



Do health behaviors explain the effect of neuroticism on mortality? Longitudinal findings from the VA Normative Aging Study

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ABSTRACT

Studies have shown that higher levels of neuroticism are associated with greater risk of mortality. Yet what accounts for this association? One major theoretical position holds that persons higher in neuroticism engage in poorer health behaviors, such as smoking and excessive drinking, thus leading to earlier death. We tested this hypothesis using 30-year mortality in 1788 men from the VA Normative Aging Study. Using proportional hazards (Cox) models we found that one health behavior, smoking, attenuated the effect of neuroticism on mortality by 40%. However, 60% remained unexplained, suggesting that the effects of other pathways (e.g., biological) also influence the relationship between neuroticism and mortality.

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1. Introduction

Over the past two decades, personality traits have emerged as important predictors of all-cause mortality (Friedman et al., 1993; Maier & Smith, 1999). One of the best documented of these effects, along with conscientiousness, is the association between neuroticism and mortality. At least half a dozen studies have shown that people higher in neuroticism die sooner than those who are not as high (Abas, Hotopf, & Prince, 2002; Christensen et al., 2002; Denollet et al., 1996; Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007; Schulz, Bookwala, Knapp, Scheier, & Williamson, 1996; Shipley, Weiss, Der, Taylor, & Deary, 2007; Wilson, Mendes de Leon, Bienas, Evans, & Bennett, 2004). Moreover, other studies have found that variables similar to neuroticism also predict mortality (e.g., MMPI Cynicism; Almada et al., 1991).

Over 20 years ago, Friedman and Booth-Kewley (1987) proposed that negative emotionality, or neuroticism, was predictive of general proneness to disease. The weight of the empirical evidence on neuroticism and mortality is consistent with this perspective (Hampson & Friedman, in press; Smith & Gallo, 2001; Suls & Bunde, 2005). Although a small number of studies have found no relationship between neuroticism and mortality (e.g., Huppert & Whittington, 1995; Iwasa et al., 2007; Taga, Friedman, & Martin, in press – although the latter did find a protective effect specifically among widowed men), and two have observed a protective effect (Korten et al., 1999; Weiss & Costa, 2005), the major-

ity of findings have supported the conclusion that higher neuroticism confers a higher mortality risk. Moreover, high initial or average neuroticism paired with an increasing rate of neuroticism change further raises the mortality risk (Mroczek & Spiro, 2007). One of the key unanswered questions in this area is what explains the connection (Friedman, 2000; Roberts & Bogg, 2004; Roberts et al., 2007). This study took up the question, testing the possibility that health behaviors fully or partially account for the link between high neuroticism and shorter life.

1.1. Theories of neuroticism, health, and mortality

Recent theoretical and empirical work has identified several candidate hypotheses that might explain the connection between personality and health (Conrada, Cather, & O'Leary, 1999; Hampson & Friedman, in press; Hampson, Goldberg, Vogt, & Dubanoski, 2007; Rozanski, Blumenthal, & Kaplan, 1999; Segerstrom, 2000; Siegler et al., 2003; Smith, 2006; Smith & Spiro, 2002). One such hypothesis states that high levels of particular traits lead to worse (or better) health behaviors (Hampson, 2008; Roberts et al., 2007). Neuroticism, or negative emotionality, is predictive of the amount of negative affect (anxiety, depression) and perceived stress (Almada et al., 1991; Bolger & Schilling, 1991; Larsen & Ketelaar, 1991; Mroczek & Almeida, 2004; Suls, Green, & Hillis, 1998; Watson & Clark, 1994). Excessive negative emotions and stress may lead to poor health behaviors such as smoking or excessive drinking that in turn contribute to worse health (Friedman, 2000; Smith, 2006). In a sense, persons high in neuroticism may self-medicate with tobacco, alcohol, or drugs to alleviate their chronically high levels of negative affect and perceived stress (Eysenck, 1973,

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1991; Eysenck & Eaves, 1980). This self-medication, while perhaps giving psychological respite, has a physical health cost.

Theoretical models of neuroticism posit various mechanisms for why people high in this trait experience greater anxiety and potential self-medication through smoking or drinking. For example, Gray's Behavioral Inhibition System (BIS) is hypothesized to underlie the activation of negative emotion and behavioral withdrawal due to threat sensitivity (Gray, 1981, 1994).

However, some people have more sensitive Behavioral Inhibition Systems than others, rendering them more responsive to real or perceived threats – these persons are typically high-neuroticism (Gray, 1994). They may be prone to alleviating the unpleasantness that arises from BIS activation through smoking or excessive drinking. These detrimental health behaviors are potential “agents of respite.” Similarly, Carver and Scheier's theory of self-regulation hypothesizes the existence of monitoring systems that yield feedback to the individual (Carver & Scheier, 1990, 1998). For example, if the pursuit of a goal is not going well, the monitoring or regulating systems will activate negative emotions, which in turn may lead to poor health behaviors that nevertheless alleviate the negative feelings.

However, neuroticism is not always hypothesized to be bad. As Tamir, Robinson, and Solberg (2006) have argued, neurotic individuals are often portrayed as victims of their frequent negative affect and maladaptive appraisals of threats. However, some neurotic individuals possess threat-identifying skills that are adaptive (Tamir et al., 2006). This study does not look at such mechanisms, yet it is important to acknowledge that neuroticism may not always be bad for health and health behaviors. Indeed, Friedman (2000) speculated that some persons high in neuroticism may enjoy better health, and presumably greater longevity, because of “neurotic vigilance” that leads to good health behaviors (see also Hampson & Friedman, *in press*; Taga et al., *in press*). However, at present there is no clear, agreed-upon way to distinguish between health and unhealthy neurotics. Thus, the present study confined itself to the more general finding in the extant literature that neuroticism is related to certain detrimental health behaviors, keeping open the possibility that future work may show our findings hold primarily for “unhealthy neurotics”.

The goal of the current study was to test the extent to which detrimental health behaviors explain the neuroticism–mortality link. Health behaviors such as smoking are considered mediators in this type of model (Friedman, 2000; Hampson, 2008; Roberts et al., 2007). In this kind of conceptual framework, neuroticism leads to poorer health behaviors, which in turn damage health and increase mortality risk. As Hampson (2008) argues, health behaviors act as a bridge that joins personality traits to health and ultimately, to mortality or longevity. Because mediator mechanisms such as poor health behaviors do their damage over long periods of time, lifespan studies that follow individuals over many years or decades are ideal for testing these hypotheses (Hampson, 2008; Hampson & Friedman, *in press*). In addition, recent conceptual work has called for research on personality and health behaviors to go further and examine their downstream consequences on health and mortality (Hampson & Friedman, *in press*). It is important to note, however, that not all the personality-related poor health behaviors actually lead to worse health or mortality, as there are likely individual differences in how such behaviors influence health, in addition to dosage effects and interactions among health behaviors (Hampson & Friedman, *in press*).

Nonetheless, empirical work has supported the general notion that high neuroticism leads to problems in physical health (keeping in mind that there are likely exceptions). For example, people high in neuroticism are at higher risk of developing hypertension (Spiro, Aldwin, Ward, & Mroczek, 1995), as well as obesity and metabolic syndrome (Hampson & Friedman, *in press*). Thus, it is

not surprising that many studies have found that high neuroticism is a risk factor for mortality (Abas et al., 2002; Christensen et al., 2002; Denollet et al., 1996; Schulz et al., 1996; Wilson et al., 2004). A recent meta-analysis has confirmed high neuroticism as detrimental for longevity (Roberts et al., 2007). It is important to bear in mind that some studies have found no relationship (Huppert & Whittington, 1995; Iwasa et al., 2007) and that two studies have identified high neuroticism as a protective factor (Korten et al., 1999; Weiss & Costa, 2005). However, these latter two studies have two factors in common. Both used samples where the age at entry was greater than 70, and both used relatively short follow-up periods for mortality (3–4 years for Korten et al., and 5 years for Weiss and Costa). In addition, the neuroticism effect was in the correct direction for women (it was a risk factor; not protective) in the Korten et al. (1999) study, but the hazard ratio was not significant. Additionally, among the Korten et al. men, only very high neuroticism (being in the upper quintile) conferred a protective effect. The great majority of the evidence rests behind the conclusion that high neuroticism elevates mortality risk.

1.2. Neuroticism and health behaviors

There is empirical evidence that neuroticism is associated with two key health behaviors that, in turn, are related to poor physical health and mortality. These are smoking and excessive alcohol use. Researchers have known for a long time that higher neuroticism is associated with cigarette smoking (Eysenck, 1973; Gilbert, 1995; Goodwin & Hamilton, 2002; Kirk, Whitfield, Pang, Heath, & Martin, 2001; Lerman et al., 2000). Persons high in neuroticism are more likely to smoke, tend to smoke more, and have greater difficulty quitting smoking (Almada et al., 1991; Rausch, Nicholson, Lamke, & Matloff, 1990). They also tend to use cigarettes and other tobacco products to self-medicate feelings of anxiety and worry, and to alleviate the negative affect that they experience much of the time (Audrain, Lerman, Gomez-Caminero, Boyd, & Orleans, 1998; Eysenck, 1991; Eysenck & Eaves, 1980; Lerman et al., 2000). Further, anxiety and smoking are correlated and likely have common biological underpinnings (Johnson et al., 2000). These relationships may exist in part because neuroticism and smoking may share some of the same genetic predispositions, especially polymorphisms that regulate serotonin and monoamine oxidase (Kirk et al., 2001; Lerman et al., 1999; Lesch et al., 1996). All in all, the fact that neuroticism and smoking are positively associated is well established.

The association between neuroticism and alcohol abuse is not as well established. Even so, several studies have documented that higher neuroticism is related to alcohol abuse and dependence (Almada et al., 1991; Grekin, Sher, & Wood, 2006; Larkins & Sher, 2006; Read & O'Connor, 2006) as well as greater negative consequences from drinking (Fischer, Smith, Annus, & Hendricks, 2007). Presumably, the same theoretical processes of self-medication and alleviation of negative emotion underlie the neuroticism–drinking association.

We tested whether smoking or drinking (or both) partially or fully explained the association between neuroticism and mortality. As Hampson and Friedman (*in press*) point out, the main competitor hypothesis to health behavior models of personality and health are biological explanations that argue for physiological mechanisms (e.g., Wiebe & Smith, 1997). Further, Hampson, Goldberg, Vogt, and Dubanoski (2006) have argued that the effect of neuroticism on health and mortality might be better suited to biological or physiological explanations. It may be the case that neuroticism works through both health behaviors as well as physiological mechanisms (e.g., higher production of cortisol or inflammatory cytokines, e.g., Segerstrom, 2000; Segerstrom & Miller, 2004). Thus, it is more realistic to expect that smoking and drinking will partially, but not fully, explain the neuroticism–mortality relationship.

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