049;.012]	-.02 [-.048;.016]
HRS[b]	.03*** [.014;.055]	-.05*** [-.065;-.029]	-.03*** [-.052;-.017]	-.03** [-.051;-.012]	-.04*** [-.062;-.023]
MIDJA[a]	-.03 [-.090;.039]	.02 [-.041; .074]	.00 [-.059;.063]	-.03 [-.096; .036]	-.03 [-.10; .033]
Random Effect	0.04*** [0.023;0.049]	-0.03*** [-0.048;-0.018]	-0.02*** [-0.035;-0.012]	-0.04*** [-0.058;-0.017]	-0.03*** [-0.048;-0.022]
Heterogeneity I^2	5.62	36.01	0	53.48	0

Note. WLSG: N= 4279; WLSS: N= 1951, MIDUS: N= 2590; HRS: N= 6143; MIDJA: N= 609

Coefficients are standardized coefficients (Confidence intervals in parentheses)

[a] Adjusted for age, sex, education, and baseline personality.

[b] Adjusted for age, sex, education, race, and baseline personality.

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 3

Summary of Analysis Predicting Follow-up Personality Traits from Changes in Smoking Status (Smoking Cessation vs. Persistent Smoking)

	Neuroticism	Extraversion	Openness	Agreeableness	Conscientiousness
WLSG[a]	.03 [-.028;.095]	.04 [-.020;.095]	.03 [-.027;.092]	-.09*** [-.155;-.027]	-.02 [-.091; .041]
WLSS[a]	-.06 [-.151;.036]	-.01 [-.088;.075]	.07 [-.027;.164]	-.06 [-.162;.039]	-.06 [-.156; .044]
MIDUS[b]	.02 [-.057;.103]	.06 [-.011; .136]	-.00 [-.081;.075]	-.04 [-.117;.042]	.08 [-.002;.162]
HRS[b]	.04 [-.021;.099]	.02 [-.035; .083]	-.04 [-.100; .012]	-.04 [-.103; .019]	-.01 [-.073; .045]
MIDJA[a]	.00 [-.122;.130]	-.05 [-.167; .073]	-.02 [-.142;.107]	-.04 [-.168; .088]	-.06 [-.198; .068]
Random Effect	0.02 [-0.014; 0.053]	0.03 [-0.006;0.057]	0.00 [-0.037;0.043]	-0.06** [-0.092;-0.023]	-0.01 [-0.055;0.037]
Heterogeneity I^2	0	0	27.68	0	36.91

Note. WLSG: N= 627; WLSS: N= 260, MIDUS: N= 435; HRS: N= 669; MIDJA: N= 155

Coefficients are standardized coefficients (Confidence intervals in parentheses)

[a] Adjusted for age, sex, education, and baseline personality.

[b] Adjusted for age, sex, education, race, and baseline personality.

* $p < .05$, ** $p < .01$, *** $p < .001$