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Alcohol use and personality change in middle and older adulthood: Findings from the Health and Retirement Study

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Abstract

Objective—Personality is known to predict alcohol consumption but how alcohol use is related to personality change is less clear, especially at older ages. The present study examined the effects of level of alcohol consumption and history of dependence on change in the five-factor model personality traits in a national cohort of Americans aged over 50.

Method—Over 10,000 adults who participated in 2006-08 waves of the Health and Retirement Study reported on personality and alcohol use and were followed over 4 years.

Results—Latent difference score models indicated decreases in extraversion to be attenuated for individuals categorized as light-to-moderate drinkers at baseline, while decreases in conscientiousness were accentuated by having experienced alcohol dependence symptoms. Moreover, personality difference scores correlated with changes in the amount of alcohol consumed at follow-up.

Conclusions—The findings suggest that patterns of alcohol consumption are associated with changes in personality across the second half of the lifespan.

Keywords

alcohol consumption; alcohol use disorders; middle and older adulthood; five-factor model; personality change

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Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

The five-factor model of personality operationalizes traits as relatively stable patterns of thoughts, feelings and behaviors that distinguish individuals from one another (McCrae & Costa, 1999). Although traits are relatively stable, there are also predictable changes in personality over the lifespan (Terracciano, McCrea, Brant, & Costa, 2005), even into old age (see Roberts & Mroczek, 2008, Roberts, Walton, & Viechtbauer, 2006, Wrzus & Roberts, 2017, for reviews). For instance, conscientiousness, the tendency to be self-controlled and disciplined, generally increases over time and peaks in middle life (e.g., Donnellan & Lucas, 2008; Roberts et al., 2006; Wortman, Lucas, & Donnellan, 2012) before declining in old age (e.g., Kandler, Kornadt, Hagemeyer, & Neyer, 2015; Mõttus, Johnson, & Deary, 2012). Neuroticism, the tendency to be prone to anxiety and depression, declines with age (e.g., Roberts et al., 2006; see also Terracciano et al., 2005) but may increase in older adulthood (e.g., Kandler et al., 2015).

In addition to normative developmental changes, there is appreciable individual variability in personality trajectories with aging (e.g., Specht, Egloff, & Schmukle, 2011). Increasing attention has been directed toward better understanding this variability because traits like (low) conscientiousness and (high) neuroticism are associated with a variety of negative outcomes, such as cognitive decline and dementia in older adulthood (e.g., Luchetti, Terracciano, Stephan, & Sutin, 2016; Terracciano et al., 2014), poor health (e.g., Löckenhoff, Terracciano, Ferrucci, & Costa, 2012; Turiano, Pitzer, Armour, Karlamangla, Ryff, & Mroczek, 2012), and mortality (e.g., Jokela et al., 2013). The association between personality and health, however, is unlikely to be unidirectional (see Jokela, Hakulinen, Singh-Manoux, & Kivimaki, 2014; Stephan, Sutin, Luchetti, & Terracciano, 2016; Sutin, Zonderman, Ferrucci, & Terracciano, 2013). For instance, the presence of chronic disease has been associated with accelerated declines in conscientiousness, extraversion, openness, and lower emotional stability over time (Jokela et al., 2014; Sutin et al., 2013). Individuals' lifestyle also appear to contribute to personality functioning and its changes over time (e.g., Allen, Magee, Vella, & Laborde, 2017; Allen, Vella, & Laborde, 2015). In a study of two cohorts of Americans, for instance, Stephan, Sutin and Terracciano (2014) found physical inactivity to be associated with maladaptive personality changes, i.e. decreases in conscientiousness. Allen and colleagues (2015) also found physical inactivity and other unhealthy behaviors (i.e. cigarettes smoking, alcohol drinking and poor diet) to predict trait mean changes at the sample level and within individuals over time. In accordance with the *corresponsive principle* of personality development (Roberts & Wood, 2006), life experiences or health/body changes deepen the traits that led individuals to those experiences and changes. This assumes that personality traits that predispose to (un)healthy lifestyle may also change in response to the adoption to certain behaviors (e.g., exercise more, drink less alcohol, etc.). For example, the traits that motivate alcohol use/abuse, such as low conscientiousness or high neuroticism (Hakulinen et al., 2015; Shin, Hong, & Jeon, 2012) may be fostered by this behavior.

The present study focuses on a specific behavior, i.e. alcohol use, and its relation with personality change in adults 50 years and older. Alcohol consumption is common and dependence and abuse (i.e. Alcohol Use Disorders, AUDs; American Psychiatric Association, 2013) are increasing among older adults in the United States (DiBartolo & Jarosinski, 2017; Han, Moore, Sherman, Keyes, & Palamar, 2017). The effect of alcohol is

not limited to physical health outcomes (Lim et al., 2012; Mostofsky et al., 2016) but extends to emotional and psychological functioning (Immonen, Valvanne, & Pitkala, 2011). Both beneficial and detrimental effects are observed, which depend on the level of alcohol consumed. For example, light-to-moderate consumption has been linked to better cognitive functioning, higher well-being and fewer depressive symptoms, compared to abstinence (e.g., Lang, Wallace, Huppert, & Melzer, 2007). In contrast, excessive consumption is associated with risks for physical health (e.g., cancer, diabetes, liver diseases, etc.) and neuropsychiatric disorders (Rehm, 2011). Although engagement in alcohol consumption is associated with change in personality in adolescence and young adulthood (e.g., Littlefield, Sher, & Wood, 2009; White et al., 2011), little is known about the association between alcohol and personality trajectories at older ages. To that end, this study examines how alcohol use, both current consumption and past dependence and/or abuse, is associated with change in personality traits, and how personality changes are related to change in alcohol drinking (i.e., number of drinks/week), using a large, longitudinal sample of middle-aged and older adults.

Alcohol use, personality and its change

Personality has long been associated with use of alcohol and other substances (Tarter, 1988; e.g., Terracciano, Löckenhoff, Crum, Bienvenu, & Costa, 2008; Turiano, Whiteman, Hampson, Roberts, & Mroczek, 2012). Of the five-factor personality traits, low conscientiousness, low agreeableness, and high neuroticism, have significant cross-sectional and longitudinal associations with different types of alcohol outcomes, including consumption, alcohol-related problems and/or disorders (Malouff et al., 2007 and Kotov, Gamez, Schmidt, & Watson, 2010 for meta-analyses; see also Hakulinen, et al., 2015; Martin & Sher, 1994; Ruiz, Pincus, & Dickinson, 2003; Turiano, Whiteman, et al., 2012). Individuals who lack of self-control and discipline tend to drink more alcohol (Bogg & Roberts, 2004; see e.g., Atherton, Robins, Rentfrow, & Lamb, 2014), and traits related to disinhibition, such as low conscientiousness, low agreeableness and impulsivity, are often implicated in alcohol use and abuse (Ruiz et al., 2003; see also Sher, Grekin, & Williams, 2005). High sociability and extraversion also predict excessive (binge) drinking (e.g., Cheng & Furnham, 2013; Hong & Paunonen, 2009) and increase in the amount of alcohol consumption over time (Hakulinen et al., 2015). For openness, the link with alcohol use is less clear, with studies reporting positive (e.g., Hakulinen et al., 2015), negative (e.g., Mezquita et al., 2015) and non-significant associations (e.g., Atherton et al., 2014; McAdams & Donnellan, 2009). Notably, findings vary based on the type of alcohol outcomes considered (see Malouff et al., 2007; e.g., Mezquita et al., 2015). Traits like neuroticism are more relevant in the context of clinical symptoms of alcohol dependence and abuse (Martin & Sher, 1994; Ruiz et al., 2003), as individuals with high neuroticism/ emotional negativity may abuse of alcohol particularly while experiencing tension, depression, or loneliness (Immonen et al., 2011).

Although research has focused primarily on personality traits as predictors of alcohol use, changes in personality may occur as a consequence of alcohol consumption and dependence. Much of what is known comes from studies of adolescents and young adults (e.g., Blonigen et al., 2015; Littlefield, Sher, & Steinley, 2010; Samek et al., in press; White et al., 2011).

For example, Littlefield and colleagues (2009) found that decreases in dependence symptoms and alcohol-related problems were associated with decreases in impulsivity and neuroticism from ages 18 to 35 and that this relation held even after controlling for acquisition of adult roles (e.g., marriage). Hicks, Durbin, Blonigen, Iacono, and McGue (2012) also found that resolution (vs. persistence) of AUDs was associated with "recovery" in terms of personality functioning (i.e. reduced negative emotionality) during emerging adulthood. Less is known about how alcohol consumption and dependence is associated with personality change in middle-aged and older adults. Chronic, excessive alcohol drinking is known to alters multiple physiological systems (Juster, Russell, Almeida, & Picard, 2016), to increase the risk of chronic conditions, including cardiovascular and respiratory diseases (Djoussé & Gaziano, 2008; Simet & Sisson, 2015). Higher disease burden and biological dysfunction have been linked to maladaptive personality change, such as lower conscientiousness, agreeableness, extraversion, openness, and higher neuroticism, in middle-aged and older adults (Jokela et al., 2014; Stephan et al., 2016). In addition, excessive alcohol consumption predict faster cognitive decline (Sabia et al., 2014), which is likely to foster personality change (Terracciano, Stephan, Luchetti, & Sutin, in press). Even after a full-remission, individuals with a history of AUDs are at greater risk to report metabolic abnormalities, cardiovascular and gastrointestinal medical conditions, especially in the elderly (Udo, Vásquez, & Shaw, 2015), which may foster maladaptive personality profiles, such as higher emotional instability (higher neuroticism), restriction of social activities and isolation, incapability of long term-planning and disorganization (lower conscientiousness). Using data from a longitudinal cohort (average age ~43), Allen and colleagues (2015) found that increases in alcohol consumption were associated with increases in neuroticism. This study assessed alcohol use on a scale from 1 to 8 (1 = 'I no longer drink or have never drank alcohol', 2 = '1 to 2 standard drinks', … 8 = '13 or more standard drinks'). However, it is important to differentiate abstinence from light-to-moderate and heavy consumption, and consider symptoms of dependence and/or abuse. As far as we know, there is no evidence on the effect of normative levels of alcohol consumption on personality development in older adulthood. Older adults tend to drink more frequently but moderately compared to young adults (Britton, Ben-Shlomo, Benzeval, Kuh, & Bell, 2015). Based on the literature that link moderate consumption to a variety of positive outcomes (e.g., less depressive symptoms and better cognitive health; Lang et al., 2007), as opposite to abstinence or heavy alcohol consumption, it is possible to hypothesize moderate alcohol use to be associated with the maintenance (or retaining) of desirable personality traits (i.e. higher conscientiousness). While changes in personality have been linked to changes in alcohol drinking during adolescence and early adulthood (e.g., Littlefield et al., 2010; Riley, Rukavina, & Smith, 2016), the relation between changes in these two constructs has not been examined in older adults, even though of clinical interest.

The present study

The present study is innovative in examining how both levels of alcohol consumption and a history of AUDs are associated with personality development focusing on the latter part of adulthood. By adopting a structural equation model framework, this study estimates latent difference score models to assess (a) intra-individual change—i.e. systematic change

(increase or decrease)—and intra-individual variability (fluctuation) within each personality dimension over time, and (b) examine individual differences in within-participants change. Based on the rational described above, we hypothesized light-to-moderate alcohol consumption at baseline to be associated with more adaptive personality profiles—in particular, with maintaining higher levels of conscientiousness over time, relative to abstinence or excessive alcohol drinking. In contrast, the presence (vs. absence) of past dependence and/or abuse was expected to increment within-person change in neuroticism, and decreases in the other traits. We additionally examined cross-lagged paths from alcohol consumption (number of drinks/week) to changes in personality and personality to change in the amount of alcohol consumed over the follow-up period, and tested whether latent difference scores of these two constructs were correlated in the current sample.

Methods

Participants

Data were drawn from the Health and Retirement Study (HRS), an ongoing longitudinal study of Americans aged 50 years and older and their spouses. The study is sponsored by the National Institute on Aging and the data are publicly available at http://hrsonline.isr.umich.edu/. HRS participants are interviewed every two years on a range of health and psychological measures. Personality traits were first assessed in 2006 as part of a psychosocial questionnaire. Half of the sample completed the questionnaire in 2006 and again in 2010; the other half completed it in 2008 and again in 2012. The current study used the combined 2006-08 samples as baseline and the 2010-12 data as follow-up (4-year interval).

A total of 14,302 participants had data on personality at baseline and 14,274 reported on alcohol consumption (N = 11,470 reported on symptoms of dependence and/or abuse). Of these, 10,094 respondents (>70%) had scores on at least one personality trait at the follow-up (see Table 1 for descriptive statistics and intercorrelations among variables). Those with follow-up data were younger (d = .45), more educated (d = .28) and wealthy (d = .11), more likely female and white, and scored higher on extraversion (d = .12), openness (d = .14), agreeableness (d = .07), and conscientiousness (d = .26), and lower on neuroticism (d = .12). Further, respondents were more likely to drink alcohol (d = .06) but less likely reported past dependence and/or alcohol abuse (17.4% vs. 19.6% for those without follow-up).

Missing data at follow-up were handled using full information maximum likelihood estimation. This approach provides more accurate parameter estimates than other common methods (i.e. listwise and pairwise deletion) and yields low convergence failures and near optimal Type I error rates in structural equation models (Enders & Bandalos, 2001).

Measures

Personality Traits—Participants completed the Midlife Development Inventory (MIDI) Personality Scales (Lachman & Weaver, 1997), a brief self-report measure of the five factor personality dimensions: neuroticism, extraversion, openness, agreeableness, and conscientiousness. Participants rated how much each of 26 adjectives described themselves

on a scale ranging from 1 (*not at all*) to 4 (*a lot*). The adjectives were: nervous, calm, moody, and worrying for neuroticism; outgoing, lively, friendly, active, and talkative for extraversion; creative, curious, broad minded, sophisticated, imaginative, intelligent, and adventurous for openness; helpful, warm, caring, softhearted, and sympathetic for agreeableness; and organized, hardworking, thorough, responsible, and careless for conscientiousness. MIDI has good construct validity and its five-factor structure holds across the adult age span (see Mroczek & Kolarz, 1998, and Zimprich, Allemand, & Lachman, 2012). In the current sample, alphas reliabilities ranged from .66 (conscientiousness) to .79 (openness) at baseline and from .68 (conscientiousness) to .79 (openness and agreeableness) at follow-up. Measurement invariance has been tested in previous works using the HRS (see Stephan, Sutin, Bosselut, & Terracciano, 2017) and further documented in the online supplementary material for the current longitudinal sample.

Alcohol Variables

Alcohol Consumption: At the baseline and follow-up assessments, participants were asked "Do you ever drink any alcoholic beverages such as beer, wine, or liquor?" If they responded yes, they were then asked how many days per week they drank alcohol and on average how much they consumed on days they drank over the previous 3 months. Weekly alcohol consumption was calculated by multiplying the number of drinks a day by the number of days per week participants reported having consumed alcohol. Based on recommendations from the National Institute on Alcohol Abuse and Alcoholism (NIAAA, 2017), respondents at baseline were categorized into "non-drinkers" (i.e. those who responded to not drink alcoholic beverage or had 0 drinks/week), "light-to-moderate drinkers" (≥1 to 7 drink/week for women and (≥1 to 14 drink/week for men), and "moderate-to-heavy drinkers" (>7 drink/week for women and >14 drink/week for men). The total number of drinks/week (continuous variable) was calculated for both 2006-08 baseline and 2010-12 follow-up, which paralleled the personality assessments.

History of AUDs: Consistent with previous research on AUDs in the HRS (Kuźma, Llewellyn, Langa, Wallace, & Lang, 2014), we used the 3-item version of the CAGE questionnaire (Hinkin et al., 2001) to identify a history of alcohol dependence and/or abuse: (1) Have people ever annoyed you by criticizing your drinking? (2) Have you ever felt bad or guilty about drinking? (3) Have you ever taken a drink first thing in the morning to steady your nerves or get rid of a hangover? Participants were considered to have a history of problematic drinking if they endorsed at least one of these items. We considered the first assessment available since the first wave of HRS in 1992 through the 2006–2008 baseline personality assessment. The time elapsed from CAGE assessment to the personality baseline was up to 16 years.

Covariates—Age, sex (coded as 0 for men and 1 for women), race/ethnicity (coded as 1 for black and 0 for white and other ethnic groups, and 1 others and 0 for black/white), level of education (in years), total household income and wealth were included as covariates. Age squared was also included to account for potential non-linear associations between age and personality. All covariates were from the baseline personality assessment.

Analytic Plan

We conducted our analyses using Mplus 8 (Muthén & Muthén, 1998–2017). Specifically, we constructed latent difference score models based on the latent factors of each personality trait at baseline and follow-up. This approach has several advantages, including the examination of intra-individual change and potential individual differences in within-individual change (see e.g., Allen et al., 2017, Paleari & Fincham, 2015, and Selig & Preacher, 2009), as well as the minimization of measurement error by fixing latent factor loadings and item intercepts to be invariant over time (Meredith, 1993).

Five models were tested, one for each personality trait. Figure 1 provides a conceptual representation of the model examining conscientiousness latent change over the 4-year follow-up. The model included fixed-unit value coefficients (=1), so that the second latent factor (i.e., C2) is defined by the sum of C1 and ΔC. As proposed by McArdle (2009), and Selig and Preacher (2009), the latent difference score was controlled for the intercept/initial level of conscientiousness (see Figure 1a). The ΔC mean captures the mean-level change; that is, whether individuals have increased (if the Δ mean is positive) or decreased (if negative) over time. The ΔC variance captures inter-individual differences around the mean change. To examine whether alcohol use/dependence influenced individual difference in within-individual change, we regressed each alcohol variables, respectively, on the initial level and change of each trait (as shown in Figure 1b). Mplus syntax examples are provided in the online supplemental material. All conditional models controlled for age, age squared, sex, race, education, income and wealth. Significance was set at $p \leq .01$.

To examine cross-lagged paths and correlated change in alcohol consumption and personality, we extended the previous difference score models using parallel assessments of alcohol use and personality traits at baseline and follow-up. For these models, we treated the total number of drinks/week reported by participants (continuous variable) as single indicator for alcohol consumption; to reduce skewness in the distribution, this variable was natural log-transformed. Latent difference scores were estimated for both alcohol drinking and each personality traits, using the same strategy outlined above. Figure 2 illustrates the paths from alcohol consumption at baseline to change in personality, from personality to change in alcohol consumption, and the correlated change between the two variables.

Results

Descriptive statistics and interrelations among all variables are shown in Table 1. For each personality dimension, we estimated latent difference scores as depicted in Figure 1. In the unconditional models (Figure 1a), significant negative mean change and variances were observed for all traits (median standardized Δ estimate = −.13, and all Δ variances ps ≤.01), indicating a certain degree of variability in within-person decrease across traits over time. All model showed adequate fit to the data (see Table 2 for details), with a comparative fit index (CFI) > .90, and a root mean square error of approximation (RMSEA) and standardized root mean square residual (SRMR) <.08 (Hu & Bentler, 1999; Marsh, Hau, & Grayson, 2005).

We then examined levels of alcohol consumption at baseline (dummy coded; reference: no consumption) and history of alcohol dependence (CAGE ≥1) as possible sources of inter-individual differences in intra-individual change of personality, net of other socio-demographic factors (i.e. conditional latent difference model, Figure 1b). Each alcohol variable was entered separately as a predictor of initial level and change of each personality traits, accounting for age, age squared, sex, race, education, income and wealth, and CAGE interval (in years) for the models estimating the effect of dependence. As shown in Table 2, the models estimating the effect of alcohol consumption on personality change confirmed a decrease for all five personality traits over the 4-year follow-up (median standardized Δ estimate = −.24, and all Δ variances *p*s ≤.01); for extraversion but not the other traits, this decrease was less pronounced for those categorized as light-to-moderate drinkers vs. non-drinkers ($\beta = .10$)[1]. For the models estimating the effect of alcohol dependence (see Table 2), within-person decreases were accentuated for conscientiousness (mean Δ = −.32) among individuals with a history of AUDs ($\beta = -.10$); no other significant effects were observed.

We also tested cross-lagged paths from alcohol consumption (i.e. number of drinks/week) to change in personality traits and from personality to change in the amount of alcohol consumed, and examined the correlation between latent differences in these variables. Alcohol consumption decreased over time, though there was significant variability in within-person decrease in drinks/week (Δ estimate = −.03, $p > .01$; variance = .84, $p \leq .01$). As shown in Table 3, the cross-lagged associations between initial alcohol drinking and personality with changes in these variables were not significant, except for openness (Openness baseline → Δ Drinks/week, $\beta = .03$) and conscientiousness (Conscientiousness baseline → Δ Drinks/week, $\beta = .04$), which were linked to attenuated decreases in number of drinks/week. Nonetheless, change in the amount of alcohol consumed correlated positively with change in extraversion and negatively with change in neuroticism.

Discussion

Using a large, longitudinal sample of middle aged and older adults, the present study examined how alcohol use, both current consumption and a history of dependence, contributes to personality change over a 4-year interval. Latent difference score models indicated a decrease for all five personality traits with significant variability in intra-individual change. In line with our expectations, moderate levels of alcohol consumption tended to be associated with the maintenance or retaining of desirable personality traits; specifically, light-to-moderate drinking predicted less of a decrease in extraversion, though this trend did not reach significance for the other traits. By contrast, a history of alcohol dependence was found to accentuate decrease in conscientiousness over time, but not decreases in the other traits. This study adds to prior work on the importance of health-related behaviors and lifestyle factors for personality development in adulthood. It also extends the findings on the effect of alcohol on personality change beyond adolescence and

[1]In a sensitive analysis, we distinguished those who responded “yes” when asked if they ever drank alcoholic beverages but reported 0 drinks/weeks at the baseline assessment (occasional/infrequent drinkers, 17.7%) from those who reported to had never drank alcohol (abstainers, 49.6%). Results on the effect of light-to moderate alcohol consumption on personality change were the same when excluding occasional/infrequent drinkers from the reference category. Of note, when using moderate-to-light alcohol consumption as reference category, we observed no effect of heavy vs. moderate drinking on latent scores of personality change.

early adulthood to a significant part of later adulthood. When using parallel assessments of personality and alcohol drinking (drinks/week), we also observed correlated changes in these variables over time.

In literature, there is evidence that link light-to-moderate alcohol consumption to a variety of positive outcomes, from stress reduction to better cognitive functioning, well-being and health (e.g., González-Rubio et al., 2016; Lang et al., 2007; Paulson et al., 2018; Reas, Laughlin, Kritz-Silverstein, Barrett-Connor, & McEvoy, 2016), as opposite to abstinence or heavy drinking. In their paper, Allen and colleagues (2015) suggested that desirable personality traits (i.e. higher extraversion, openness or conscientiousness) might be maintained through lifestyle improvements or healthy choices. In this study, we found preliminary evidence that supports this hypothesis. In particular, light-to-moderate drinkers showed an attenuated decrease in extraversion over time. Individual who drink alcohol are likely to be healthier, more outgoing and socially engaged than abstainers, and derive more reward (i.e. mood enhancement) from drinking alcohol in social contexts (see Fairbairn et al., 2015). It is thus possible that alcohol foster extraversion over time through social factors connected with drinking. Moreover, alcohol drinkers relative to those who never drank or stop drinking tend to report a better health status (Frisher et al., 2015; see also Green & Polen, 2001), which in turn helps to maintain a more (socially) active lifestyle. Contrary to our expectation, however, moderate alcohol drinking was not significantly associate with change in conscientiousness nor openness.

Alcohol dependence also predicted personality change in later life. In particular, decreases in conscientiousness were accentuated for individuals with a history of AUDs (CAGE ≤1). Alcohol dependence is accompanied by brain damages and neurotransmitter imbalances (Bühler & Mann, 2011; Oscar-Berman & Marinković, 2007), which are likely to manifest in change of behavior and personality over time. It is also associated with increased risk for of chronic diseases, including severe cognitive impairment and dementia (e.g., Kuźma et al., 2014), which are related to decrease in traits like conscientiousness (Pocnet, Rossier, Antonietti, & Von Gunten, 2013; Terracciano et al., in press). Even after remission of clinical symptoms, it may be possible for individuals who experienced alcohol dependence to continue to be disorganized and incapable of long-term planning. Surprisingly, CAGE was not associated with change in neuroticism, though neuroticism has been identified as a significant predictor of alcohol-related problems and disorders in past studies (Martin & Sher, 1994; Ruiz et al., 2003).

As noted above, alcohol may influence personality development in several ways. For instance, the amount of alcohol consumed or the decision to abstain from alcohol may depend on individuals' health, especially at older ages. Also, genetic influences may determine variation in the development of dependence symptoms and personality. Twin studies have demonstrated significant overlap between the genetic diathesis for AUDs and genetic variation in the five-factor personality traits (de Moor et al., 2011; Littlefield et al. 2011). Future studies need to focus on possible mediators and sequential pathways through with alcohol use and personality are related. Notably, our study provided preliminary evidence of correlated changes between these two constructs at later stages of life, as emerged in cross-lagged difference score models. Even though directional causality cannot

be inferred from the data, it is clinically relevant to know whether personality change occur with modification in life-styles and health behaviors.

A few limitations of the study need to be taken into account. First, this study do not account for early life factors that potentially influence risk taking behaviors and alcohol use in later life. For example, lower scores on IQ tests in childhood/adolescence have shown to predict higher alcohol consumption and occurrence of hangovers in middle adulthood (e.g., Batty, Deary, & Macintyre, 2006; Sjölund, Hemmingsson, & Allebeck, 2015). Similarly, childhood personality (low conscientiousness) have been found to predict levels of alcohol consumption in middle-age (e.g., Hampson, Goldberg, Vogt, & Dubanoski, 2006; Kubicka, Matejcek, Dytrych, & Roth, 2001). Individuals with lower levels of conscientiousness in early adulthood may be more likely to engage in unhealthy patterns of alcohol drinking and develop AUDs in later life, which would consequently influence further decrease on conscientiousness trait over time. Moreover, the present work relayed exclusively on self-report data and a single indicator of alcohol drinking, i.e. count of drinks/week. Future research should consider measures of actual alcohol consumption (i.e. physiological tests) or diagnosis of AUDs, as well as self-report and informant ratings to assess personality.

Despite these limitations, this study suggests that personality traits may change with specific patterns of alcohol consumption beyond early adulthood. The size of the associations also suggests that alcohol may be a distal factor for personality change, perhaps acting through other biological, cognitive and psychological pathways, or in conjunction with other health-related behaviors (see Stephan et al., 2014).

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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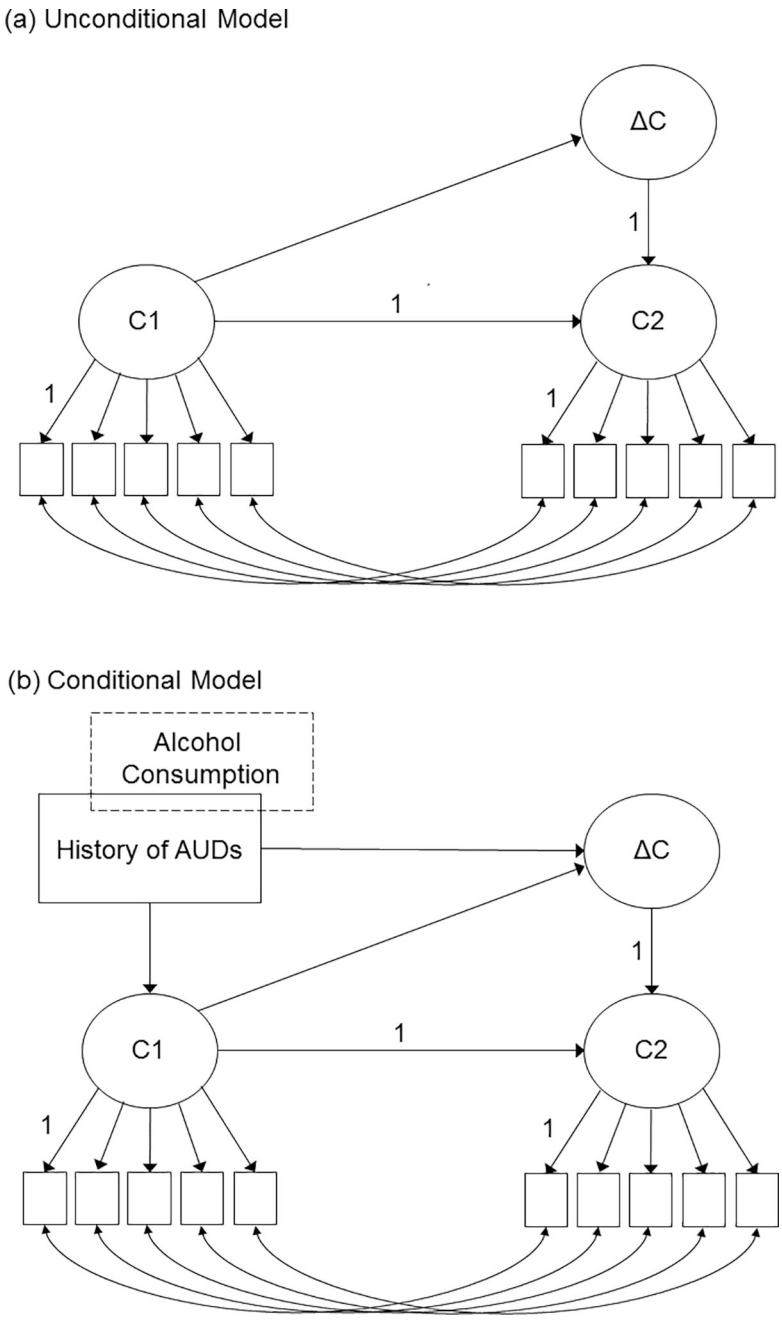

Figure 1.

Conceptual model exploring conscientiousness latent difference score. Item loadings and intercepts were set to be equal across time points. Socio-demographic covariates (age, age squared, sex, race, education, income and wealth) and alcohol variables were entered as predictors of C1 and ΔC in the conditional latent difference score model.

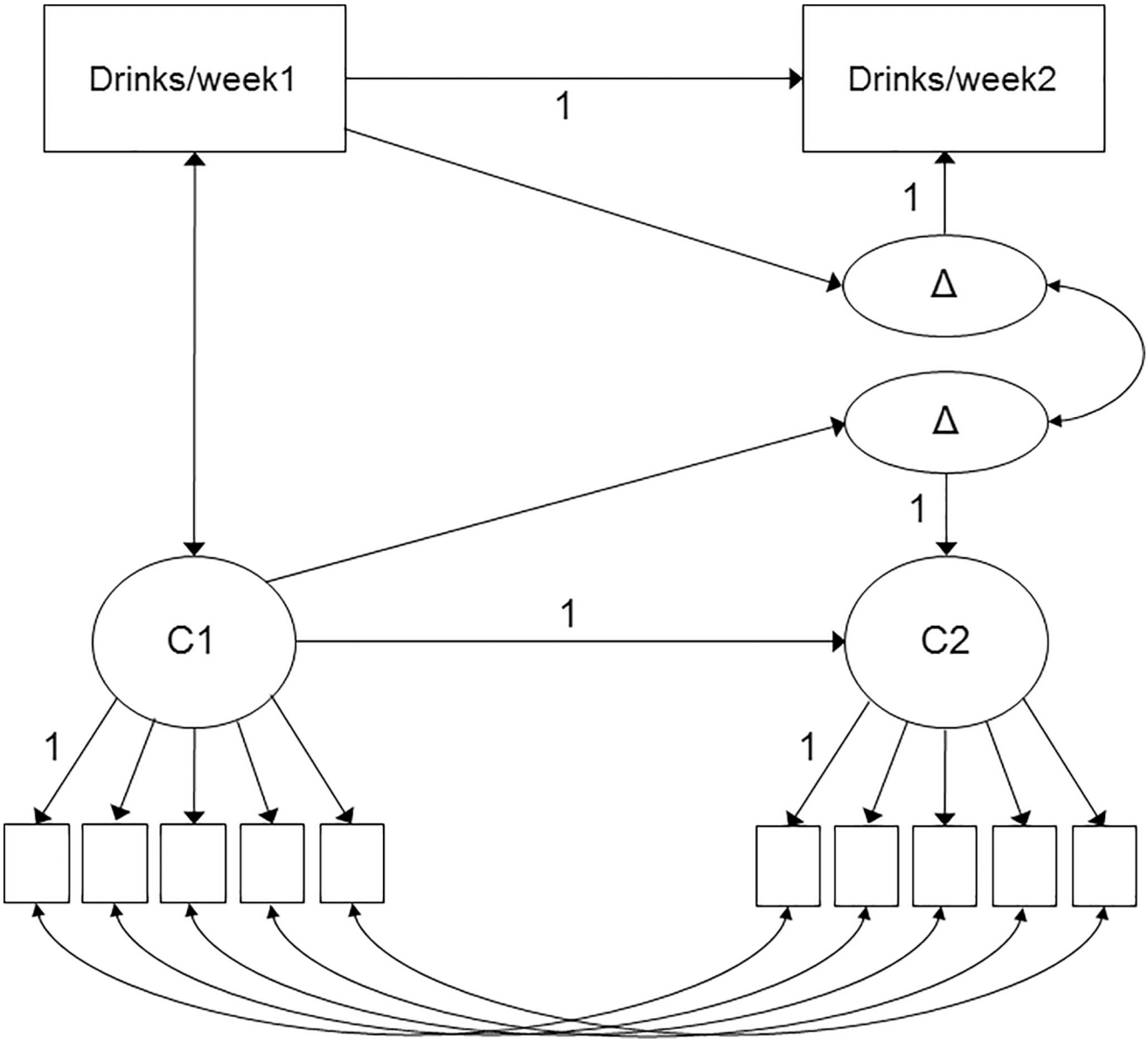

Figure 2.

Conceptual model exploring correlated difference scores of alcohol consumption and conscientiousness. Number of drinks/week was used as single indicator of alcohol consumption at baseline and follow-up; this variable were natural log transformed to reduce the skewness of the distribution. Item loadings and intercepts of personality indicators were set to be equal across time points. Model controlled for socio-demographic covariates.

Table 1

Descriptive statistics for the variables under study

				Intercorrelations									
Variables	***M***	***SD***	***N***	**N1**	**N2**	**E1**	**E2**	**O1**	**O2**	**A1**	**A2**	**C1**	**C2**
Personality													
N1	2.05	0.62	14,226	1									
N2	1.99	0.60	10,007	.63*	1								
E1	3.19	0.56	14,289	−.22*	−.20*	1							
E2	3.16	0.57	10,102	−.19*	−.25*	.68*	1						
O1	2.93	0.56	14,249	−.20*	−.21*	.54*	.39*	1					
O2	2.88	0.58	10,072	−.17*	−.24*	.38*	.55*	.66*	1				
A1	3.52	0.48	14,293	−.13*	−.10*	.57*	.34*	.42*	.27*	1			
A2	3.51	0.50	10,018	−.11*	−.14*	.40*	.57*	.30*	.45*	.62*	1		
C1	3.35	0.49	14,275	−.25*	−.22*	.41*	.29*	.47*	.34*	.45*	.32*	1	
C2	3.36	0.50	10,092	−.19*	−.27*	.27*	.43*	.32*	.49*	.30*	.48*	.62*	1
Socio-demographics													
Age	68.85	9.97	14,302	−.10*	−.06*	−.04*	−.04*	−.12*	−.12*	−.02*	−.05*	−.10*	−.10*
Sex (female)	58.8%		14,302	.08*	.10*	.09*	.09*	−.00	.01	.26*	.25*	.10*	.10*
Race 1 (black)	12.8%		14,301	−.07*	−.08*	.06*	.04*	.02	.01	.01	−.01	−.04*	−.04*
Race 2 (other)	4.3%		14,301	.03*	.04*	−.01	.00	−.01	.01	−.00	−.01	−.01	−.01
Education	12.56	3.12	14,284	−.13*	−.12*	.07*	.072*	.28*	.27*	.06*	.07*	.18*	.19*
Income	64467.97	162253.38	14,302	−.03*	−.03*	.03*	.04*	.08*	.08*	.00	.01	.07*	.06*
Wealth	527928.99	1265057.77	14,302	−.04*	−.05*	.03*	.06*	.09*	.11*	−.02	.00	.09*	.09*
Alcohol Variables													
History of AUDs													
CAGE Score ≥1	18.0%		11,470	.09*	.06*	−.04*	−.05*	−.02	−.02	−.08*	−.09*	−.11*	−.11*
CAGE Interval	12.46	4.75	11,470	−.07*	−.05*	.03*	.02	−.07*	−.08*	.01	.01	−.03*	−.04*
Drinking Categories													

				Intercorrelations									
Variables	***M***	***SD***	***N***	**N1**	**N2**	**E1**	**E2**	**O1**	**O2**	**A1**	**A2**	**C1**	**C2**
Non-drinkers	67.3%		14,274	.04*	.04*	−.04*	−.05*	−.11*	−.12*	.06*	.04*	−.05*	−.05*
Light-to-moderate drinkers	27.0%		14,274	−.05*	−.05*	.04*	.05*	.10*	.11*	−.05*	−.03*	.06*	.06*
Moderate-to-heavy drinkers	5.7%		14,274	.02	.01	.01	.01	.03*	.04*	−.03*	−.02	.00	−.01
Drinks/week at baseline	2.50	6.23	14,274	−.03*	−.03*	.03*	.04*	.10*	.11*	−.07*	−.05*	.04*	.04*
Drinks/week at follow-up	2.34	5.77	11,855	−.02*	−.05*	.03*	.06*	.12*	.13*	−.06*	−.04*	.06*	.06*

Note. Means and standard deviations are reported if not otherwise specified. Of 14,302 respondents with personality data, 14,274 also reported on alcohol consumption at baseline (*N* = 11,470 reported on alcohol dependence/abuse; of these, 10,094 scored at least on one personality dimension at the follow-up. N1 / N2: Neuroticism at baseline / follow-up; E1 / E2: Extraversion at baseline / follow-up; O1 / O2: Openness at baseline / follow-up; A1 / A2: Agreeableness at baseline / follow-up; C1 / C2: Conscientiousness at baseline / follow-up. Drinking Categories: no alcohol consumption, light-to-moderate (≥1 to 7 drinks/week for women and ≥1 to 14 drinks/week for men), and moderate-to-heavy consumption (>7 drinks/week for women and >14 drinks/week for men). Number of drinks/week at baseline and follow-up were natural log transformed for the analyses. CAGE Score ≥1 identify past alcohol dependence and/or abuse.

* $p \leq .01$.

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Table 2

Levels of alcohol consumption and history of AUDs as predictors of latent difference scores of personality traits

	Standardized estimates (99% Confidence Interval)									
Models/Paths	**N**		**E**		**O**		**A**		**C**	
Unconditional Model										
Δ Means/Intercepts	−.13*	(−17, −.10)	−.13*	(−.17, −.10)	−.14*	(−.18, −.11)	−.07*	(−.10, −.03)	−.12*	(−.16, −.09)
Δ Variances	.86*	(.84, .89)	.92*	(.90, .94)	.91*	(.90, .93)	.91*	(.89, .93)	.95*	(.93, .97)
Personality baseline → Δ Personality	−.37*	(−.41, −.34)	−.29*	(−.32, −.25)	−.30*	(−.33, −.27)	−.30*	(−.34, −.27)	−.23*	(−.27, −.19)
Model fit indices										
RMSEA	.04		.06		.06		.04		.04	
SRMR	.03		.05		.05		.03		.03	
CFI	.98		.95		.91		.98		.97	
Conditional Model 1: Levels of Alcohol Consumption										
Δ Means/Intercepts	−.19*	(−.36, −.02)	−.24*	(−.41, −.07)	−.27*	(−.43, −.12)	−.24*	(−.40, −.08)	−.35*	(−.53, −.16)
Δ Variances	.85*	(.82, .88)	.91*	(.88, .93)	.89*	(.87, .91)	.88*	(.86, .91)	.92*	(.90, .95)
Personality baseline → Δ Personality	−.39*	(−.42, −.35)	−.30*	(−.33, −.26)	−.34*	(−.37, −.30)	−.33*	(−.37, −.30)	−.27*	(−.31, −.22)
Light-to-moderate → Δ Personality	−.01	(−.08, .06)	.10*	(.02, .18)	.06	(−.01, .13)	.06	(−.01, .14)	.06	(−.02, .14)
Moderate-to-heavy → Δ Personality	−.01	(−.15, .12)	.09	(−.05, .23)	.06	(−.06, .19)	.07	(−.07, .20)	−.01	(−.16, .14)
Model fit indices										
RMSEA	.04		.05		.05		.04		.03	
SRMR	.03		.04		.04		.03		.02	
CFI	.94		.91		.88		.94		.94	
Conditional Model 2: History of AUDs										
Δ Means/Intercepts	−.12	(−.39, .14)	−.14	(−.40, .13)	−.28*	(−54, −.03)	−.26*	(−.52, −.00)	−.32*	(−.62, −.02)
Δ Variances	.85*	(.82, .87)	.90*	(.88, .93)	.89*	(.87, .91)	.89*	(.86, .91)	.92*	(.89, .95)
Personality baseline → Δ Personality	−.39*	(−.43, −.36)	−.30*	(−.34, −.26)	−.34*	(−.38, −.30)	−.34*	(−.38, −.30)	−.28*	(−.33, −.23)
AUDs → Δ Personality	.03	(−.06, .13)	−.07	(−.16, .02)	−.06	(−.15, .03)	−.05	(−.14, .04)	−.10*	(−.21, −.00)
Model fit indices										

	Standardized estimates (99% Confidence Interval)				
Models/Paths	**N**	**E**	**O**	**A**	**C**
RMSEA	.04	.05	.05	.04	.03
SRMR	.03	.03	.04	.03	.02
CFI	.95	.91	.88	.95	.94

Note. The conditional latent difference score models were adjusted for age, age squared, sex, race, education, income and wealth; models with AUDs as predictor of change further adjusted for CAGE interval (years). Levels of alcohol consumption were entered as dummy coded variables in the models (reference category: no consumption). Number of observations ranged from 14,265 to 14,294 across personality dimensions for the unconditional models, from 14,219 to 14,247 for the models assessing the effect of alcohol consumption, and from 11,428 to 14,450 for the models assessing history of AUDs.

N = Neuroticism; E = Extraversion; O = Openness; A = Agreeableness; C = Conscientiousness. RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual; CFI = comparative fit index.

* $p \leq .01$.

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Table 3

Correlated latent difference scores of alcohol consumption and personality traits

	Standardized estimates (99% Confidence Interval)									
Models/Paths	**N**		**E**		**O**		**A**		**C**	
Means/Intercepts										
Δ Drinks/week	−.03	(−.13, .07)	−.03	(−.13, .07)	−.03	(−.13, .07)	−.03	(−.13, .07)	−.03	(−.13, .07)
Δ Personality Trait	−.19*	(−.35, −.02)	−.25*	(−.42, −.08)	−.29*	(−.45, −.13)	−.24*	(−.40, −.08)	−.35*	(−.54, −.17)
Variances										
Δ Drinks/week	.84*	(.82, .85)	.84*	(.82, .85)	.84*	(.82, .85)	.84*	(.82, 85)	.84*	(.82, .85)
Δ Personality Trait	.85*	(.82, .88)	.91*	(.88, .92)	.89*	(.87, .91)	.89*	(.86, .91)	.92**	(.90, .95)
Personality ↔ Drinks/week at baseline	−.01	(−.04, .01)	.04*	(.01, .06)	.04*	(.02, .06)	−.03*	(−.05, −.01)	.02*	(.00, .05)
Personality baseline → Δ Personality	−.39*	(−.42, −.35)	−.30*	(−.33, −.26)	−.34*	(−.38, −.31)	−.34*	(−.37, −.30)	−.27*	(−.31, −.22)
Personality baseline → Δ Drinks/week	−.00	(−.03, .02)	.02	(−.00, .05)	.03*	(.00, .06)	.00	(−.02, .03)	.04*	(.02, .07)
Drinks/week baseline → Δ Drinks/week	−.45*	(−.48, −.43)	−.45*	(−.48, −.43)	−.46*	(−.48, −.43)	−.45*	(−.48, .43)	−.45*	(−.48, −.43)
Drinks/week baseline → Δ Personality	−.00	(−.04, .03)	.04	(−.00, .07)	.02	(−.01, .06)	.01	(−.02, .05)	.01	(−.03, .05)
Δ Drinks/week ↔ Δ Personality	−.04*	(−.08, −.01)	.05*	(.01, .08)	.03	(−.00, .06)	.01	(−.02, .04)	.01	(−.03, .04)
Model fit indices										
RMSEA	.04		.05		.05		.04		.03	
SRMR	.03		.04		.04		.03		.02	
CFI	.96		.93		.90		.95		.96	

Note. All cross-lagged difference score models were adjusted for age, age squared, sex, race, education, income and wealth. Number of drinks/week at baseline and follow-up were natural log transformed. Number of observations was 14,283 for each cross-lagged difference score models.

N = Neuroticism; E = Extraversion; O = Openness; A = Agreeableness; C = Conscientiousness. RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual; CFI = comparative fit index.

* $p \leq .01$.