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Personality, Subjective Well-Being, and Mortality Risk Across the Lifespan: Pathways Linking Neuroticism, Conscientiousness, and Health

A Dissertation submitted in partial satisfaction
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by

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It's funny how seemingly small, potentially mundane experiences have the power to change your life. Forget graduate school imposter syndrome; as an undergraduate, I was constantly convinced the "joke would be up," and someone would quickly realize I wasn't smart enough to be here. Yet UCR had such a warm, supportive, and encouraging environment, particularly for students from disadvantaged backgrounds, that I thought "why not?" and figured if my professors and other staff were encouraging me to pursue research, maybe I had a shot. At the time, I could not have imagined that I would be so well-suited for academia.

Yet here I am – a professional academic. Graduate study is not without challenges, and my path to a PhD has been no different. I could write about the countless hours of work, and the persistence required to finish them. I could write about the many doubts any new trainee has, and the encouragement from one's mentors required to overcome them. I could also write about the numerous "real life" challenges I encountered, but it seems that the most important thing to acknowledge is the support of family, friends, mentors, and colleagues who helped me to continue pursuing my dreams in the face of adversity.

Indeed, that is what is most important in graduate school, and in life: the support of caring, considerate, kind people. And that is what I have had. From my grandfather, who inspired in me my love of learning, to my cousin, whose own burgeoning intellectual curiosity is a delight to watch develop. From my father, who taught me the meaning and rewards associated with hard work, to my mother, who gave me the gift of reading. My

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sick, and who stays well?" I confessed that while I thought the theoretical background and conclusions of some of his papers were exciting, I really wanted to "understand the middle." Nine years later, I definitely understand the middle! Throughout my training, Howard has been my greatest advocate. He ticks off all the boxes on measures of social support, networks, and integration, and I am so thankful that I have had the opportunity to work with him for what has become a third of my life. I look forward to many more fruitful years of collaboration with Chandra, Sara, and Howard to come.

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ABSTRACT OF THE DISSERTATION

Personality, Subjective Well-Being, and Mortality Risk Across the Lifespan: Pathways Linking Neuroticism, Conscientiousness, and Health

by

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Much research confirms that high conscientiousness is related to decreased mortality risk, in part because conscientious people are more likely to engage in salubrious health behaviors and maintain healthy social support networks. High neuroticism is associated with decreased subjective well-being (SWB) and poorer self-rated health, but there is dispute over the extent to which this reflects actual health problems and increased mortality risk, or heightened sensitivity to somatic symptoms without a true increase in measurable disease and mortality risk. Associations between combinations of conscientiousness and neuroticism and well-being, however, have received relatively little attention. Here, the concept of "healthy neuroticism" was tested, which proposes that the combination of high conscientiousness and high neuroticism is health protective. Survival and regression analysis to were used examine whether "healthy neuroticism" in adulthood (1940) was related to mortality risk and well-being in the lifespan Terman data (*N*=1528). Following previous literature, the interaction of conscientiousness and neuroticism was modeled via linear and spline terms (which isolates the interaction for

participants high in conscientiousness and neuroticism). Contrary to previous theory, results showed that combinations of high conscientiousness and neuroticism were related to worse subjective well-being, particularly for men. Because trait interactions differentially predict subjective well-being and mortality risk, results suggest that subjective and objective measures of health are distinct, with implications for lifelong models of health and well-being.

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Chapter 1

One of the most provocative and challenging questions for personality and health psychologists involves understanding how and why personality traits predict and sometimes produce good health and successful aging (Guralnik & Kaplan, 1989). The study of personality processes examines how people's unique patterns of thoughts, feelings, and behaviors result in consequential outcomes (Duggan & Friedman, 2014; Friedman, 2000; Hampson, 2012; Shanahan, Hill, Roberts, Eccles, & Friedman, 2013). Personality traits capture people's unique genetic, familial, and sociocultural experiences (Martin, Friedman, & Schwartz, 2007), as well as their automatic behaviors and conscious, effortful thought processes (Magidson, Roberts, Collado-Rodriguez, & Lejuez, 2014). Because health psychology involves the study of who becomes sick, and why (Adler & Matthews, 1994), the question of personality processes and how they relate to trajectories of health and well-being throughout the lifespan is core.

Conceptualizations of health should integrate multiple systems. Biopsychosocial models posit that good health is not merely the absence of disease; rather, it is a state of physical, social, and mental well-being (World Health Organization, 1946), and these biological, psychological, and social processes are integrated (Engel, 1977; Suls & Rothman, 2004). Importantly, good health is not just "feeling good." Being happy or satisfied with one's life is important (Diener, Oishi, & Lucas, 2003), but does not encompass (though it may be related to) physical health, and oversimplification can lead to unfounded inferences about causality (Friedman & Kern, 2014). Full causal models

that integrate subjective and objective measures of physical, mental, and social well-being are necessary (Friedman, 2000; Kern, Della Porta, & Friedman, 2014).

In order to understand how personality traits relate to multidimensional trajectories of health and well-being, an integrative, life-span developmental framework is necessary (Baltes, 1987; Hofer & Piccinin, 2010). One particularly important but under-studied aspect of health-relevant personality traits involves their interactions with other personality traits, and how these trait interactions may be embedded in each individual's unique biopsychosocial milieu. This can be done using the highly reliable, integrative framework of the five factor model of personality (John & Srivastava, 1999) which describes traits using five broad constructs: conscientiousness (constraint and impulse control), agreeableness (altruism and affection), neuroticism (negative emotionality), openness (originality and open-mindedness), and extraversion (energy and enthusiasm; John, Naumann, & Soto, 2008).

These traits have been related to consequential outcomes at the intrapersonal, interpersonal, and community level, including happiness and subjective well-being, self-concept and identity, family, peer, and romantic relationships, occupational success, prosocial behavior, and political attitudes (Ozer & Benet-Martínez, 2006). Decades of research have revealed that of all the five traits, conscientiousness and neuroticism are most important to and most highly related to physiological, psychological, and social well-being (Ozer & Benet-Martínez, 2006); they predict disease states and disease progression (Jokela, Hakulinen, Singh-Manoux, & Kivimäki, 2014; Sutin, Zonderman, Ferrucci, & Terracciano, 2013), physical health (Friedman & Kern, 2014), and longevity

(Chapman, Roberts, & Duberstein, 2011; Terracciano, Löckenhoff, Zonderman, Ferrucci, & Costa, 2008).

Conscientiousness

Conscientiousness describes individual differences in socially-prescribed impulse control, task- and goal-oriented behavior, planfulness, persistence, and dependability (Friedman, 2000; John & Srivastava, 1999; Roberts, Lejuez, Krueger, Richards, & Hill, 2014). At the facet level, conscientiousness includes orderliness (being neat and prepared) and industriousness (working hard, aspiring to excellence, and persisting despite challenge), as well as self-control (John et al., 2008; Roberts et al., 2014), and these facets may be particularly important to good health. Conscientiousness also overlaps with other constructs in the social, developmental, and cognitive research literatures, including delay of gratification, ego control, effortful control, self-control, self-regulation, impulsivity, constraint, and grit (Roberts et al., 2014). It has been consistently associated with increased self-rated health (Hampson, Goldberg, Vogt, & Dubanoski, 2006) and decreased mortality risk (Kern & Friedman, 2008) in a dose-dependent manner (Moffitt et al., 2011), even when measured as early as childhood (Friedman et al., 1995; Hampson et al., 2015).

Although conscientiousness is well-known as a health-relevant trait (Friedman, 2000), little research has exampled the role of conscientiousness and health *processes* (Bogg & Roberts, 2004). That is, aside from understanding that conscientiousness predicts mortality partly via increased physical activity, better diet, and less smoking (Shanahan et al., 2014), relatively less research has examined conscientiousness and

mediators of the personality-health relationship, and how these factors might interact with other personality traits.

Conscientiousness is thought to influence health through three main pathways (Friedman, Kern, Hampson, & Duckworth, 2014; Friedman, 2000; Hampson, 2012): (1) increased health-promoting behaviors and the avoidance of risky activities (Bogg & Roberts, 2004), including increased treatment adherence (Molloy, O'Carroll, & Ferguson, 2014; O'Cleirigh, Ironson, Weiss, & Costa, 2007) and decreased substance use (Atherton, Robins, Rentfrow, & Lamb, 2014; Terracciano, Löckenhoff, Crum, Bienvenu, & Costa, 2008); (2) selection into health-promoting pathways and environments (Bogg & Roberts, 2013; Friedman et al., 2014), including increased education (Kern, Hampson, Goldberg, & Friedman, 2014), more productive careers (Kern, Friedman, Martin, Reynolds, & Luong, 2009), and stable social relationships (Hill, Nickel, & Roberts, 2014); and (3) physiological differences, including underlying third variables that influence both personality development and disease risk (e.g., genes; Hampson & Friedman, 2008), as well as health-protective physiological factors and feedback loops that protect against the development of disease (Weston, Hill, & Jackson, 2015). Cumulatively, these complex influences show up in mortality risk, a highly reliable, valid, and important outcome.

Neuroticism

In contrast, the long-term implications of neuroticism are not well understood. Neuroticism is the tendency towards emotional reactivity, anxiety, and negative affect (John & Srivastava, 1999). As opposed to being stable, calm, and contented, individuals high in neuroticism are tense, anxious, moody, touchy, and high-strung (John et al.,

2008). Neuroticism is a broad construct (Costa & McCrae, 1987) and shares common variance with negative affect (Watson & Clark, 1992) and other related measures, including anxiety, depressive symptoms, and self-consciousness (Smith & MacKenzie, 2006). In fact, measures such as anxiety, neuroticism, depression, and maladjustment may all be part of a single, unified construct (Watson & Clark, 1984), complicating our understanding of whether and when neuroticism is related to consequential outcomes, relative to clinically-meaningful psychopathology and other personality-related problems; (Boudreaux, Piedmont, Sherman, & Ozer, 2013).

Neuroticism is associated with decreased subjective well-being (Costa & McCrae, 1980; Diener, Oishi, & Lucas, 2003), and poorer self-rated health (Svedberg, Bardage, Sandin, & Pedersen, 2006), but the relations to objective health and mortality risk are uncertain, with some studies showing negative sequelae (Abas, Hotopf, & Prince, 2002; Denollet, Stroobant, Rombouts, Gillebert, & Brutsaert, 1996; Goodwin & Friedman, 2006; Schulz, Bookwala, Knapp, Scheier, & Williamson, 1996; Shipley, Weiss, Der, Taylor, & Deary, 2007; Wilson, Mendes de Leon, Bienias, Evans, & Bennett, 2004), and others showing null effects (Almada et al., 1991; Iwasa et al., 2008; Mosing et al., 2012) or benefits (Korten et al., 1999; Taga, Friedman, & Martin, 2009; Weiss & Costa, 2005). Neuroticism is associated with poor subjective and objective well-being through risky health behaviors such as smoking (Hall, Fong, & Epp, 2013), self-selection into stressful situations (Kern, Della Porta, et al., 2014), and difficulty coping with stressful life events (Connor-Smith & Flachsbart, 2007; Gunthert, Cohen, & Armeli, 1999; Watson & Hubbard, 1996).

However, it is also well-known that neuroticism is associated with vigilance to symptoms, physical complaints, perceived suffering, and increased sensitivity to side effects of medications (DeNeve & Cooper 1998; Dorsey & Bootzin, 1997; Johnson & Neilands, 2007; Watson & Pennebaker, 1989). Thus, there is substantial uncertainty as to whether and when and why neuroticism is related to actual health problems and increased mortality risk, or rather, heightened sensitivity to somatic symptoms without an increase in mortality risk (Costa & McCrae, 1987; Friedman & Kern, 2014). Some of the uncertainly may arise from how neurotic tendencies interact with other traits and play out across situations.

Trait Combinations

The trait combinations of conscientiousness and neuroticism, and their associations to health and well-being, have received little attention, despite their likely significance to health trajectories. Trait combinations may be particularly important to study because they uniquely define specific groups of individuals (Asendorpf, 2002; Costa & Herbst, 2002; DeYoung, 2006) and can better explain certain complex phenomena (Hogan & Roberts, 1996) than individual traits on their own. The combination of conscientiousness and neuroticism may be especially important due to emergent behavior patterns. In particular, Friedman (2000) proposed the idea of a healthy neuroticism: that is, good health may emerge when the increased vigilance associated with high neuroticism combines with the responsibility and persistence associated with high conscientiousness to affect a host of healthy behaviors and protective psychosocial actions. Other researchers have analogously proposed that "overcontrolled" individuals

might seek treatment for medical symptoms earlier, better adhere to treatment regimens, follow public health recommendations, and ultimately live longer lives (Robins, John, Caspi, Moffitt, & Stouthamer-Loeber, 1996; Van Leeuwen, De Fruyt, & Mervielde, 2004).

Most of the research on combinations of conscientiousness and neuroticism has focused on health behaviors. One study found that combinations of high conscientiousness and neuroticism were not associated with smoking until the onset of disease (Weston & Jackson, 2015), at which time individuals high in both traits were more likely to quit. In another study, neuroticism was related to smoking, but particularly for people low in conscientiousness (Terracciano & Costa, 2004). When examining multiple health behaviors, Turiano and colleagues (2012) found that individuals low in conscientiousness and high in neuroticism reported more alcohol consumption than individuals high in conscientiousness and high in neuroticism, but no interaction between conscientiousness and neuroticism for smoking and drug use. Further evidence for the importance of these personality styles comes from a study showing those low in conscientiousness and high in neuroticism were the most likely to binge eat and binge drink (Rush, Becker, & Curry, 2009); however, this study compared this group against all other participants, which might mask health-relevant processes for individuals high in conscientiousness and neuroticism.

Scattered additional evidence supports the idea that although individuals high on neuroticism will report more stress and health problems, those neurotics who are also high on conscientiousness will take protective actions or enter healthier situations,

resulting in better objective health and presumably in increased longevity. Such matters could have important implications for interventions that target personality in the hope of altering health outcomes (Vollrath & Torgersen, 2000). Attempts to impact health and health behaviors by changing aspects of neuroticism may not be fruitful without considering levels of conscientiousness. In support of this, individuals from the Midlife Development in the U. S. Study (MIDUS) who were both high in both conscientiousness and neuroticism had low circulating interleukin-6 levels (a marker of inflammation), partially because the "healthy neurotics" were less likely to be overweight (Turiano, Mroczek, Moynihan, & Chapman, 2013). All in all, these limited results suggest that combinations of conscientiousness and neuroticism are important to health, but when do conscientiousness- neuroticism combinations predict subjective well-being and when do they predict more objective health outcomes? That is, when is "healthy neuroticism" healthy?

The Current Study

In order to understand whether and when combinations of conscientiousness and neuroticism are related to health and to subjective well-being, multi-method, longitudinal studies are needed, with comprehensive, distinct outcome measures (Friedman & Kern, 2014). To address this matter, combinations of conscientiousness and neuroticism were examined in relation to physical health, mental health, and subjective well-being in the Terman sample, a prospective, longitudinal study which was started by Lewis Terman and has followed 1,528 gifted Californian children since the 1920s. Because the Terman data include self- and observer-reports of adult personality, health, and well-being, as

well as objectively-measured length of life through 2009 (via death certificates; Duggan & Friedman, 2014), the current study addresses many of the problems and challenges of this literature while shedding light on the context and consequences of personality traits throughout the life course.

Chapter 2

Methods

Data Collection

Data were refined and supplemented with death certificates to ascertain and verify length of life for participants from the Terman Life Cycle Study, started by Lewis Terman between 1917 and 1921. All archival data supplementation and death certificate collection procedures were reviewed and approved by the University of California, Riverside Human Research Review Board. Terman asked California schoolteachers to nominate the youngest and brightest children in their classes, and those with an IQ of at least 135 were admitted to the study (Terman, 1925). Terman added participants until 1928, yielding a final sample of 1,528 intelligent boys (N = 856) and girls (N = 672). Participants were mostly White, middle-class children who were then followed every 5 to 10 years throughout their lives, with survey assessments through 1999. In order to be consistent with previous work using these data, the current study was limited to participants born between 1904 and 1915 who lived to at least 1940 and had complete personality data in 1940. Of the original sample, 1,373 participants were born between 1904 and 1915, 50 died prior to 1940, and 210 were missing adult conscientiousness and neuroticism data, yielding a final sample size of 1113 (Mage = 29.50, SD = 2.89; 55.7% male). Participants who did not have adult personality data but who were born between 1904-1915 and lived to at least 1940 did not differ on measures of conscientiousness (t(1210) = -0.26, p = .79) or permanency of mood (t(1272) = 0.60, p = .53) in childhood.

Measures

Personality. In 1940, participants completed the Bernreuter Personality Inventory (Bernreuter, 1933) and 14 additional self-report personality items. Scales corresponding to four of the NEO Personality Inventory-Revised (NEO PI-R; Costa & McCrae, 1992) dimensions were created and validated (for additional details, see Martin & Friedman, 2000). In the current study, we focus on conscientiousness (7 items; α = .65) and neuroticism (17 items, α = .85). Sample conscientiousness items include "Do you enjoy planning your work in detail?", "How impulsive are you?", and "How persistent are you in the accomplishment of your ends?" Sample neuroticism items include "Are you moody?", "Do your feelings alternate between happiness and sadness without apparent reason?", and "Do you often feel just miserable?" For personality descriptives for the full sample, see Table 1. For descriptives separately by sex, see Tables 2 and 3.

Longevity. Death certificates were obtained from state and county agencies through 2009. For participants for whom we obtained death certificates, the average age of death is 76.54 (*SD* = 14.14). Individuals without a vital status (9%) are censored at their last date of follow-up in the survival analyses. Thus, lifetime attrition of those with adult personality data is very low, as most of the death certificates have been located. Fewer than 30 were known to be alive as of 2009.

Table 1. *Descriptives for the full sample (N = 1113).*

Variable	*N*	*M* (*SD*)	Median	Range
Adult personality				
Conscientiousness	1113	10.02 (0.63)	10.11	8.07-11.68
Neuroticism	1113	10.00 (0.60)	9.91	8.77-11.89
Physical health				
Age at death	1013	76.54 (14.14)	79.52	28.70-102.71
Self-rated health, 1940	1046	3.33 (0.76)	3.00	1-4
Mental health				
Terman-rated mental adjustment, 1940	1102	2.76 (0.50)	3.00	1-3
Self-reported psychological adjustment, 1950	917	4.98 (1.90)	5.00	1-9
Subjective well-being				
Living up to potential, 1950	919	3.88 (1.27)	4.00	1-6
Extent enjoying social relationships, 1950	912	6.00 (1.78)	6.00	2-11
Life satisfaction, 1950	902	4.13 (1.73)	4.00	1-9

Self-rated physical health. In 1940, participants also reported their own health in recent years; we categorized self-rated physical health using a 4-point scale (1 = very poor or poor health; 2 = fair; 3 = good; 4 = very good health). Participants generally reported feeling in good health (M = 3.33, SD = 0.76).

Mental health. In 1940, Terman and colleagues drew on meetings with the participants and their families, personal correspondence, and data on the participants' tendency toward nervousness, anxiety, and mental breakdowns in order to categorize their mental health (Duggan & Friedman, 2014; Terman & Oden, 1947). Three categories emerged: (1) participants with serious maladjustment (those with marked symptoms of anxiety, depression, personality maladjustment, psychopathic personality, or a mental breakdown requiring hospitalization; 3.5% of the current sample), (2) participants with some maladjustment (those with emotional conflicts, nervous

tendencies, and social maladjustments that were definite problems but did not interfere significantly with their social or personal lives or with their achievement; 16.4% of the current sample), and (3) satisfactory adjustment (reporting desires, emotions, and interests that were compatible with the social standards and pressures of their environments, and able to cope adequately with difficulties; 80% of the current sample).

Participants also self-reported their psychological adjustment in 1950 by responding to six items on their happiness of temperament, self-confidence, whether they were easy to get along with, moodiness, feelings of inferiority, and sensitive feelings. These items were averaged and participants were categorized on a 9-point scale (1 = poor adjustment; 9 = well-adjusted; Tucker et al., 1997). Consistent with Terman's mental adjustment categorization from 1940, most participants reported feeling moderately well-adjusted in 1950 (M = 4.98, SD = 1.90).

Table 2. *Descriptives for males (n = 620).*

Variable	*N*	*M* (*SD*)	Median	Range
Adult personality				
Conscientiousness	620	10.08 (0.64)	10.16	8.07-11.68
Neuroticism	620	9.92 (0.61)	9.83	8.77-11.89
Physical health				
Age at death	579	75.19 (14.46)	78.46	30.54-100.82
Self-rated health, 1940	579	3.42 (0.71)	4.00	1-4
Mental health				
Terman-rated mental adjustment, 1940	613	2.77 (0.50)	3.00	1-3
Self-reported psychological adjustment, 1950	505	5.08 (1.87)	5.00	1-9
Subjective well-being				
Living up to potential, 1950	505	3.89 (1.24)	4.00	1-6
Extent enjoying social relationships, 1950	503	5.85 (1.85)	6.00	2-11
Life satisfaction, 1950	497	4.26 (1.79)	4.00	1-9

Subjective well-being. In 1950, participants responded to a number of questions regarding their satisfaction with life. First, participants answered how well they had lived up to their intellectual potential and whether they were satisfied with their present occupation on a 6-point scale (Martin, Friedman, Clark, & Tucker, 2005). These items were averaged and rounded to whole numbers; higher scores indicate participants felt they were living up to their potential (M = 3.88, SD = 1.27). Next, participants reported whether they were enjoying their social relations using a single item, 11-point scale (Tucker et al., 1997); participants were moderately satisfied with their social relationships (M = 6.00, SD = 1.78). Participants also reported their satisfaction with life on a 9-point scale across 9 additional domains (work, recognition for accomplishments, income, avocational activities, marriage, children, religion, social contacts, and community service). These items were averaged and represent participants' overall satisfaction with life (M = 4.13, SD = 1.73).

Table 3. *Descriptives for females (n = 493).*

Variable	*N*	*M* (*SD*)	Median	Range
Adult personality				
Conscientiousness	493	9.95 (0.61)	9.99	8.16-11.31
Neuroticism	493	10.10 (0.58)	10.02	9.06-11.86
Physical health				
Age at death	434	78.34 (13.52)	80.93	28.70-102.71
Self-rated health, 1940	467	3.22 (0.81)	3.00	1-4
Mental health				
Terman-rated mental adjustment, 1940	489	2.76 (0.51)	3.00	1-3
Self-reported psychological adjustment, 1950	412	4.86 (1.93)	5.00	1-9
Subjective well-being				
Living up to potential, 1950	414	3.88 (1.31)	4.00	1-6
Extent enjoying social relationships, 1950	409	6.18 (1.68)	6.00	2-10
Life satisfaction, 1950	405	3.97 (1.64)	4.00	1-9

Analyses

Personality trait combinations. After examining the distribution of conscientiousness and neuroticism in 1940, these traits were centered on the number 10 (subtracting a constant) to aid in the interpretability of the regression and survival analysis estimates. Two measures of the interaction between conscientiousness and neuroticism were created (Cohen, Cohen, West, & Aiken, 2003). First, a linear interaction (Terracciano & Costa, 2004; Turiano et al., 2013, 2012; Weston & Jackson, 2015) was examined, which multiplies centered conscientiousness and centered neuroticism together. Individuals with scores near 0 were near the middle on both traits. Individuals with positive values either scored high (greater than or equal to 0) on both conscientiousness and neuroticism, or low (lower than 0) on both conscientiousness and neuroticism. Individuals with negative values scored high on one trait, but low on the

other. Thus, the linear interaction does not test whether the interaction of conscientiousness and neuroticism is limited to one specific group (such as individuals high in both conscientiousness and neuroticism); rather, it has an inherent contrast that tests the consistent combinations (participants scoring high or low on both traits) on the outcome against inconsistent combinations (participants scoring high on one trait but low on the other). Significant linear interactions were probed by visually examining plots of predicted scores for participants low (-1-2 *SD*s), at the middle (0), and high (+1-2 *SD*s) on each trait.

Because previous theory suggests that combinations of high conscientiousness and neuroticism should be health-protective, a multiplicative linear spline (hereafter referred to as a spline) was also examined. The spline term multiplies centered conscientiousness and neuroticism together, but only for participants "high" (scoring above 0) on both traits; all other participants are coded 0. Thus, all participants contribute to the spline model, but only those that are high on both traits contribute to the interaction term. This is a theoretically-driven model that specifies that there is no interaction between conscientiousness and neuroticism, except for participants high on both traits.

Survival analyses. To test whether personality trait and conscientiousness-neuroticism combinations in 1940 were related to mortality risk, we fitted nested Cox proportional hazards regression models (a form of survival analysis) using SAS software, version 9.3. Hazard regression analysis simultaneously considers the mortality rate across time and how this rate is related to each predictor. Furthermore, Cox models properly treat censored (unobserved) data, including left-censored data (created by our

decision to limit analyses to survival to 1940 and beyond) as well as right-censored data (where age at death is unknown). Thus, survival analysis is advantageous because rather than discarding individuals who have not yet died or who were lost to follow-up during the study, the participants are censored at their last age of follow-up (Cox, 1972), and all available data are utilized. In survival analyses, hazard ratios greater than 1 indicate that the parameter is associated with increased mortality risk, whereas a hazard ratio of less than 1 indicate that the parameter is associated with decreased mortality risk. Because models were nested within each other, deviance statistics across models were compared using chi-square difference test to establish the significance of added parameters. Thus, when evaluating the interaction parameters, both the change in overall model fit (using deviance statistics) and the significance of the interaction term were considered.

Linear regressions. To test whether personality trait and conscientiousness-neuroticism combinations in 1940 were related to well-being (physical health, mental health, and satisfaction with life), nested linear regression models were fitted in SAS. In linear regressions, beta weights (*B*s) are interpreted as the unit change in outcome variable per 1-unit increase in personality trait beyond the centering value (0 for each trait), controlling for the other variables in the model. Standardized beta weights (βs) are interpreted as the standard deviation change in the outcome variable per 1-standard deviation increase in personality trait, controlling for the other variables in the model. To evaluate the significance of the interaction parameter, both the change in overall model fit (by comparing variance explained) and the significance of the interaction parameter were considered.

Modeling strategy. Due to the likelihood of different personality and behavioral pathways to health for males and females, all models were examined separately by sex. In Models 1A and 1B, conscientiousness and neuroticism were tested as separate predictors of mortality risk (in the survival analyses) or well-being (in the linear-regressions). These models were computed to examine the associations between these traits and the outcome variable, independent of any other control variables or covariates. In Model 2, the joint ability of the two traits in predicting each outcome was compared against the ability of each predictor on its own by adding in both conscientiousness and neuroticism as predictors. In Models 3A (linear) and 3B (spline), the interaction terms were tested while controlling for the linear effects of conscientiousness and neuroticism. This ensures that a significant interaction between conscientiousness and neuroticism is not due to the participant's conscientiousness or neuroticism level, and is therefore a strict statistical test of the interaction.

Chapter 3

Results

Mortality Risk

As expected, different patterns emerged for men and women, and so the results are reported separately by sex. Table 4 reports the results for males. In separate models, high conscientiousness (Model 1A; $p = .24$) and high neuroticism (Model 1B; $p = .13$) were associated with slightly (and non-significantly) lower mortality risk ($ps \geq .13$). When both conscientiousness and neuroticism were entered into the same model and examined simultaneously in Model 2 ($p = .13$), only high neuroticism was a significant predictor of decreased mortality risk ($HR = 0.87$, $p = .05$), even after controlling for conscientiousness (which was also protective, but trending in significance; $HR = 0.89$, $p = .09$). This model fit significantly better than the model with conscientiousness alone (Model 1A; $p = .05$), and fit better than the model with neuroticism alone at trending significance (Model 1B; $p = .10$). Neither the linear term (Model 3A, $p = .12$; $HR = 0.91$, $p = .37$) nor the spline term (Model 3B, $p = .15$; $HR = 1.23$, $p = .64$) were consistently or significantly associated with mortality risk. Furthermore, the linear ($ps \geq .10$) and spline ($ps \geq .14$) did not fit significantly better than the models without the interaction terms. Thus, for males, the best-fitting model includes high levels of neuroticism and conscientiousness as predictors of decreased mortality risk; combinations of conscientiousness and neuroticism were not significantly associated with mortality risk over and above the linear levels of each trait.

Table 4. *Personality trait combinations and mortality risk for males.*

Model	Model Fit	Parameters		
		C	N	Interaction
1A: C	-2LL = 6283.990	*B* = -0.08		
	$\chi^2(1) = 1.36$	*HR* = 0.92		
	p = .24	*p* = .24		
1B: N	-2LL = 6282.993		*B* = -0.11	
	$\chi^2(1) = 2.35$		*HR* = 0.90	
	p = .13		*p* = .13	
2: C, N	-2LL = 6280.226	*B* = -0.12	*B* = -0.14	
	$\chi^2(2) = 5.12$	*HR* = 0.89	*HR* = 0.87	
	p = .08	*p* = .09	*p* = .05	
3A: C, N,	-2LL = 6279.432	*B* = -0.12	*B* = -0.15	*B* = -0.09
linear CxN	$\chi^2(3) = 5.91$	*HR* = 0.89	*HR* = 0.86	*HR* = 0.91
	p = .12	*p* = .09	*p* = .04	*p* = .37
3B: C, N,	-2LL = 6280.017	*B* = -0.13	*B* = -0.16	*B* = 0.21
spline CxN	$\chi^2(3) = 5.33$	*HR* = 0.88	*HR* = 0.85	*HR* = 1.23
	p = .15	*p* = .09	*p* = .06	*p* = .64
Model Fit Comparisons				
		Model 1A: C	Model 1B: N	Model 2: C, N
Model 2: C, N		$\Delta\chi^2(1) = 3.76$	$\Delta\chi^2(1) = 2.77$	N/A
		p = .05	*p* = .10	
Model 3A: C, N, linear CxN		$\Delta\chi^2(2) = 4.56$	$\Delta\chi^2(2) = 3.56$	$\Delta\chi^2(1) = 0.79$
		p = .10	*p* = .17	*p* = .37
Model 3B: C, N, spline CxN		$\Delta\chi^2(2) = 3.97$	$\Delta\chi^2(2) = 2.98$	$\Delta\chi^2(1) = 0.21$
		p = .14	*p* = .23	*p* = .65

Table 5 reports the results for females. In separate models, high conscientiousness (Model 1A; $p < .0001$) was associated with significantly lower mortality risk (*HR* = 0.71, $p < .0001$), whereas low neuroticism (Model 1B; $p = .004$) was associated with significantly decreased mortality risk (*HR* = 1.27, $p = .003$). When examined in the same model (Model 2; $p < .0001$), both high conscientiousness (*HR* = 0.74, $p < .0001$) and low neuroticism (*HR* = 1.18, $p = .05$) remained significant predictors of decreased mortality risk while controlling for each other. Model 2 fit significantly better than Model 1A (conscientiousness alone, $p = .05$) and Model 1B (neuroticism

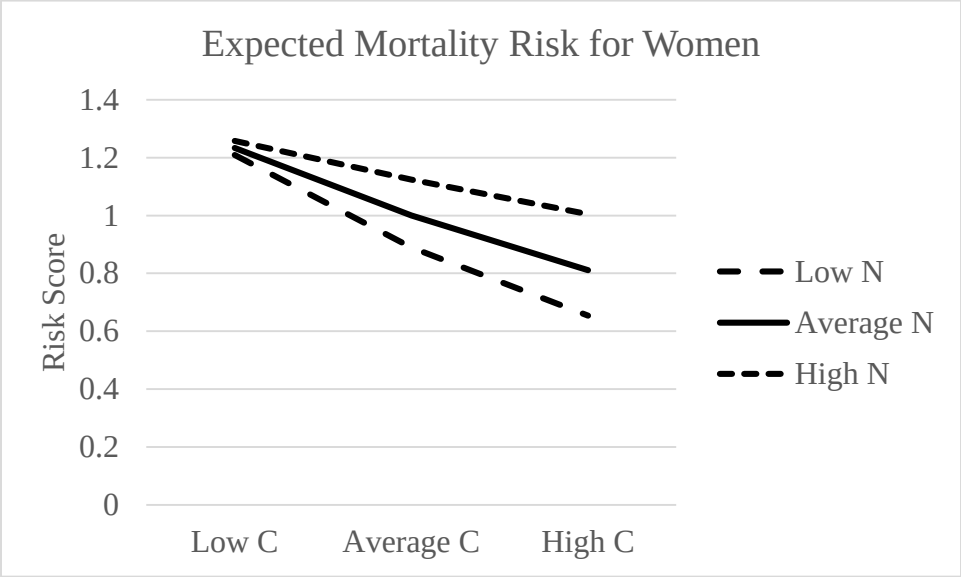
alone, $p = .0003$). The model with the linear interaction (Model 3A; $p < .0001$) fit significantly better than Model 1A (conscientiousness alone, $p = .01$), Model 1B (neuroticism alone, $p = .0001$), and Model 2 (both traits together, $p = .03$). In this model, high conscientiousness ($HR = 0.71$, $p < .0001$), low neuroticism ($HR = 1.22$, $p = .02$), and the linear interaction ($HR = 1.32$, $p = .03$) were statistically significant predictors of mortality risk. On the other hand, the model with the spline parameter (Model 3B, $p < .0001$) did not result in a significantly better fitting model than prior models ($ps \geq .07$), and the spline parameter was non-significant ($HR = 1.65$, $p = .20$), suggesting this interaction is not limited to participants high in conscientiousness and neuroticism. Thus, we retained Model 3A (linear interaction) as the best fitting model.

Table 5. *Personality trait combinations and mortality risk for females.*

Model	Model Fit	Parameters		
		C	N	Interaction
1A: C	-2LL = 4464.278	*B* = -0.34		
	$\chi^2(1) = 18.09$	*HR* = 0.71		
	p < .0001	*p* < .0001		
1B: N	-2LL = 4473.814		*B* = 0.24	
	$\chi^2(1) = 8.55$		*HR* = 1.27	
	p = .004		*p* = .003	
2: C, N	-2LL = 4460.502	*B* = -0.30	*B* = 0.16	
	$\chi^2(2) = 21.86$	*HR* = 0.74	*HR* = 1.18	
	p < .0001	*p* = .0002	*p* = .05	
4: C, N,	-2LL = 4455.702	*B* = -0.34	*B* = 0.20	*B* = 0.27
linear CxN	$\chi^2(3) = 26.66$	*HR* = 0.71	*HR* = 1.22	*HR* = 1.32
	p < .0001	*p* < .0001	*p* = .02	*p* = .03
5: C, N,	-2LL = 4458.982	*B* = -0.36	*B* = 0.11	*B* = 0.50
spline CxN	$\chi^2(3) = 23.38$	*HR* = 0.70	*HR* = 1.12	*HR* = 1.65
	p < .0001	*p* = .0001	*p* = .25	*p* = .20
Model Fit Comparisons				
		Model 1A: C	Model 1B: N	Model 2: C, N
2: C, N		$\Delta\chi^2(1) = 3.78$	$\Delta\chi^2(1)=13.31$	N/A
		p = .05	*p* = .0003	
3A: C, N, linear CxN		$\Delta\chi^2(2) = 8.58$	$\Delta\chi^2(2) =18.11$	$\Delta\chi^2(1) = 4.80$
		p = .01	*p* = .0001	*p* = .03
3B: C, N, spline CxN		$\Delta\chi^2(2) = 5.30$	$\Delta\chi^2(2) =14.83$	$\Delta\chi^2(1) = 1.52$
		p = .07	*p* = .0006	*p* = .22

To probe the linear interaction from Model 3A, we plotted simple slopes for participants at the centering value as well as 1 SD above and below the centering value. As shown in Figure 1, there is no effect of neuroticism at low levels of conscientiousness. However, at higher levels of conscientiousness, higher levels of neuroticism became increasingly associated with mortality risk. Thus, women high in conscientiousness and low in neuroticism are at the lowest mortality risk.

Figure 1. Expected Mortality Risk for Women



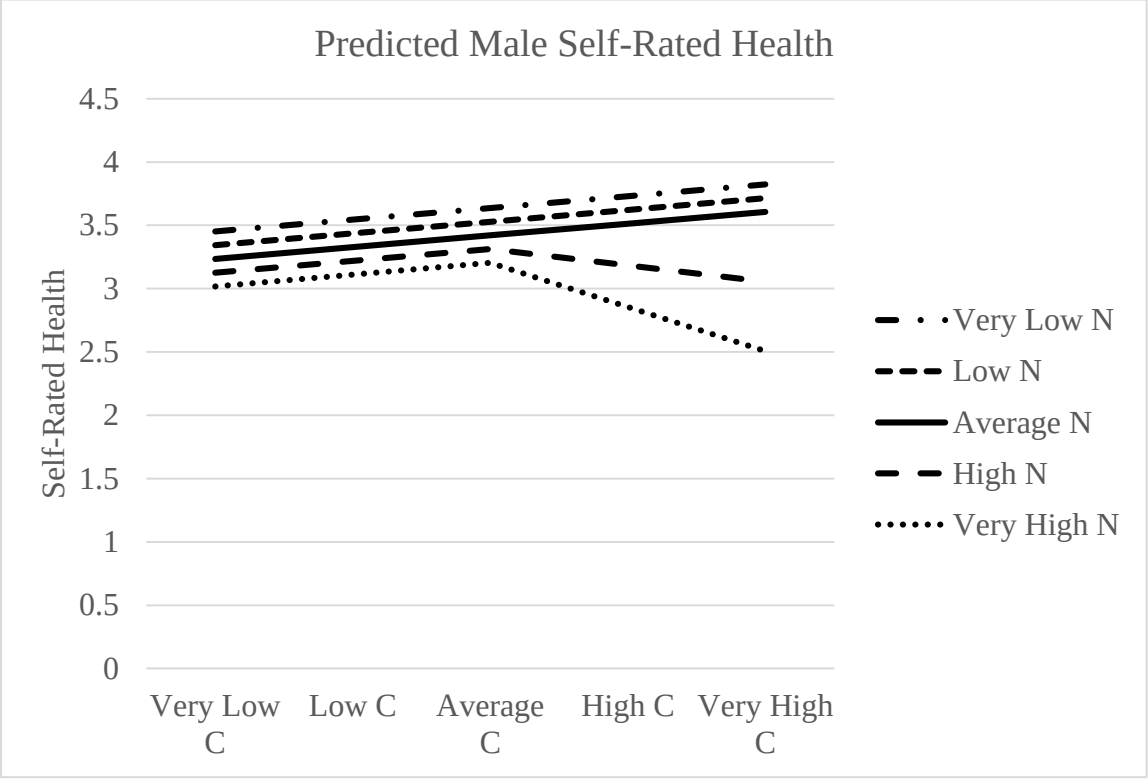
Self-Rated Physical Health

When included in separate models, high conscientiousness (Model 1A, R^2 = 1.89%; B = 0.16, p = .0005) and low neuroticism (Model 1B, R^2 = 5.90%; B = -0.25, p < .0001) were associated with significantly better self-rated physical health for males. When included in the same model (Model 2), variance explained increased (6.38%); both high conscientiousness (B = 0.09, p = .05) and low neuroticism (B = -0.26, p < .0001) remained statistically significant predictors of better self-rated health. The addition of the linear interaction (Model 3A) slightly decreased the variance explained (6.33%), and the linear parameter was non-significant (B = -0.06, p = .40). However, the addition of the spline interaction (Model 3B) increased variance explained (7.23%). In this model, conscientiousness (B = 0.15, p = .004), neuroticism (B = -0.19, p = .001), and the spline parameter (B = -0.62, p = .01) were statistically significant. This suggests that combinations of high conscientiousness and neuroticism are associated with significantly

lower self-rated physical health over and above linear conscientiousness and neuroticism levels (see Table 6).

This interaction was plotted in Figure 2 for male participants at the centering value, -1-3 *SD*s below the centering value, and 1-3 *SD*s above the centering value on conscientiousness and neuroticism. For most participants, conscientiousness was associated with better self-rated health, and neuroticism was associated with worse self-rated health. However, for participants high in conscientiousness and neuroticism, as conscientiousness increased, neuroticism became associated with relatively worse self-rated health. Thus, participants high in conscientiousness and high in neuroticism had the worst self-rated health.

Figure 2. Predicted Male Self-Rated Health



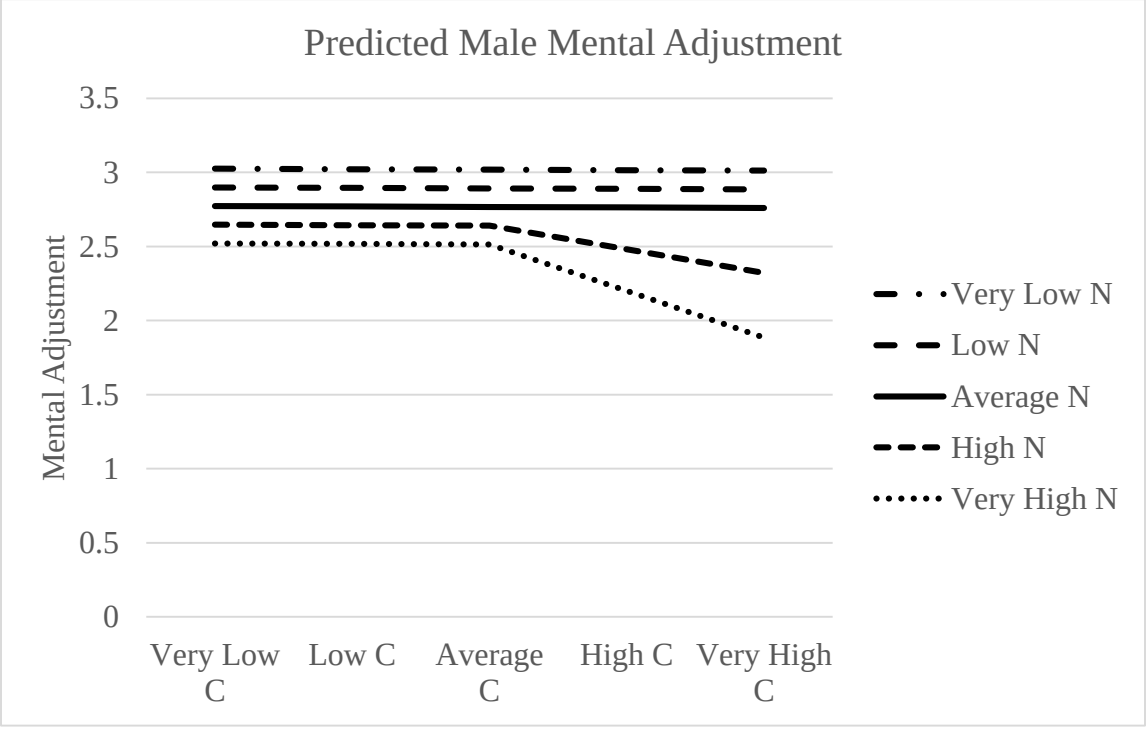
For women, when included in separate models, low neuroticism (Model 1B, R^2 = 5.84%; B = -0.25, p < .0001) but not conscientiousness (Model 1A, R^2 = 0.39%; B = 0.08, p = .09) was associated with significantly better self-rated physical health. When included in the same model (Model 2), variance explained decreased slightly from Model 1A (5.76%); low neuroticism (B = -0.24, p < .0001), but not conscientiousness (B = 0.03, p = .45), remained a significant predictor of better self-rated health. The addition of the linear interaction (Model 3A) slightly decreased the variance explained (5.73%), and the linear parameter was non-significant (B = -0.04, p = .35). The addition of the spline interaction (Model 3B) also decreased variance explained (5.77%), and the spline parameter was non-significant (B = -0.06, p = .30). Overall, the best-fitting model included only low neuroticism as a predictor of better self-rated health for women (see Table 7).

Mental Health

Terman-rated mental adjustment. For mental health, ratings made by Terman and colleagues in 1940 are available, as well as self-reports from 1950. For male Terman-rated mental adjustment in 1940, conscientiousness was not associated with mental adjustment (Model 1A, R^2 = 0; B = 0.04, p = .38), but high neuroticism was significantly worse mental adjustment (Model 1B, R^2 = 9.67%; B = -0.25, p < .0001). When combined in the same model (Model 2, R^2 = 9.85%), high neuroticism remained a statistically significant predictor of worse mental adjustment (B = -0.27, p < .0001), even after controlling for conscientiousness (which was non-significant; B = -0.05, p = .13). The addition of the linear interaction (Model 3A) did not substantially increase variance

explained (9.87%), and the linear parameter was non-significant (B = 0.04, p = .23). However, the addition of the spline interaction (Model 3B) did increase variance explained (10.72%). In this model, both neuroticism (B = -0.22, p < .0001) and the spline interaction (B = -0.44, p = .009) were significant predictors of mental adjustment, even after controlling for conscientiousness (B = -0.005, p = .88). Thus, we retained the spline (Model 3B) as the best fitting model. We plotted this spline interaction in Figure 3. As the figure shows, low levels of neuroticism were associated with significantly better mental adjustment, regardless of levels of conscientiousness. However, for participants high in conscientiousness and neuroticism, an interaction emerged, such that higher levels of conscientiousness and neuroticism were associated with increasingly worse mental adjustment as rated by Terman.

Figure 3. Predicted Male Mental Adjustment



For female Terman-rated mental adjustment, when examined separately, conscientiousness (Model 1A, R^2 = 0.11%) was not associated with mental adjustment (B = 0.05, p = .21), but neuroticism (Model 1B, R^2 = 4.14%) was (B = -0.18, p < .0001). Having both predictors in the same model (Model 2) decreased variance explained (3.99%); neuroticism remained significant (B = -0.18, p < .0001) and conscientiousness remained non-significant (B = 0.02, p = .64). The addition of the linear interaction (Model 3A) did not substantially increase variance explained (4.18%), and the linear parameter was non-significant (B = -0.08, p = .16). Similarly, the addition of the spline interaction (Model 3B) decreased variance explained (3.94%), and the spline parameter was non-significant (B = -0.16, p = .38). Overall, there was no interaction of conscientiousness and neuroticism; for women, neuroticism is the best predictor of observer-rated mental adjustment.

Self-reported psychological adjustment. Participants also provided information on their own psychological adjustment in 1950. For males, both high conscientiousness (Model 1A, R^2 = 0.83%; B = 0.30, p = .03) and low neuroticism (Model 1B, R^2 = 33.04%; B = -1.77, p < .0001) were significantly associated with better self-reported psychological adjustment. When combined into the same model (Model 2, R^2 = 33.43%), high neuroticism remained a statistically significant predictor of worse self-reported psychological adjustment (β = -0.60, p < .0001). However, the direction of the conscientiousness parameter reversed; after controlling for neuroticism levels, high conscientiousness was associated with significantly worse mental adjustment (β = -0.08, p = .05). The addition of the linear interaction (Model 3A), slightly decreased variance

explained (33.29%), and the linear interaction was non-significant (B = 0.00, p = .99). The addition of the spline interaction (Model 3B) did not substantially improve variance explained (R^2 = 33.61%), and the spline interaction was non-significant (B = 0.89, p = .12). Overall, the best-fitting model includes only neuroticism as a predictor of psychological adjustment. These results also suggest that the interaction of conscientiousness and neuroticism is more important to observer rather than self-reports of psychological adjustment for males.

For females, conscientiousness was not significantly associated with self-reported psychological adjustment (Model 1A, R^2 = 0; B = 0.07, p = .65). However, high levels of neuroticism were associated with significantly worse self-reported psychological adjustment (Model 1B, R^2 = 28.63%; B = -1.80, p < .0001). When combined in the same model (Model 2), conscientiousness and neuroticism explained slightly more variance (29%) than Model 1A (neuroticism alone). In this model high neuroticism was a significant predictor of worse self-reported psychological adjustment (B = -1.84, p < .0001), and high conscientiousness was associated with lower self-reported psychological adjustment at trending significance (B = -0.24, p = .08). The addition of the linear interaction (Model 3A) slightly decreased variance explained (28.85%), and the linear interaction was non-significant (B = -0.08, p = .70). The addition of the spline interaction (Model 3B) did not change the variance explained (28.94%), and the spline interaction was non-significant (B = -0.62, p = .42). These results mirror those of observer-rated mental health for females, and suggest that low neuroticism is the best predictor of self-reported psychological adjustment.

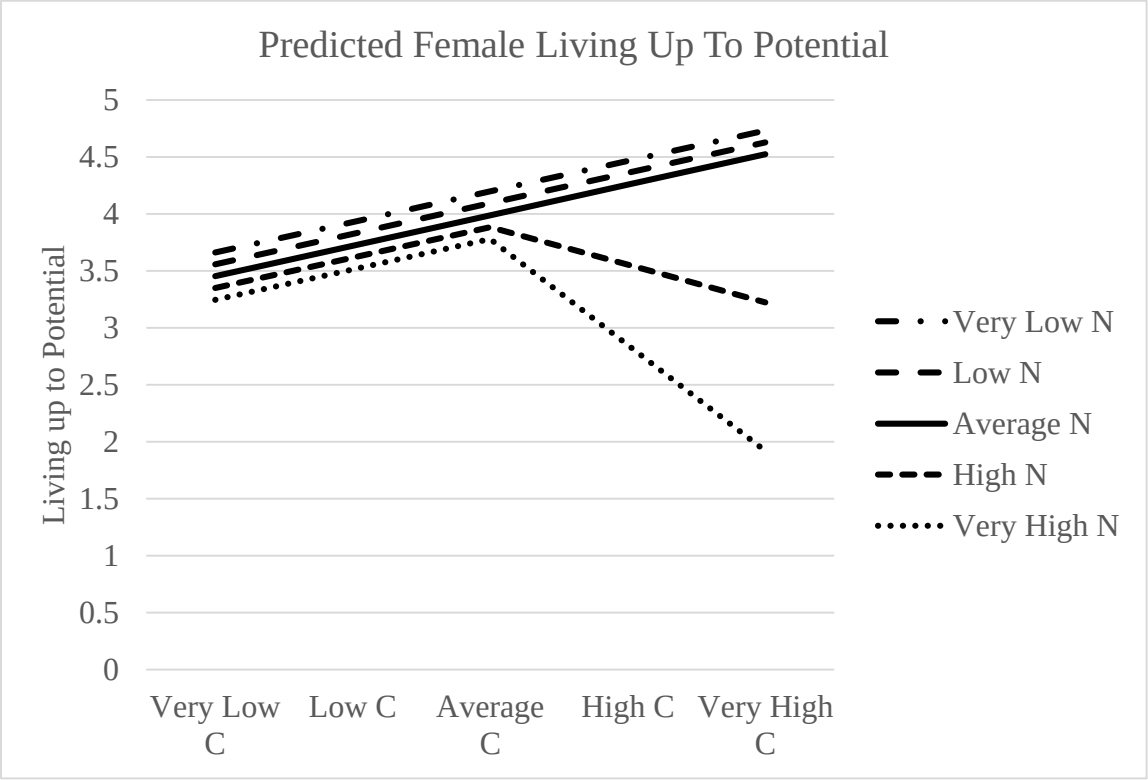
Subjective Well-Being

Living up to one's potential. When examined separately for men, both high conscientiousness (Model 1A, R^2 = 5.70%; B = 0.48, p < .0001) and low neuroticism (Model 1B, R^2 = 6.11%; B = -0.51, p < .0001) were associated with significantly higher feelings of having lived up to one's potential. When combined in the same model (Model 2), variance explained increased (9.05%); both high conscientiousness (B = 0.36, p < .0001) and low neuroticism (B = -0.40, p < .0001) remained statistically significant. The addition of the linear interaction (Model 3A) decreased the variance explained (8.86%), and the linear parameter was non-significant (B = -0.008, p = .95). The addition of the spline interaction (Model 3B) slightly increased the variance explained (9.21%), but the spline interaction was non-significant (B = -0.61, p = .17). Overall, these results suggest that linear levels of high conscientiousness and low neuroticism are the best predictors of feelings of having lived up to one's potential for males, but they do not interact.

When examined separately for females, both high conscientiousness (Model 1A, R^2 = 2.44%; B = 0.35, p = .0008) and low neuroticism (Model 1B, R^2 = 2.94%; B = -0.41, p = .0003) were associated with significantly higher feelings of having lived up to one's potential. When combined in the same model (Model 2), the variance explained increased (4.53%); both high conscientiousness (B = 0.30, p = .005) and low neuroticism (B = -0.35, p = .002) remained significant. The addition of the linear parameter (Model 3A) slightly increased the variance explained (4.95%), but the linear interaction was only trending in significance (B = -0.08, p = .10). The addition of the spline for females high in conscientiousness and neuroticism (Model 3B) increased the variance explained

(6.08%). In this model, high conscientiousness (B = 0.44, p = .0001) and the spline parameter (B = -1.69, p = .006) were statistically significant; neuroticism (B = -0.18, p = .16) was non-significant. This spline interaction was visually examined and plotted in Figure 4. Higher levels of conscientiousness and lower levels of neuroticism were associated with higher ratings of having lived up to one's potential. However, for women high in conscientiousness and neuroticism, increasingly higher levels of both traits were associated with worse ratings of having lived up to one's potential. Overall, these results suggest that women high in conscientiousness are more likely to feel they have lived up to their potential, but women high in conscientiousness and neuroticism are less likely to feel they have lived up to their potential.

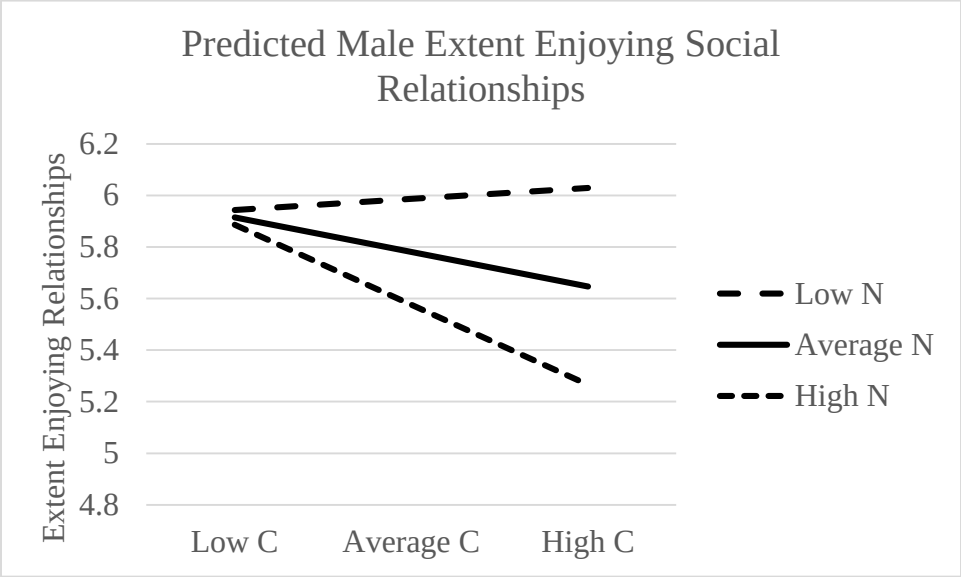
Figure 4. Predicted Female Ratings of Living up to One's Potential



Enjoyment of social relationships. When examined separately for males, conscientiousness was not significantly associated with enjoyment of social relationships (Model 1A, R^2 = 0.09%; B = -0.16, p = .23), but low neuroticism was associated with more enjoyment of social relationships at trending significance (Model 1B, R^2 = 0.44%; B = -0.24, p = .07). When combined in the same model (Model 2), the variance explained increased (0.90%); low levels of conscientiousness (B = -0.25, p = .07) and neuroticism (β = -0.32, p = .02) were associated with greater enjoyment of social relationships. The addition of the linear interaction (Model 3A) increased the variance explained (1.97%). In this model, low neuroticism (B = -0.35, p = .01) and the linear interaction (B = -0.50, p = .01) were significantly associated with enjoyment of social relationships; conscientiousness was non-significant but associated with lower enjoyment of social relationships (B = -0.22, p = .11). The addition of the spline interaction (Model 3B) decreased variance explained (1.06%), and the spline interaction was non-significant (B = -0.93, p = .18). Overall, these results suggest there is a true linear interaction between conscientiousness and neuroticism for the male participants.

To probe the linear interaction from Model 3A, we plotted simple slopes for male participants at the centering value as well as 1 SD above and below the centering value. As shown in Figure 5, at low levels of conscientiousness, there is no effect of neuroticism. However, at high levels of conscientiousness, men high in neuroticism have particularly low enjoyment of social relations.

Figure 5. Predicted Male Extent Enjoying Social Relationships

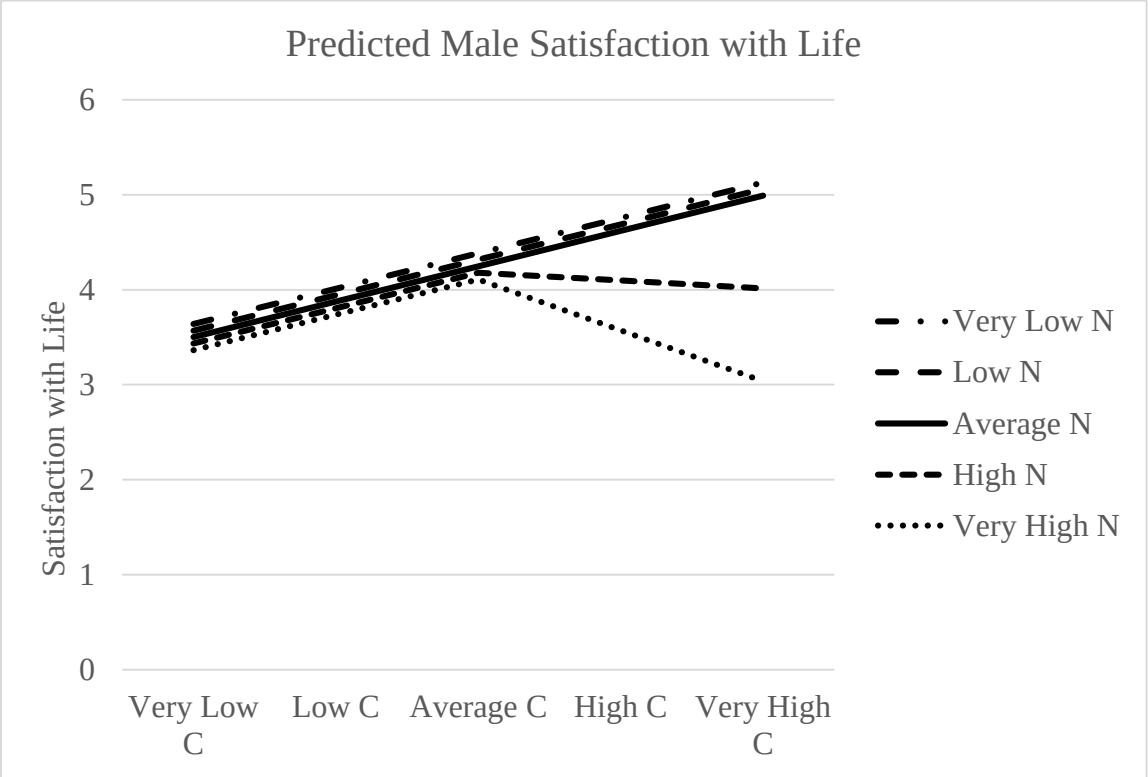


When examined separately for women, conscientiousness was not associated with enjoyment of social relationships (Model 1A, R^2 = -0.23; B = -0.04, p = .78), but low levels of neuroticism were associated with significantly greater enjoyment of social relationships (Model 1B, R^2 = 2.75%; B = -0.50, p = .0004). When combined in the same model (Model 2), the variance explained decreased slightly (2.70%), and neuroticism was the only statistically significant predictor (B = -0.53, p = .0003). Adding the linear interaction (Model 3A) did not change the variance explained (2.74%), and the linear interaction was non-significant (B = 0.24, p = .28). The addition of the spline interaction (Model 3B) decreased variance explained (2.61%), and the spline interaction was non-significant (B = 0.62, p = .44). These results suggest that neuroticism is the most important predictor of enjoyment of social relationships for women.

Life satisfaction. When examined separately, both high conscientiousness (Model 1A, R^2 = 3.71%; B = 0.56, p < .0001) and low neuroticism (Model 1B, R^2 =

1.88%; B = -0.42, p = .001) were associated with significantly higher life satisfaction. When combined in the same model (Model 2), both parameters remained statistically significant; high conscientiousness (B = 0.48, p = .0002) and low neuroticism (B = -0.28, p = .04) explained 4.34% of the variance in satisfaction with life. The linear interaction was non-significant (B = -0.23, p = .23), and Model 4 did not substantially increase the variance explained (4.43%). However, the addition of the spline interaction for the high conscientiousness, high neuroticism groups increased the variance explained (4.87%). In this model, individuals high in conscientiousness had significantly higher life satisfaction (B = 0.61, p < .0001), whereas individuals high in both conscientiousness and neuroticism had lower life satisfaction (B = -1.28, p = .05). Plots of the interaction (Figure 6) revealed that at low levels of neuroticism, conscientiousness was associated with greater male satisfaction with life. However, at higher levels of conscientiousness and neuroticism, neuroticism became associated with increasingly poor satisfaction with life.

Figure 6. Predicted Male Satisfaction with Life.



For women, the interaction of conscientiousness and neuroticism was less important to satisfaction with life. When examined in separate models, conscientiousness (Model 1A, R^2 = 1.44%; B = 0.35, p = .009) was associated with significantly higher satisfaction with life, but neuroticism was not (Model 1B, R^2 = 0.22%; B = -0.20, p = .17). When combined in the same model (Model 2), the variance explained slightly decreased (1.40%) from the model with conscientiousness alone (Model 1A); conscientiousness was a significant predictor (B = 0.33, p = .02) of life satisfaction, but neuroticism was not (B = -0.13, p = .36). The addition of the linear interaction (Model 3) slightly decreased the variance explained (1.32%). In this model, conscientiousness was

a significant predictor of life satisfaction (B = 0.34, p = .01), but neuroticism (B = -0.15, p = .30) and the linear interaction (B = -0.19, p = .41) were not. The addition of the spline interaction for the high conscientiousness, high neuroticism group increased model fit (1.73%) and the interaction term was in the same direction as the linear interaction (B = -1.21), but did not reach traditional statistical significance levels (p = .13). However, all parameters were in the same direction as the results for living up to one's potential (conscientiousness, B = 0.43, p = .005; neuroticism, B = -0.01, p = .95), though effect sizes were slightly smaller and statistical significance was lower. Overall, for women the best fitting model for life satisfaction included high conscientiousness alone.

Table 6. *Personality trait combinations and well-being for males.*

DV	Interaction Type	Model Fit	Parameters			
			Intercept	C	N	Interaction
Self-rated health	Spline: men high in C and N have lower self-rated health	$F(3, 575) = 16.01$ $p < .0001$ $R^2 = .0723$	$B = 3.42$ $p < .0001$	$B = 0.15$ *Std. B* = 0.14 $p = .004$	$B = -0.19$ *Std. B* = -0.16 $p = .001$	$B = -0.62$ *Std. B* = -0.12 $p = .01$
Terman-rated mental adjustment	Spline: men high in C and N have lower mental adjustment	$F(3, 609) = 25.49$ $p < .0001$ $R^2 = .1072$	$B = 2.77$ $p < .0001$	$B = -0.005$ *Std. B* = -0.007 $p = .88$	$B = -0.22$ *Std. B* = -0.27 $p < .0001$	$B = -0.44$ *Std. B* = -0.12 $p = .009$
Self-reported psychological adjustment	N/A	$F(1, 503) = 249.71$ $p < .0001$ $R^2 = .33.04$	$B = 4.94$ $p < .0001$		$B = -1.77$ *Std. B* = -0.58 $p < .0001$	
Living up to potential	N/A	$F(2, 502) = 26.06$ $p < .0001$ $R^2 = .0905$	$B = 3.82$ $p < .0001$	$B = 0.36$ *Std. B* = 0.18 $p < .0001$	$B = -0.40$ *Std. B* = -0.20 $p < .0001$	
Enjoying social relationships	Linear: men high in C and N report less enjoyment of social relationships	$F(3, 499) = 4.36$ $p = .005$ $R^2 = .0197$	$B = 5.78$ $p < .0001$	$B = -0.22$ *Std. B* = -0.07 $p = .11$	$B = -0.35$ *Std. B* = -0.12 $p = .01$	$B = -0.50$ *Std. B* = -0.11 $p = .01$
Satisfaction with life	Spline: men high in C and N report less satisfaction with life	$F(3, 493) = 9.47$ $p < .0001$ $R^2 = .0487$	$B = 4.23$ $p < .0001$	$B = 0.61$ *Std. B* = 0.22 $p < .0001$	$B = -0.12$ *Std. B* = -0.04 $p = .45$	$B = -1.28$ *Std. B* = -0.10 $p = .05$

Note. C = conscientiousness, N = neuroticism

Table 7. *Personality trait combinations and well-being for females.*

DV	Interaction Type	Model Fit	Parameters			
			Intercept	C	N	Interaction
Self-rated health	N/A	$F(1, 465) = 29.91$ $p < .0001$ $R^2 = .0584$	$B = 3.29$ $p < .0001$		$B = -0.34$ *Std. B* = -0.25 $p < .0001$	
Terman-rated mental adjustment	N/A	$F(1, 487) = 22.07$ $p < .0001$ $R^2 = .0414$	$B = 2.78$ $p < .0001$		$B = -0.18$ *Std. B* = -0.21 $p < .0001$	
Self-reported psychological adjustment	N/A	$F(1, 410) = 165.88$ $p < .0001$ $R^2 = .2863$	$B = 5.02$ $p < .0001$		$B = -1.80$ *Std. B* = -0.54 $p < .0001$	
Living up to potential	Spline: women higher in C and N report feeling less likely to have lived up to their potential	F(3, 410) = 9.92 $p < .0001$ $R^2 = .0608$	$B = 3.99$ $p < .0001$	$B = 0.44$ *Std. B* = 0.20 $p = .0002$	$B = -0.18$ *Std. B* = -0.08 $p = .16$	$B = -1.69$ *Std. B* = -0.16 $p = .006$
Enjoying social relationships	N/A	$F(1, 407) = 12.52$ $p = .0004$ $R^2 = .0275$	$B = 6.22$ $p < .0001$		$B = -0.50$ *Std. B* = -0.17 $p = .0004$	
Satisfaction with life	N/A	$F(1, 403) = 6.89$ $p = .009$ $R^2 = .0144$	$B = 3.98$ $p < .0001$	$B = 0.35$ *Std. B* = 0.13 $p = .009$		

Note. C = conscientiousness, N = neuroticism, and CxN represents the interaction of conscientiousness and neuroticism.

Chapter 4

Discussion

This study is the first to examine links between combinations of conscientiousness and neuroticism in adulthood with both self- and observer-reports of physical health, mental health, and subjective well-being. Overall, results show that relationships between combinations of conscientiousness and neuroticism — particularly high conscientiousness and neuroticism — and well-being depend on the measure as well as the observer. Neuroticism alone also emerged as an important predictor of well-being, including lower self-reported psychological adjustment for men, and lower physical health, Terman-rated and self-reported psychological adjustment, and less enjoyment of social relationships for women. Conscientiousness alone was related to higher satisfaction with life for women. Finally, high conscientiousness and low neuroticism were associated with more feelings of having lived up to one's potential (for men), as well as decreased mortality risk (for women).

Furthermore, "healthy neuroticism" (the interaction between neuroticism and conscientiousness) was associated with feelings of not having lived up to one's potential for women. For men, the interaction was associated with worse self-rated health, Terman-rated mental adjustment, lower satisfaction with life, and less enjoyment of social relations. Additionally, high conscientiousness and neuroticism (linearly, but not their interaction) was associated with lower male mortality risk for men. Thus, "healthy neuroticism" may not always be healthy, and this is particularly true for subjective well-being rather than mortality risk.

Physical health

For longevity, the single best measure of health (Friedman & Kern, 2014), results were mixed. For males, high neuroticism was protective against increased mortality risk, and conscientiousness was trending in significance. For women, both high conscientiousness and low neuroticism were health protective. However, there was a clear linear interaction, and simple slopes revealed women low in conscientiousness and high in neuroticism were at the greatest mortality risk. For self-rated health, a different pattern emerged. For males, high conscientiousness and low neuroticism were associated with significantly better self-rated health, but there was an interaction: men high on both traits had lower self-rated physical health. For women, only low neuroticism was associated with significantly better self-rated health.

Overall, personality trait interactions seem more important to objective health (mortality) for women, and subjective (self-rated) health for men. Furthermore, neuroticism was more important to subjective (rather than objectively measured) physical health, highlighting the differences between health and subjective well-being. This is consistent with relations between neuroticism and subjective well-being being due to sensitivity to physical complaints and subjective measures of health being clouded by perceived suffering or negative affect (DeNeve & Cooper 1998; Dorsey & Bootzin, 1997; Johnson & Neilands, 2007; Watson & Pennebaker, 1989). However, personality traits do not share definitional nor common method variance with mortality risk, which strengthens conclusions about the robustness of the relationship between personality and physical health.

Mental health

Just as there were divergent associations between combinations of conscientiousness and neuroticism with objective and subjective markers of physical health, there were also divergent associations for observer- and self-reported mental health. Terman and colleagues consistently rated male participants who were highly neurotic as having worse mental health; this was especially true for men high in conscientiousness. Yet for self-reported mental adjustment, there was no trait interaction; low neuroticism was associated with worse self-rated mental adjustment for men. For women, neuroticism was the best predictor of Terman-rated as well as self-reported mental adjustment.

It is not surprising that neuroticism predicts self-rated mental health, because neuroticism, depression, anxiety, and negative affect may be part of a single construct (Smith & MacKenzie, 2006; Watson & Clark, 1984; Watson & Clark, 1992). In support of this, the facets of anxiety, anger, and depression better predict subjective well-being than do self-consciousness, immoderation, and vulnerability (Schimmack, Oishi, Furr, & Funder, 2004). Stronger evidence for links between personality and psychological well-being comes from the association between neuroticism and Terman-rated mental health. For both men and women, high neuroticism was associated with worse observer-rated mental adjustment. Additionally, for men, high neuroticism was associated with relatively worse mental adjustment, particularly when paired with high conscientiousness. Terman had decades of written correspondence and in-person meetings with the participants and their families, and he relied on his experience as a

professional psychologist when making the ratings (Duggan & Friedman, 2014). Recent research (De Clercq, Rettew, Althoff, & De Bolle, 2012) suggests that children who are high in neuroticism and low in conscientiousness are more likely report behavioral problems and later be diagnosed with a mental health disorder. These results add to this literature by showing that these associations are also present in adulthood, and also by suggesting that the combination of high neuroticism and conscientiousness (not examined in that study) may also be risk factors for clinically-meaningful psychopathology (Boudreaux et al., 2013).

Satisfaction with Life

Consistent with the direction of the interaction for mental health, men high in conscientiousness and neuroticism tended to report less enjoyment of social relations and lower satisfaction with life, and women reported feeling less like they had lived up to their potential. Otherwise, results were mixed: high conscientiousness and low neuroticism were related to male living up to potential, low neuroticism to female enjoyment of social relations, and high conscientiousness to female satisfaction with life.

One of the more pressing questions in the science of well-being is understanding why certain variables differentially influence various subjective well-being measures, including emotional responses (e.g., psychological adjustment above) as well as cognitive evaluations of specific domains (e.g., enjoyment of social relations and living up to potential) and global judgments (e.g., satisfaction with life; Diener, Suh, Lucas, & Smith, 1999; Kahneman & Krueger, 2006). Personality traits are one of the most consistent predictors of subjective well-being (Diener et al., 1999). Although much research has

identified high neuroticism (Costa & McCrae, 1980; Diener et al., 2003; Headey & Wearing, 1989) — and to some extent, low conscientiousness (DeNeve & Cooper, 1998) — the current work adds to this literature by suggesting the combination of high conscientiousness and high neuroticism may be particularly risky.

Implications, Limitations, and Conclusions

Combinations of conscientiousness and neuroticism were associated with different pathways for men and women. For men, trait combinations were not associated with mortality but were associated with worse self-reported physical health, observer-rated mental health, and less enjoyment of social relationships. For women, trait combinations explained were relatively less important to physical and psychological well-being, and they also explained much less of the variance in these outcomes. Thus, understanding the relations between traits and well-being depends on the outcome as well as who is doing the rating.

Contrary to previous theory and research, our results suggest that "healthy neuroticism" might not always be healthy. Part of the reason for the different results may have to do with the function of conscientiousness and neuroticism for men and women. For men, neuroticism might have more to do with emotional lability and flexibility, whereas for women, it might be more related to negative affect. In support of this, although women score higher on all facets of neuroticism, this is particularly true for the anxiety and vulnerability facets (Costa, Terracciano, & McCrae, 2001). Men and women with these traits are also treated differently by others. Sex differences in perceived loneliness are explained by differences in neuroticism; that is, women who report feeling

dissatisfied with their social support also tend to be higher in neuroticism (Cheng & Furnham, 2002). Furthermore, individuals who become less optimistic (and thus, likely more anxious and depressed) experience decreases in social network size (Brissette, Scheier, & Carver, 2002), and strained friendships are related to lower subjective well-being, particularly for younger adults (Walen & Lachman, 2000). Thus, it is likely that high levels of neuroticism may have more strongly influenced the subjective well-being of women because of facet-level differences that influence the size and quality of their social support network. Future research could examine this by tracking personality (at the facet level), subjective well-being, and social support metrics across time.

Cohort differences in gender roles might also explain why traits and trait combinations were relatively less important for women. There is also some evidence that women's satisfaction with life is more influenced by the quality of their social relationships, particularly negative interactions, than men's (Brunstein, Dangelmayer, & Schultheiss, 1996; Rook, 1984; cf. Schimmack et al., 2002). This may be particularly true for neurotic women in the 1940s. However, World War II may have opened up new career opportunities for women (Goldin, 1991), which may have limited the social and emotional support resources available to neurotic women, but also given them a sense of purpose and control. This may be why conscientiousness was more predictive of women's satisfaction with life than it was for men.

The Terman cohort consists of intelligent, initially healthy, primarily middle-class White children, with access to health care and education at the start of the study. This limitation on generalizability is a simultaneous strength of the cohort, as early-life

differences related to socioeconomic status, ethnicity, or intelligence likely do not confound the current results. Importantly, the longitudinal, prospective nature of the current sample can be leveraged to study long-term personality processes related to mortality; although the Terman participants lived slightly longer (on average), their survival trajectories followed those of the general population (Duggan & Friedman, 2014). Furthermore, there is little to no selection for health-relevant traits based on selection due to IQ in the current sample (Reynolds, McArdle, Kern, & Friedman, 2016). However, the current study is limited to personality traits (1940) and well-being (1940-1950) measured during adulthood, though the robustness of the findings is strengthened via the use of mortality data collected through 2009.

The current findings, demonstrating a cross-sectional link between personality trait combinations and subjective well-being, as well as a nearly six-decade link between trait combinations and mortality risk for women, are an important extension to previous research on personality traits and health more generally (Friedman, 2000). Importantly, they also extend current research on independent associations between personality traits, health behaviors, coping, and inflammation (Rush et al., 2009; Turiano et al., 2013; Weston & Jackson, 2015) to multifactorial well-being and mortality. Future research in this sample and others could examine other traits, such as extraversion (Kokko, Tolvanen, & Pulkkinen, 2013), examine personality trait combinations in childhood, and also determine whether personality trait combinations predict trajectories of well-being from mid- into older-adulthood (1940-1960).

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