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Smoking mediates the effect of conscientiousness on mortality: The Veterans Affairs Normative Aging Study

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ABSTRACT

This study examined the relationship between conscientiousness and mortality over 18 years and whether smoking behavior mediated this relationship. We utilized data from the Veterans Affairs Normative Aging Study on 1349 men who completed the Goldberg (1992) adjectival markers of the Big Five. Over the 18-year follow-up, 547 (41%) participants died. Through proportional hazards modeling in a structural equation modeling framework, we found that higher levels of conscientiousness significantly predicted longer life, and that this effect was mediated by current smoking status at baseline. Methodologically, we also demonstrate the effectiveness of using a structural equation modeling framework to evaluate mediation when using a censored outcome such as mortality.

1. Introduction

Personality traits have emerged in recent years as important predictors of longevity. One of the most robust findings indicates that a higher level of trait conscientiousness predicts longer life expectancy (Friedman et al., 1993; Hampson & Friedman, 2008; Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007). Conscientiousness involves the ability to be organized, responsible, disciplined, and planful (Roberts, Jackson, Fayard, Edmonds, & Meints, 2009, chap. 25). Although the potential health benefits associated with greater conscientiousness may appear straightforward, the precise reasons for this are not clearly established. One hypothesis states that conscientiousness is related to longevity because individuals high in this trait abstain from health damaging behaviors such as smoking (Smith, 2006). Given strong empirical evidence connecting low level of conscientiousness and smoking behavior (Bogg & Roberts, 2004), it is likely that this damaging health behavior is one conduit through which conscientiousness influences longevity. However, there is very little empirical evidence documenting that health behaviors, such as smoking, significantly mediate the conscientiousness–longevity association over an extended follow-up period.

The aim of the current study was to test whether smoking behavior explained the conscientiousness–longevity association. If so, it would provide evidence for a key theoretical position linking personality to health—the health behavior model (Smith, 2006). Additionally, we utilize an innovative statistical technique, extending structural equation modeling (*SEM*) for use with a censored outcome (Asparouhov, Masyn, & Muthén, 2006; Hill, Turiano, Hurd, Mroczek, & Roberts, 2011; Muthén & Masyn, 2005; Ploubidis & Grundy, 2009) to test our hypothesis that individuals scoring lower in conscientiousness would be more likely to smoke and thus have an increased risk of mortality.

The empirical evidence connecting conscientiousness with longevity has received much attention in recent years. Studies using diverse samples have, almost without exception, documented that high level of conscientiousness decreases mortality risk. This has been replicated in studies from different cultures (Iwasa et al., 2008; Taylor et al., 2009), in at-risk samples (i.e., participants with coronary disease; Christensen et al., 2002), and in healthy community samples (Terracciano, Löckenhoff, Zonderman, Ferrucci, & Costa, 2008). Moreover, the finding holds regardless of whether conscientiousness was assessed when participants were children (Friedman et al., 1993; Martin, Friedman, & Schwartz, 2007) or when they were adults (Hill et al., 2011; Wilson, Mendes de Leon,

Abbreviations: SEM, Structural equation modeling; NAS, Normative Aging Study.

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Bienas, Evans, & Bennett, 2004). Overall, the majority of studies finds that conscientiousness is positively associated with longevity, and meta-analyses of this topic provide further confirmation (Kern & Friedman, 2008; Roberts et al., 2007).

With the basic effect well-established, researchers are now turning to questions of mechanism. What mediating factors operate in the explanatory pathways leading from conscientiousness to the often quite distal endpoint of mortality? In other words, how does conscientiousness "get outside the skin" (Hampson, 2012) to affect behavior? The *health behavior model* provides the most theoretically elegant explanation for why conscientiousness predicts mortality (Friedman, 2000; Smith, 2006). The model holds that a general personality trait such as conscientiousness leads to specific conscientious behaviors, such as taking better care of one's health, which in turn lead to better health and ultimately greater longevity. A large part of taking care of one's health involves avoiding health-damaging behaviors, such as smoking. Meta-analyses of cross-sectional studies have shown that those lower in conscientiousness are far more likely to smoke tobacco (Bogg & Roberts, 2004; Malouff, Thorsteinsson, & Schutte, 2006), and longitudinal investigations have buttressed these results, documenting that low levels of conscientiousness in childhood predicted increased smoking in middle age and beyond (Friedman et al., 1995; Hampson, Goldberg, Vogt, & Dubanoski, 2006).

Even with the wealth of data documenting the associations among conscientiousness, smoking, and mortality, there is limited empirical evidence that smoking behavior does in fact statistically mediate the conscientiousness–mortality relationship (Friedman et al., 1995; Hampson, 2008; Martin et al., 2007; Terracciano et al., 2008; Wilson et al., 2004). These prior studies are limited because smoking behavior is treated as a *control variable* and the variance associated with smoking is often ignored. We believe this strategy is flawed theoretically because smoking is actually a mediator on the causal pathway between conscientiousness and mortality. Both conscientiousness and smoking are important predictors of mortality, yet the former is likely more distal in the explanatory chain than the latter.

Moreover, due to limitations in commonly used statistical methods, most prior studies have not conducted significance tests for mediation of the personality–longevity association, including some of our own previous work (e.g., Mroczek, Spiro, & Turiano, 2009). Many prior investigations have treated smoking (as well as other health behavior variables) as a control variable (Friedman, Kern, & Reynolds, 2010; Kern et al., 2009; Martin et al., 2007; Shipley, Weiss, Der, Taylor, & Deary, 2007; Terracciano et al., 2008; Wilson et al., 2004), which can be misleading because many such indicators are "middle" variables, or mediators, on an explanatory pathway. However, this is not a statistical test of mediation because there was no test to determine whether the mediating variable indeed explained variance in the conscientiousness–mortality association. Covarying a variable instead of treating it as a mediator may mask the significant indirect effect health behaviors have between personality and mortality risk.

Taylor et al. (2009) used *SEM* to formally test mediation but the mortality outcome was dichotomous (dead or alive) and did not use the pertinent information of varying survival time, which can be critical when examining mortality over longer follow-up times. The main reason the health behavior pathway has never been formally evaluated is that *SEM* could not, until recently, be easily used with censored outcomes such as survival time (Hill et al., 2011; Muthén & Masyn, 2005; Ploubidis & Grundy, 2009). By using this technique of testing proportional hazards within an *SEM* framework, we attempted to provide a more complete test of the full conscientious–smoking–mortality pathway in a single parsimonious model which would provide empirical support for the health behavior model of personality.

2. Methods

2.1. Sample

Data included participants from the Department of Veterans Affairs Normative Aging Study (NAS), a longitudinal investigation of aging in healthy men. Founded at the Boston VA Outpatient Clinic in 1963 (Bosse' et al., 1984), the aims of the NAS were to follow a large cohort of men to understand the characteristics of healthy aging, identify the precursors of age-related diseases, and estimate the influence of these diseases on the aging process itself.

Between 1961 and 1970, approximately 6000 men were screened for the absence of serious physical or mental illnesses to obtain a closed panel of 2280 initially healthy men (born between 1884 and 1945). The NAS sample was generally representative of the greater Boston, Massachusetts area as of 1970, although only 2% of the sample is African American. A full description of the NAS sample and overview of the various examination cycles can be found elsewhere (Bosse' et al., 1984).

For purposes of the current study, participants were included if they completed the Goldberg (1992) personality measure in 1990–1991. Between the start of the NAS in 1970 and 1990–1991, 374 men (16%) had died, 204 men were only partially active in the study (9%), 155 had dropped out (7%), and 47 men were either too ill to continue participation or could not be contacted. More than half of the lost participants occurred between the first and second examination cycles (1968–1973; Rose, Bosse, & Szretter, 1976). Thus, by the end of 1991, there were 1485 men active in the NAS who were eligible to complete the personality measure. Of these, 1349 men completed the Goldberg personality assessment and were included in the current study. We compared these men to those who did not have full data; the latter were less likely to be retired, but did not differ on income level, marital status, or self-rated health. In a related study, Spiro and colleagues (1994) concluded that the men who responded to the surveys used in the current study were generally representative of the original sample of NAS men.

2.2. Measures

2.2.1. Conscientiousness

Conscientiousness was assessed via the Goldberg (1992) adjectival markers of the Big Five. This measure contains 100 different adjectives (20 for each of the Big Five), and are administered in unipolar format (Goldberg found that this was more robust across samples than bipolar scales). Overall, Goldberg (1992) found the structure of these 100 adjectives provided a good alternative to using the NEO-PI and Hogan personality inventories.

Participants completed the questionnaire in late 1990 through mid-1991. The conscientiousness measure consists of 20 adjectives (e.g., inconsistent, haphazard, organized, careful), each rated on a 9-point Likert scale (*Extremely Inaccurate – Extremely Accurate*). Negative adjectives were reverse coded and the mean of all 20 adjectives represented level of conscientiousness. Cronbach's alpha for the conscientiousness scale was .86 in this sample.

2.2.2. Education

Education was included as a covariate since there are known social gradients in both personality and mortality risk (Chapman, Fiscella, Kawachi, & Duberstein, 2010). Education was assessed at study entry and ranged from completion of grade school up to an advanced graduate or professional degree. Education was utilized as a continuous variable; 1 (*grade school*) to 9 (*professional degree*).