

Health processes in personality

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One of the leading models of personality is the Big Five taxonomy, representing five broad personality domains (conscientiousness, neuroticism, agreeableness, extraversion, and openness). The five-factor structure has been widely replicated through empirical investigations (Costa & McCrae, 1992; John & Srivastava, 1999). These personality traits have been demonstrated as reliable predictors of various health outcomes across the life span, including longevity (Hampson & Friedman, 2008), with the magnitude of personality effects being comparable to other widely used predictors of health (e.g., socioeconomic status and intelligence; Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007). Although empirical evidence is mounting that personality traits are associated with a host of important health outcomes, researchers have consistently called for more thorough investigations into the underlying mechanisms explaining these health processes (Eysenck, 1987; Friedman, 2000, 2008; Mroczek, 2014; Smith & MacKenzie, 2006; Turiano, Chapman, Gruenewald, & Mroczek, 2015). It is still unknown whether a single causal mechanism exists or if multiple mechanisms account for personality-health associations. Moreover, do these pathways differ across the lifespan? Answering these questions will provide a finer-grained understanding of how personality is associated with health outcomes across the lifespan.

The current chapter summarizes both theoretical and empirical evidence connecting personality to various health processes. We start with a broad overview of the various outcomes that personality can predict and the differences in associations by trait. The second part of the chapter provides an overview of the three main pathways linking personality to lifespan health outcomes, as adapted from seminal work by Smith (2006) and Adler and Matthews (1994). The pathway with the most empirical support to date is guided by the health behavior model of personality, which posits that certain personality traits may lead to either health promoting or debilitating behaviors that ultimately impact health and longevity over time (Turiano et al., 2015). The second pathway focuses on how physiological mechanisms explain why personality is associated with health outcomes (Smith, 2006). Specifically, personality influences appraisals of stressful circumstances and the resulting coping responses, which, in turn, alters physiological processes that are often involved in disease etiology. A third pathway focuses on person-environment transactions such that personality influences our social relationships, which, in turn, impact our exposure to stress and consequential coping mechanisms (Roberts, Smith, Jackson, & Edmonds, 2009). We also provide an integration of three mechanisms via the Personality and Health Processes (PHP) Model and discussion of the methodological techniques used to support these three mechanistic models. In the latter half of the chapter we discuss the translational potential of personality-health associations. Namely, how personality-health research can be used in a translational manner to improve lifespan health outcomes.

Personality traits and health outcomes

Individual differences in personality traits are valid and reliable predictors of health outcomes experienced at all stages of the lifespan (Hampson & Friedman, 2008). When considering the Big Five taxonomy, conscientiousness has been the trait with the most consistent associations across a variety of health outcomes. Those scoring higher on conscientiousness are typically persons who tend to be organized, responsible,

disciplined, goal-directed, and in control of impulses (Roberts, Lejuez, Krueger, Richards, & Hill, 2014). Thus, it is not surprising that those scoring higher on conscientiousness

are at a reduced risk of having common chronic health conditions (e.g., hypertension, stroke, diabetes, metabolic disorder; Goodwin & Friedman, 2006; Sutin et al., 2010; Weston, Hill, & Jackson, 2015), mild cognitive impairment or Alzheimer’s disease (Wilson, Schneider, Arnold, Bienias, & Bennett, 2007), tend to exhibit slower disease progression (Ironson, O’Cleirigh, Schneiderman, Weiss, & Costa Jr, 2008), and ultimately live longer lives (Jokela et al., 2013).

Neuroticism, and many of its underlying facets (e.g., anxiety, depression, negative affect, emotional reactivity), are also robustly associated with a variety of stress-related cardiovascular complications (Friedman & Booth-Kewley, 1987; Mangold & Wand, 2006; Spiro, Aldwin, Ward, & Mroczek, 1995; Suls & Bunde, 2005), such as increased stress hormone circulation (Portella, Harmer, Flint, Cowen, & Goodwin, 2005; Vedhara, Stra, Miles, Sanderman, & Ranchor, 2006; Zobel et al., 2004). Higher levels of neuroticism are also associated with immune (Sutin, Terracciano, et al., 2010) and metabolic dysfunction (Phillips et al., 2010; Sutin et al., 2010), and even an increased mortality risk in some populations (see Turiano et al., 2015 for discussion). Since higher levels of neuroticism are strongly associated with an increased stress response, there are robust associations neuroticism has with multiple negative health outcomes.

Extraversion, agreeableness, and openness to experience have typically shown less consistent associations with health relative to conscientiousness and neuroticism, and the associations may differ depending on the lower-order facets of these traits that one considers. Regarding agreeableness, lower levels of certain facets of the trait (e.g., hostility) are clearly associated with an increased risk of coronary heart disease (Friedman & Rosenman, 1959; Myrtek, 2001; Rosenman & Chesney, 1980) and increased mortality risk (Miller, Smith, Turner, Guijarro, & Hallet, 1996). Although evidence is not consistent across study populations and age groups, higher levels of extraversion are generally considered to be health protective, especially among facets related to activity and positive emotions (Cohen & Pressman, 2006; Weston et al., 2015; Wilson, Mendes de Leon, Bienias, Evans, & Bennett, 2004). Associations are also mixed between openness and health, with a handful of studies showing protective effects of this trait in terms of reduced risk of high blood pressure, stroke, and diabetes (Weston et al., 2015), slower disease progression (Ironson et al., 2008), and increased longevity (Iwasa et al., 2008; Jonassaint et al., 2007; Swam & Carmelli, 1996; Taylor et al., 2009; Turiano, Spiro III, & Mroczek, 2012).

Mechanisms explaining personality-health associations

There is a long history documenting how individual differences in personality traits predict health processes. However, it was not until late in the twentieth century when the personality-health field really shifted its focus from just examining the Big Five predicting health outcomes, to a focus on identifying the mechanisms responsible for the personality-health association—in other words, an inquiry into why personality traits would be associated with so many health outcomes. Adler and Matthews (1994) provided one of the first conceptual models outlining how the social environment, health-related behaviors, and psychophysiological factors are involved in the connection between individual dispositions and health outcomes. Smith (2006) updated these potential explanations of personality-health processes using much of the same pathways such as health behaviors, physiological responses to stress, and appraisal/coping resources. Smith also added a more thorough discussion of the bidirectional effects among each of these variables further highlighting the complex associations between personality and health. Although others have attempted to

summarize and advance the personality-health field (e.g., Ferguson, 2013; Friedman, 2000; Hampson, 2012), Smith (2006) and Adler and Matthews (1994) provided the foundation to understanding personality-health processes. However, at the time of the publication date, each proposed model was largely hypothetical in nature because there was not convincing empirical evidence supporting such theories/models. Moreover, the use of the term “mechanism” was appropriate, but the field still suffered from the lack of a clear methodological toolkit (e.g., mediation, longitudinal designs) that could be used to compile the evidence needed to

show why personality predicted lifespan health outcomes. [Hampson \(2012\)](#) recently took up this issue and provided a potential methodological roadmap for understanding how personality traits “get outside the skin” (see also this issue Hampson Chapter xx). Our goal here is to summarize the three main mechanisms underlying the personality-health association: (1) health behaviors; (2) physiological functioning; and (3) social relationships. We also seek to extend beyond single mechanistic models by describing a single model that explains how each of these processes is interconnected via the Personality & Health Processes (PHP) Model (see [Fig. 1](#)).

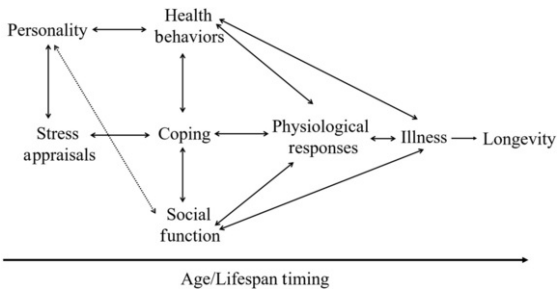


Fig. 1 Personality and Health Processes Model describing pathways of influence from personality to health.

alt-text: Fig. 1

Health behavior model

One of the most widely researched topics in terms of personality-health processes is the association between personality and health behaviors. Higher levels of conscientiousness have repeatedly shown to be associated with healthier behavior profiles. For example, a meta-analysis of 194 studies found that higher levels of conscientiousness were almost universally associated with more optimal health behaviors, such as increased physical activity and optimal dietary intake, lower levels of alcohol, tobacco, and drug use, and generally less risky behavior ([Bogg & Roberts, 2004](#); [Walton & Roberts, 2004](#)). Not only are more conscientious people less likely to engage in detrimental health behaviors, they are more likely to engage in prudent health behaviors ([Bogg & Roberts, 2004](#)), such as seeing a doctor regularly and adhering to medication regimens ([Christensen, Moran, & Wiebe, 1999](#); [Hill & Roberts, 2011](#)). Even under conditions of high stress, more conscientious individuals engage in more positive health behaviors than less conscientious individuals ([Korotkov, 2008](#)).

Neuroticism is also robustly associated with several key health behaviors that are detrimental to health over the short and long term. For example, more neurotic individuals are more

likely to smoke cigarettes ([Almada et al., 1991](#); [Mroczek, Spiro, & Turiano, 2009](#); [Rausch, Nicholson, Lamke, & Matloff, 1990](#)), abuse alcohol ([Grekin, Sher, & Wood, 2006](#); [Larkins & Sher, 2006](#); [Read & O'Connor, 2006](#)), and engage in unhealthy eating patterns ([Friedman, 2000](#)). Individuals scoring high in neuroticism may self-medicate feelings of stress with tobacco, alcohol, or drugs to alleviate their chronically high levels of negative affect and perceived stress, which leads to poorer health over time ([Eysenck, 1991](#); [Lerman et al., 2000](#)).

Trait-relevant behaviors of the other Big Five personality traits are less robust. Findings for agreeableness are not consistent at the trait level but two specific facets, hostility and aggression, are associated with increased use of alcohol, tobacco, and marijuana ([Gerrard, Gibbons, Stock, Houlihan, & Dykstra, 2006](#); [Hampson, Andrews, & Barckley, 2007](#); [Malouff, Thorsteinsson, Rooke, & Schutte, 2007](#); [Malouff, Thorsteinsson, & Schutte, 2006](#); [Terracciano, Löckenhoff, Crum, Bienvenu, & Costa, 2008](#)). Higher levels of extraversion measured in childhood ([Hampson, Goldberg, Vogt, & Dubanoski, 2006](#); [Tucker et al., 1995](#)), adolescence to early adulthood ([Allsopp, 1986](#); [Martsh & Miller, 1997](#)), and from younger to older adulthood ([Turiano, Whiteman, Hampson, Roberts, & Mroczek, 2012](#)) are associated with excessive alcohol use. Meta-analytic findings suggest that in some countries, higher levels of extraversion are associated with increased smoking rates ([Malouff et al., 2006](#); [Munafò, Zetteler, & Clark, 2007](#)), and extraversion is one of the strongest traits of the Big Five associated with increased physical activity levels ([Rhodes & Smith, 2006](#); [Wilson & Dishman, 2015](#)). Lastly, although the empirical literature on openness is sparse, there is some indication that marijuana users ([Terracciano et al., 2008](#)) and other illicit drug users ([Turiano, Whiteman, et al., 2012](#)) score higher on openness measures ([Terracciano et al., 2008](#)). At the facet level, it is widely replicated that individuals scoring lower on intelligence measures are more likely to smoke, abuse alcohol and drugs, and be overweight, to name a few ([Batty & Deary, 2004](#); [Gottfredson & Deary, 2004](#); [Taylor et al., 2003](#); [Whalley & Deary, 2001](#)).

The literature connecting each of the Big Five to unique health behaviors is much more expansive than described here, but the primary message is that some of the Big Five show clear associations with a diverse set of behaviors. To understand processes from trait, to behavior, to health outcomes, we rely on the health behavior model of personality. Formally labeled by [Smith \(2006\)](#), the model suggests that individuals with certain personality characteristics are more or less likely to engage in certain behaviors, and engagement in these behaviors will ultimately influence health and well-being over time. For example, a person scoring lower on trait conscientiousness is more likely to engage in detrimental health behaviors such as tobacco and alcohol use (e.g., [Bogg & Roberts, 2004](#)). There may be little to no negative health consequences in the short term from using such substances, but long-term use can have detrimental effects on health and longevity ([Mokdad, Marks, Stroup, & Gerberding, 2004](#)). In other words, behavioral choices explain why traits predict who is more or less likely to experience long-term health consequences later in life.

The health behavior model seems intuitive, but the problem is that there has been a piecemeal approach to testing it to date. Two separate literatures have connected this mechanistic process, with one documenting associations between personality and behavior, and the other set of findings focusing on links between personality and health. Since personality traits are associated with both behaviors and health outcomes, and the fact that these behaviors were strongly predictive of health themselves, researchers started connecting these separate empirical areas to suggest that personality must influence health through the behaviors one engages in. However, this approach is

problematic, methodologically speaking, because an analysis of mediation is necessary to conclude that behaviors do in fact explain why personality traits predict health (e.g., [Hayes, 2009](#)). To date, there have been only a handful of studies to our knowledge that have utilized appropriate tests of mediation, let alone the longitudinal data needed to provide more causal explanations needed when experimental data involving personality traits are limited.

One of the first investigations attempting to explicate the health behavior model of personality examined whether smoking cigarettes explained why higher levels of neuroticism predicted 30-year mortality risk in a sample of men from the Normative Aging Study ([Mroczek et al., 2009](#)). The authors found that higher levels of neuroticism did predict an increased hazard of dying over the follow-up period, and when smoking behavior was entered into the model as a covariate, the personality-mortality effect was substantially reduced. This reduction in effect provided preliminary evidence that behaviors could partly explain why personality predicted mortality, but no formal test of mediation was conducted. In fact, much of the early studies into the health behavior model relied on this statistical approach of examining how much personality-health outcome effects were attenuated when a third and possible explanatory variable was introduced into the model. In cases such as [Mroczek et al. \(2009\)](#), this approach was necessary because a simple test of mediation was not readily available at that time in a proportional hazards modeling framework, which is required when predicting death. That said, this study served as the foundation for others to properly use mediation to find empirical support of the health behavior model.

Formal tests of mediation analyses and more optimal temporal ordering of pathways were finally introduced to the personality-health field when [Ploubidis and Grundy \(2009\)](#) found that tobacco and alcohol use partially explained why adults higher in neuroticism and extraversion were more likely to die. This study was influential to the field because it demonstrated a novel technique of using structural equation modeling in a survival analysis framework to decompose direct and indirect pathways for more concrete evidence of indirect pathways connecting personality to health. Using these prior studies ([Mroczek et al., 2009](#); [Ploubidis & Grundy, 2009](#)) study as a foundation, [Turiano et al. \(2015\)](#) utilized a large sample from the National Midlife Development in the US (MIDUS) study to determine if each of the Big Five personality traits predicted 14-year mortality risk through a combination of several key health behaviors. Utilizing mediation tests via estimations of indirect effects, they found that those scoring lower on conscientiousness were more likely to die during the follow-up period because they used alcohol in higher quantities, were more likely to have used cigarettes in their lives, and had greater waist circumferences (a proxy for diet and physical activity levels). This study was critical because it was longitudinal and utilized several key health behaviors since personality-health processes are likely connected via multiple behaviors. Most importantly, the study utilized a formal test of mediation to show the processes involved from personality to health via behaviors. However, evidence of the temporal ordering of this causal pathway was lacking since it would be necessary to have at least three data points ([Hayes, 2009](#); [Maxwell & Cole, 2007](#)) with personality measured at the first wave, behavior measured at the second wave, and outcome measured at the third wave. Such data are scarce, but many ongoing longitudinal studies are currently on pace to collect data to allow for testing causal chains of influence.

Additional studies have been conducted since that have further advanced our understanding of mediation models and the precise pathways connecting personality to health. For example, a nationally representative sample of over 8000 adults from the United Kingdom, several health behaviors were tested as mediators of

the association between personality and two-year memory change in verbal learning and recall ([Allen, Laborde, & Walter, 2019](#)). Mediation models supported the health behavior model of personality for four of five traits. Those scoring higher on neuroticism were more likely to engage in sedentary behavior (e.g., greater television watching), which was associated with worse memory performance. High levels of extraversion were associated with increased physical activity, which, in turn, was related to better memory performance. Higher levels of agreeableness were associated with worse memory performance due to less physical activity, consumption of less alcohol, and more time viewing television. Lastly, lower levels of conscientiousness were associated with worse memory performance due to a lack of physical activity and greater television viewing. The longitudinal nature of this study, as well as the examination of multiple health behaviors, is a key example of what is needed in future studies exploring why personality is associated with health over time.

A final example also utilized the MIDUS sample by examining whether facets of personality trait domains predicted immune markers via physical activity levels ([Graham et al., 2018](#)). Results indicated that those scoring higher on the achievement facet (higher conscientiousness) had lower levels of interleukin-6 (IL-6) and c-reactive protein (CRP) (indicative of better immune system functioning) primarily due to increased physical activity. Individuals self-reporting that they are hard workers and use their ambitions to accomplish goals may see the value in maintaining good health and a long life, and thus may be more likely to engage in physical activity. This increased physical activity is likely to benefit cardiovascular, metabolic, and as in the referenced study, immune functioning. Another key aspect from this study revolves around the fact that although other traits and facets predicted both physical activity and/or immune levels, no other significant indirect effects were found. This highlights the difficulty in establishing mediation effects even in the presence of significant direct effects. Future research needs to perform formal tests of mediation because relying on direct associations to infer personality-health processes may be misleading. Moreover, the data were mainly cross-sectional in nature with personality traits and health behavior measured at the same time point (with immune function measured anywhere from a few months to 4 years after baseline). Thus, the availability of longer-term data is needed to fully uncover the chains of risk from personality, to behavior, to health.

The studies summarized here are just a handful of the publications to date that attempt to use formal tests of mediation to document the health behavior model of personality. There are certainly others, but the fact remains that this area of inquiry is still in its infancy. Moreover, there are clear limitations with the existing empirical evidence, most notably the lack of longitudinal data. As tests of mediation become easier in many statistical software packages and the availability of high-quality longitudinal data increases, we should also see an increase in the number of publications explicating the health behavior model of personality. Future research will benefit from exploring not only multiple health behaviors as conduits, but also multiple health outcomes. Much of the published evidence focuses on substance abuse behaviors, so future work would benefit from exploring a diverse set of health behaviors, such as sleep quality, preventative health care maintenance and medication adherence, dietary intake behaviors (e.g., fruit and vegetable consumption, reduced fat intake, etc.), and physical activity.

Physiological functioning

Exploring associations between personality and physiological functioning initiated as a shift to using personality to predict more objective indices of health. Documenting that personality traits were associated with biomarkers of health

such as immune, cardiovascular, and metabolic levels ([Cacioppo & Berntson, 2006](#); [Kemeny, 2003, 2007](#)) gave more concrete evidence of personality-health processes than more subjective health complaints. The one reason why documenting these associations was foundational for the field is that dysfunction in these physiological systems is thought to underlie disease incidence and shortened longevity ([McEwen, 1998](#)). Thus, it is necessary to examine a mediational chain where personality predicts a biomarker of health, which in turn is associated with an increased risk of illness or shortened life.

There is a burgeoning literature documenting associations between each of the Big Five and physiological functioning. Higher levels of neuroticism and underlying facets are a major risk factor for suboptimal physiological profiles such as elevated inflammatory cytokines (e.g., IL-6 and CRP; [Armon, Melamed, Shirom, Berliner, & Shapira, 2013](#); [Sutin, Terracciano, et al., 2010](#)), higher cholesterol and triglyceride levels (impulsivity and depression facets; [Armon, 2014](#); Pereira, Tomaz, Cavaco, & Tavares-Ratado, 2014; [Sutin, Costa, et al., 2010](#)), and heart rate variability (see [Čukić & Bates, 2015](#)).

Higher levels of neuroticism are detrimental for physiological health due to the stress response because more neurotic individuals are more likely to appraise stressors as threats rather than as challenges, and tend to experience them as more aversive and react with higher levels of negative affect ([Bolger & Zuckerman, 1995](#); [Magnus, Diener, Fujita, & Payot, 1993](#); [Suls & Bunde, 2005](#)). The stress and negative affect experienced has physiological consequences such as increased blood pressure and overall cardiovascular activity, increased inflammation, as well as higher levels of circulating stress hormones such as cortisol ([Berntson, Sarter, & Cacioppo, 1998](#); [Smith & MacKenzie, 2006](#); [Suarez, 2003, 2004](#)). Neuroticism is positively associated with hyperactivity of the hypothalamic-pituitary-adrenal (HPA) axis, which can be seen in altered adrenocortical regulation such as enhanced early morning salivary cortisol levels ([Portella et al., 2005](#)), higher cortisol awakening responses ([Vedhara et al., 2006](#)), as well as higher cortisol reactivity following simulated laboratory stressors ([Zobel et al., 2004](#)). Although beneficial and

necessary in the short term, long-term activations of the HPA axis and cardiovascular systems can directly promote arterial damage and overall poorer health (for review, see [McEwen, 2006](#)). This can lead to an increased risk of developing hypertension, coronary heart disease, and stroke ([Davidson, Jonas, Dixon, & Markovitz, 2000](#); [Suls & Bunde, 2005](#)) in both clinical and nonclinical samples of adults. However, the negative effects of neuroticism for physiological health go beyond influencing the experience of stress, as engagement in unhealthy behaviors such as smoking, drinking, and inactivity can also exacerbate cardiovascular problems.

Higher levels of conscientiousness are commonly found to predict better physiological profiles. For example, higher conscientiousness was found to be robustly associated with more optimal CRP and IL-6 levels via meta-analytic findings (see [Luchetti, Barkley, Stephan, Terracciano, & Sutin, 2014](#) for review) and better cholesterol and triglyceride levels ([Armon, 2014](#); [Sutin, Terracciano, et al., 2010](#)). The self-control aspect of conscientiousness appears to be physiologically protective due to the engagement in better behaviors and a reduced stress response.

Findings between each of the other Big Five traits and physiological processes are not as consistent as they are for neuroticism and conscientiousness. One specific facet of agreeableness, hostility, is associated with dysfunction of the cardiovascular system. The frequent and more intense outbursts of anger that hostile persons experience resulted in increased blood pressure, prolonged elevated heart rate, and release of cortisol ([Smith & Gallo, 1999](#); [Smith, Glazer, Ruiz, & Gallo, 2004](#)). Although findings are not consistent regarding openness, there are a handful of studies suggesting higher levels are

protective. For example, higher openness is related to lower CRP levels ([Luchetti et al., 2014](#)), better cholesterol and triglyceride levels ([Armon, 2014](#)), lower blood pressure ([Taylor et al., 2009](#)), and slower human immunodeficiency virus (HIV) disease progression over a 4-year period. Williams and colleagues (2009) conducted one of the most convincing studies to understand the protective role of high openness by measuring stress reactivity in younger adults within a laboratory setting. Individuals scoring higher on openness had lower blood pressure reactivity (lower sympathetic arousal), increased respiratory sinus arrhythmia (index for increased parasympathetic arousal), and modest increase in positive affect. Lastly, higher levels of extraversion are thought to be health protective but significant findings with key markers of physiological functioning have been scare or contradictory ([Bouhuys, Flentge, Oldehinkel, & van den Berg, 2004](#); [Eysenck, 1991](#); [Segerstrom, 2000](#)).

Providing empirical evidence for physiological processes as the mechanism connecting personality to lifespan health is still in its infancy. Since personality can have direct (e.g., increased reactivity to stress that causes increased heart rate and blood pressure) and indirect effects on physiology (e.g., engagement in health behaviors such as smoking and suboptimal diet that in turn increase high blood pressure and cholesterol), it will take high-quality longitudinal data to uncover these associations. We summarized only a select few markers of physiological function in the current chapter for purposes of scope. However, with the increasing ease of collecting and analyzing biomarkers of health, more studies are being conducted that show robust associations between the Big Five and a diverse set of physiological outcomes. The next step is to break down the causal pathway from trait levels to physiological dysfunction and the onset of some health outcome (e.g., illness or chronic condition).

Social relationships

Individuals are not isolated entities, and thus their personalities influence more than simply their own behaviors (e.g., [Roberts et al., 2009](#)). Instead, it is appropriate to consider that individuals are embedded in a social environment and their personalities have implications on the social environment in which they reside. According to a person-environment transactions perspective, individuals (a) actively pursue social environments that are consistent with their personalities; (b) manipulate their social environments to be more consistent with their personalities; and (c) evoke responses from their social environments ([Buss, 1987](#); [Roberts, Wood, & Caspi, 2008](#)). These processes are not mutually exclusive; one can easily utilize any or all three to explain the associations between personality and social processes ([Mund, Jeronimus, & Neyer, 2018](#)). For example, individuals who are higher on extraversion enjoy social interactions and are more likely to be with friends, both in the moment and in the future ([Wrzus, Wagner, & Riediger, 2016](#)). It is possible that these individuals actively pursued social interactions or manipulated their social environments to include other individuals who also like social interactions.

When examining the associations between personality and social relationships, the literature suggests that the traits of agreeableness, conscientiousness, and extraversion are consistently associated with better social relationships and functioning. More specifically, individuals who are higher on agreeableness have more self-reported friendships, have higher relationship quality and satisfaction, are liked more by their peers, receive more emotional and practical support, and report fewer conflicts and social strain from their social networks ([Allemand, Job, & mroczek, 2019](#); [Allemand, Schaffhuser, & Martin, 2015](#); [Asendorpf & Wilpers, 1998](#); [Iveniuk, Waite, Laumann, McClintock, & Tiedt, 2014](#); [Jensen-Campbell & Malcolm, 2007](#);

Mund et al., 2018; Neyer & Lehnart, 2007; Neyer & Voigt, 2004; Sturaro, Denissen, van Aken, & Asendorpf, 2008; Wortman & Wood, 2011). Individuals who are higher on conscientiousness are liked more by their peers, have more positive peer relationships, report greater relationship satisfaction, have lower divorce rates, receive more emotional and practical support, and report fewer conflicts and social strain from their social networks (e.g., Allemand et al., 2015; Jensen-Campbell & Malcolm, 2007; Neyer & Lehnart, 2007; Neyer & Voigt, 2004; Roberts et al., 2007; Silva, Henrie, & Patrick, 2016; Sturaro et al., 2008; Wortman & Wood, 2011). Those scoring higher on extraversion are accepted by their peers, have larger peer networks, have more contact with their friends, are more emotionally close to their friends, and report fewer conflicts and social strain from their social networks (Allemand et al., 2015; Asendorpf & Wilpers, 1998; Jensen-Campbell & Malcolm, 2007; Mund & Neyer, 2014; Parker, Lüdtke, Trautwein, & Roberts, 2012).

The literature suggests that higher levels of neuroticism are associated with poorer social relationships. More specifically, individuals who are higher on neuroticism report poorer friendship quality, poorer relationship satisfaction, more interpersonal conflicts and social strain, are less socially integrated, and report receiving less emotional and practical support from their social networks (Allemand et al., 2015; Bolger & Zuckerman, 1995; Iveniuk et al., 2014; Jensen-Campbell & Malcolm, 2007; Lehnart & Neyer, 2006; Neyer & Lehnart, 2007; Silva et al., 2016).

Findings regarding openness to experience is mixed; some studies report better social relationships, whereas others report poorer social relationships. Higher levels of openness have been associated with greater relationship satisfaction, more emotional and practical support, and greater conflict frequency (Allemand et al., 2015; Neyer & Voigt, 2004; Parker et al., 2012; Silva et al., 2016). These mixed results may be due to examining the broad Big Five personality traits, and not the narrower facets that make up these broader traits. Recent research suggests that narrower facets are more effective (e.g., more precise prediction) when examining personality-relationship associations (Mund, Finn, Hagemeyer, & Neyer, 2016; Mund & Neyer, 2014).

It is also well known that social relationships, in turn, can influence physical health. One aspect of social relationships that is strongly associated with physical health is social support.^a Social support has been associated with better self-rated health, greater resistance to upper respiratory infections, and lower rates of mortality (Cohen, Doyle, Skoner, Rabin, & Gwaltney, 1997; Holt-Lunstad, Smith, & Layton, 2010; Uchino, 2004). Another aspect of social relationships that is associated with physical health is social negativity. Social negativity has been associated with an increased risk for the onset of stroke, lung disease, diabetes, and high blood pressure, decreased self-rated health, increased number of functional limitations, and higher rates of mortality (Birditt & Antonucci, 2008; Hill, Weston, & Jackson, 2014; Lund, Christensen, Nilsson, Kriegbaum, & Rod, 2014; Newsom, Mahan, Rook, & Krause, 2008).

Like the health behavior model of personality, there is ample research suggesting associations between personality and aspects of the social environment, and that social relationships are predictive of health, but no known studies to date have examined this full pathway in a single study using formal methods of mediation. Future work needs to determine exactly how personality and social relationships interconnect

to predict health. For example, as proposed by Smith (2006), it may be possible that individuals who are more hostile and emotionally reactive will appraise social interactions as more stressful, which not only has physiological effects on the body, but also the lack of social support from peers can be detrimental when support is needed (e.g., sickness). As we will discuss with the Personality and Health Processes model later in this chapter, it is clear that the mechanistic pathways through social relationships and physiological function processes are intertwined.

Personality and health processes model

The three mechanisms listed here are broad categorizations of possible processes connecting personality to health. The list is not meant to be exhaustive but represents what we believe to be the three most important mechanisms that connect personality to health. The Personality and Health Processes (PHP) Model (Fig. 1) displays a more integrated model, reflecting that there are multiple mechanisms connecting personality to health and including the presence of feedback loops. The model is based off prior work (e.g., Adler & Matthews, 1994; Smith, 2006), but takes a step forward because it provides a more complete explanation of the personality processes that ultimately lead to poor health outcomes. The key takeaway from the PHP is that personality traits are impacting health simultaneously through multiple mechanisms; and if we do not take this into account, we will never fully understand how personality-health processes unfold over the lifespan.

Interpreting the model is best from left to right and top to bottom. The first major pathway is the direct association between personality and behavior (the Health Behavior Model of personality). Engagement

in certain behaviors will eventually impact illness risk, and ultimately how long someone will live. But how personality influences health is much more complex than just via behavior. The second key direct association with personality is via stress appraisals. In everyday life, people are confronted with life events that they may or may not appraise as stressful. It is now agreed that individuals scoring higher on neuroticism are more likely to perceive life events as more stressful (e.g., [Bolger & Schilling, 1991](#)), but everyone experiences stress to some degree. Differences also arise in how one responds to or copes with the (perceived) stress in their lives. One way to deal with stressors is to engage in health behaviors that alleviate feelings of stress. What complicates research is that exercise or meditation are effective means of relieving stress for some people, while drinking alcohol, smoking, and binge eating works well for others. There are obvious differences in health outcomes depending on which type of coping behavior one uses, and we can use individual differences in personality traits to predict who is likely to engage in protective versus damaging behaviors.

The first level of the PHP model is important because it suggests that personality directly relates to health behaviors, but also indirectly via coping and social function. For example, someone low in conscientiousness is less likely to plan for the future or realize behavioral actions in early adulthood may have negative consequences on long-term health and longevity ([Bogg & Roberts, 2004](#)). Thus, an individual may experiment with illicit substances, smoke tobacco products, or eat unhealthily because they do not consider the negative long-term ramifications of doing so. But that is not the only way behaviors and personality are connected. A person high in neuroticism may also use behaviors such as overeating or stimulants to suppress feelings of anxiety that they are often bombarded with. This coping behavior is different than behavior related to the lack of future thinking. Each personality trait can result in direct or indirect pathways to behavior, and it is easy to see how someone with less health-optimal

personality characteristics can be at-risk for engaging in various health behaviors.

Aside from health behaviors as coping mechanisms, social resources also may help buffer or exacerbate stress for individuals ([Cohen & Wills, 1985](#)). Individuals with more supportive social networks lead healthier lives and respond to illness better. It is also well known that supportive relationships can help motivate others to engage in healthier behaviors and provide instrumental care when needed that can improve health over time. Social relationships are a part of everyone's life from birth to old age, and it is undeniable how important these relationships can be in terms of coping with everyday stressors.

Whether engaging in certain behaviors, social networks, or some combination of both, coping processes have direct influences on many physiological functions within the body. For example, smoking cigarettes results in profound negative consequences on the cardiovascular and immune systems, and poor diet and the lack of physical activity are the leading causes of metabolic dysfunction and increased risk of cardiovascular disease ([Heron, 2019](#); [Mokdad et al., 2004](#)). Likewise, social relationships can also influence physiological function. For example, chronic exposure to negative social ties can lead to cardiovascular problems and immune dysfunction (e.g., [Cohen & Pressman, 2006](#)). Although the body can respond to stress and poor behavior choices in the short term (e.g., allostasis), chronic overuse of these physiological systems can lead to excessive wear and tear on the body, illness, and ultimate premature death ([McEwen, 2006](#)).

The PHP model is not a new idea; rather it is the synthesis of prior work in the field that has attempted to connect the dots between personality and health. If we truly want to understand how personality influences health, a comprehensive model such as the PHP needs to be empirically tested, because like our predecessors, we present a model that is theoretical in nature and relies currently on a very piecemealed approach to providing empirical support. Moreover, the PHP model suggests that there are bidirectional effects between personality and each construct listed in the model. Thus, complex longitudinal data are needed to model these bidirectional effects (e.g., autoregressive latent trajectory models). Second, personality, behavior, stress appraisals, social relationships, and physiological function all change over time. Since these constructs are all moving targets, it makes it difficult to procure empirical evidence of this theoretical model. As discussed in (see also this issue Hampson Chapter xx), [Shanahan, Hill, Roberts, Eccles, and Friedman \(2014\)](#) have proposed the Life Course of Personality Model, which suggests that there are very complex personality processes unfolding over time. Third, the mechanisms connecting personality to health are also moving targets because the pathways linking personality to health at age 20 (e.g., risky behavior, substance use) are likely much different than at age 60 (e.g., medication adherence, physical activity levels).

Given the potential for three differential pathways, we need to consider factors such as age, sex, race/ethnicity, socioeconomic class, and other influential demographic variables into account within our analytical models. This requires tests of moderated mediation, which becomes even more complex. Additionally, long-term longitudinal data are needed to empirically uncover these processes, but even with such data the analytic techniques are complicated. For example, the behaviors that one engages in early life are potentially the ones that will eventually damage health later on in life. Drinking excessive amounts of alcohol or smoking tobacco during the early 20s might not have an immediate impact on health or even be noticeable by a doctor or lab report because the body is resilient at this age. If this person decides to quit smoking or

excessive alcohol intake by the time they are in their 40s, they may or may not have done irreparable damage

to their body. If we were to measure personality at age 60 for this person, examine their current substance use behaviors over the next few years, and then some distal health outcome such as cancer incidence, we may not find significant mediation effects because although they have high neuroticism and cancer, they currently did not smoke or use alcohol. Thus, there is no behavioral mediation since the behavioral damage has already been done in the past. There are clear guidelines to establishing the causal sequence with mediation, but how do we account for these lifelong processes? How can we test a behavioral mediator that happened prior to when personality and the health outcome occurred? These issues need to be addressed as the field moves forward to understanding personality-health processes. Our one suggestion is to utilize the exemplary longitudinal data that have already been collected in large scale studies such as the Terman Study, the Midlife Development in the U.S. Study, and the Health and Retirement Survey. Utilizing these longitudinal data sources to track personality and health, as well as everything else in between described in the PHP model, we can come closer to the empirical evidence needed to move the field forward. This is especially needed as we start to consider whether personality traits can be a direct target of intervention so that health and longevity can ultimately be improved ([Bleidorn et al., 2019](#); [Roberts, Hill, & Davis, 2017](#)).

Personality within medical settings

One common question, given the linkages between personality and health outcomes, is how do medical professionals and policy makers best use this information to promote healthier lifestyles and well-being? The most common answer has been to administer personality inventories to gain valuable information for tailoring their treatments ([Hagger-Johnson & Whiteman, 2008](#); [Matthews, Saklofske, Costa, Deary, & Zeidner, 1998](#)). This parallels the push for what is called *personalized medicine* or *precision medicine* in which healthcare can be customized individually for more optimal health outcomes. For example, a patient presenting with borderline glucose intolerance might say they will improve their weight via changes in their diet and exercise regimen to improve sugar metabolism levels. However, if the physician knows that this person scores relatively low on conscientiousness or higher on neuroticism, research would suggest this person is unlikely to follow through with these healthy behavior changes. Instead, a more personalized approach would be to use medication to possibly lower levels and to ensure the person actually takes their medication. This example offers a simplistic scenario of how to treat someone with a potential at-risk physiologic profile, but it highlights the potential ways personality can aid in medical treatment decisions.

Using personality assessment to better understand who someone is, the behaviors they may engage in, and the health outcomes they may experience will be useful in terms of aiding existing treatments and interventions. However, another option that is gaining traction is to consider whether one can intervene on personality traits directly, in ways that promote later health outcomes ([Bleidorn et al., 2019](#); [Roberts et al., 2017](#)). Researchers have focused less attention on this option for three primary reasons. First, until relatively recently it was widely assumed that personality traits are largely immutable, at least in adulthood (e.g., [McCrae & Costa Jr, 1994](#))—a perspective largely refuted in more contemporary work ([Mroczek & Spiro, 2003](#); [Roberts & Mroczek, 2008](#); [Roberts, Walton, & Viechtbauer, 2006](#)). Second, there are ethical quandaries invoked whenever the topic of changing people’s personalities is broached. Third, and perhaps most influential, even if one wanted to change certain personality traits, there are few theoretical frameworks that

provide insights into how best to proceed (see also this issue Hudson Chapter xx).

Recently though, researchers have noted the importance of considering the state-trait duality of personality dimensions in order to potentially induce change (e.g., [Roberts et al., 2017](#); [Roberts & Jackson, 2008](#)). Personality traits can be thought of as reflecting consistency in, or density distributions of, an individual's state manifestations of personality over time ([Fleeson, 2004](#); [Roberts, 2009](#)). Personality states represent how individuals think, feel, or behave in a given moment ([Roberts & Jackson, 2008](#)). With these concepts in mind, it is easier to think about trying to influence how an individual acts or thinks in a given moment, with the idea that should those changes occur over time in a consistent fashion, it could enact lasting change at the trait level.

Perhaps then it is unsurprising that much of the evidence that personality can change via interventions comes from clinical work, given that therapists often encourage patients to alter their behavioral and cognitive routines with the hopes of enacting enduring changes in dispositions. For instance, cognitive-behavioral therapy (CBT), which targets changing such routines, appears to be one prominent route to personality trait change (Roberts et al., 2017). One of the earliest documented cases of support for personality-based interventions comes from Borkovec et al. (1987), who documented changes in neuroticism as a result of CBT. Since then, multiple studies have found evidence of personality trait change as a result of CBT or similar techniques (see also De Fruyt, Van Leeuwen, Bagby, Rolland, & Rouillon, 2006; Piedmont, 2001). Similarly, one can consider biophysiological changes as potential catalysts for change in thoughts, feelings, and behaviors; indeed a handful of investigations have identified pharmacologic entities that have brought about changes, again, mostly in neuroticism (Bagby, Joffe, Parker, Kalemka, & Harkness, 1995; Tang et al., 2009).

These reports set the stage for a recent meta-analysis of intervention-induced personality trait change, which pinpointed 207 studies dating back to the 1970s (Roberts et al., 2017). Very few of these investigations set out to test an intervention explicitly designed to alter personality traits. However, many interventions aimed at psychopathology outcomes (e.g., anxiety, depression, substance abuse) happened to also measure personality traits. Across studies, the average effect size of intervention-based change was nonzero for each of the Big Five traits, with the largest effects shown for neuroticism. This is not surprising, given the interventions were focused on psychopathology, which is tightly related to neuroticism. Yet even the smallest effects, on openness and agreeableness, were nonzero and of modest size.

This meta-analysis also provides insights into how to change personality traits by virtue of comparing the interventions that seemed more influential for one trait than others. For instance, though interventions targeting psychopathology were more relevant for neuroticism, cognitive-based approaches seemed more influential for changes in openness to experience. For example, one study found that an intervention promoting inductive reasoning among older adults also led to concomitant changes in openness to experience (Jackson, Hill, Payne, Roberts, & Stine-Morrow, 2012). However, training studies focused on other aspects of cognition have failed to show effects on openness (Sander, Schmiedek, Brose, Wagner, & Specht, 2017). These findings underscore a particularly important lesson for those attempting to intervene on personality; namely, one should not expect personality trait change from any intervention program, and instead researchers must be mindful of influencing the state-level thoughts, feelings, and behaviors specific to the targeted trait of interest.

Another difficult question for interventionists is the length of the program. Put differently, for how long must one enact change in an

individual's personality states before that leads to lasting trait-like change? Roberts et al. (2017) were able to provide initial insights on this front, given that the studies reviewed ranged in terms of length. Of particular interest is that personality trait change may be possible in relatively short periods of time. Indeed, several studies in the meta-analysis exhibited personality trait change within weeks, and longer interventions were not necessarily associated with stronger effect sizes on personality. Questions remain, though, about whether these changes hold after longer periods or whether there was some regression back to prior levels. This possibility is proposed by dynamic equilibrium models of personality that argue for set points to which people revert after temporary trait change (Ormel, Riese, & Rosmalen, 2012; see also Luhmann, Orth, Specht, Kandler, & Lucas, 2014). Thus, it is not clear if intervention-induced personality trait change requires boosting efforts to maintain the change.

Even if personality traits can be changed and these changes would persist to some magnitude, would health also improve? How long would it take after personality is changed for the health changes to be realized? Based on the mechanisms we discussed, we would expect health behaviors, stress appraisals, coping resources, and social networks to change in the short-term after personality change occurred. However, although there are some immediate health risks associated with binge drinking or having a poor diet, it takes years of damage to accumulate from these behaviors to impact global health such as cardiovascular function and longevity. Likewise, even if personality change can improve social relationships, how long would it actually take for there to be improved health outcomes resulting from higher-quality social support? Investigating the processes connecting personality to health are essential foundations for any attempt to change personality via intervention because we may not be able to rely on whether personality change is useful by measuring just health outcomes as they are too distal. Instead, documenting that personality change influences more proximal behaviors, stress appraisals, coping resources, and social networks will provide the evidence needed to support personality change interventions. Lastly, there are studies suggesting personality change might not be beneficial in terms of health regardless of whether the change is in seemingly adaptive directions (Graham & Lachman, 2012; Human et al., 2013). Thus, if we do change personality, will there be universal positive effects, or is there a possibility that negative outcomes could be experienced? Currently though, there is not enough empirical evidence to adequately answer questions such as these.

Another question worth consideration is the motivation to change. Recent work has suggested that individuals often voice motivations to change certain personality traits, which in turn may lead to stronger effects for personality change (Hudson & Fraley, 2015, 2016). This motivation to change also underlies several of the studies in the meta-analysis by Roberts et al. (2017), given that several of the participants were likely in psychopharmacological or therapeutic interventions because they were seeking change in the first place. These samples largely comprise people who wish to change something about themselves, which may play a factor even if the participants are not explicitly stating a desire to change on the Big Five traits.

If motivation does play a role in intervention efficacy, it may prove valuable to showcase the benefits of being conscientious for health outcomes. Theoretical frameworks have suggested that observing the benefits of a given trait in others may lead individuals to desire higher personal levels on that domain (e.g., Hill & Jackson, 2016; Roberts et al., 2008). Furthermore, it is likely as important to see personal benefits of conscientious activity as a catalyst for change. Indeed, the Invest-and-Accrue Model suggests that individuals are likely motivated to increase their levels of conscientiousness following the

accrual of the benefits associated with conscientiousness, such as positive health (Hill & Jackson, 2016). Accordingly, one direction for future research is to understand whether (a) individuals are capable of identifying the personality catalysts associated with healthier lifestyles (i.e., I feel better because I acted in conscientious ways) and (b) if this identification leads individuals to be more motivated to change the trait in the future.

Conclusions

Understanding the role personality plays in health processes is not just inherently fascinating, but it provides an avenue to better identify at-risk populations as well as tailoring existing prevention/intervention efforts based on personality characteristics. As the medical field moves toward more customizable healthcare, personality assessment will be yet another factor to consider when making healthcare decisions. Moreover, the potential to change personality to promote downstream improvements in behavior, health, and longevity is exciting. However, much more research is needed to understand the complex and bidirectional pathways connecting personality to health outcomes. The complexity of this field necessitates multidisciplinary teams of psychologists, epidemiologists, physicians, nutritionists, and many others so that the full pathways from individual difference variables can be uncovered and modified for widespread improvements in population health and well-being.

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Footnotes

^aIt should also be noted that the literature on social support and physical health is divided into two main aspects of social support—perceived support and received support ([Uchino, 2009](#)), although there are certainly other aspects of social support (e.g., financial, emotional, etc.).

Abstract

With personality traits emerging as robust predictors of a variety of health outcomes and longevity, this chapter summarizes the underlying processes that explain how certain personality characteristics result in poor health. Specifically, personality traits influence health outcomes through the behaviors one engages in, the physiological arousal to stress, and through engagement in social interactions. The chapter highlights both theoretical and empirical evidence supporting these mechanisms, and also discusses the methodological limitations of current research and future directions to remedy these issues. The chapter also presents the Personality and Health Processes (PHP) Model to guide future work linking personality to health and longevity. The chapter ends with a discussion of the translational potential of using personality to improve lifespan health outcomes.

Keywords: Big Five taxonomy; Personality traits; Mechanism; Immune system; Physical activity; Social interactions

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