

# Personality Predicts Health Declines Through Stressful Life Events During Late Mid-Life

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## Abstract

Personality predicts the occurrence of dependent stressful life events (SLE; i.e., events reliant, at least in part, on an individual's behavior). This process, termed *stress generation*, contributes to psychiatric outcomes, but its role in physical health is unknown. Data were included from 998 participants (aged 55–64) in the St. Louis Personality and Aging Network (SPAN) study. Assessments occurred every 6 months for 18 months. Neuroticism, impulsivity, and agreeableness were measured with the Revised NEO Personality Inventory. Dependent (e.g., divorce) and independent (e.g., family death) SLE occurring within 6 months following baseline were assessed with the List of Threatening Experiences and confirmed by interviews. Health problems occurring within a year after SLE were the outcome. Analyses examined whether neuroticism, impulsivity, and agreeableness indirectly predict the onset of new health problems through exposure to dependent SLE. Each personality trait was associated with dependent, but not independent, SLE. Only dependent SLE predicted new health problems. Each personality trait indirectly predicted the onset of new health problems through dependent SLE. Findings suggest that personality-driven stress generation influences physical health during late mid-life. Addressing personality in interventions may reduce the occurrence of SLE, in turn decreasing health risks.

## INTRODUCTION

Personality, the collection of relatively stable and global traits that influence thoughts, feelings, and behaviors, has a significant impact on physical health (Goodwin & Friedman, 2006; Powers & Oltmanns, 2012, 2013; Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007; Turiano et al., 2012). However, the mechanisms underlying this relationship are poorly understood (Ferguson, 2013; Hampson, 2012). Mechanistic clues come from independent lines of research showing that personality influences the occurrence of stressful life events (SLE) (Gleason, Powers, & Oltmanns, 2012; Kendler, Gardner, & Prescott, 2003; Liu & Kleiman, 2012; Powers, Gleason, & Oltmanns, 2013), and that SLE potentially predict the onset and course of various physical health conditions (e.g., cardiovascular disease, stroke) (Loerbroks, Apfelbacher, Thayer, Debling, & Stürmer, 2009; Renzaho et al., 2014). The current study integrates these distinct literatures to investigate the connections among personality traits, SLE, and health in a longitudinal sample of late mid-life adults.

Evidence suggests that personality traits influence stressful life event exposure, a process known as stress generation (Hammen, 2006; Liu & Alloy, 2010). Specifically, research indicates that those with elevated levels of specific personality traits (e.g., neuroticism) more frequently experience *dependent* SLE. These events are, at least in part, attributable to the person's own behav-

ior (e.g., the end of a close relationship). On the other hand, *independent* SLE are considered typically to be independent of the person's behavior (e.g., death of a loved one) (Hammen, 1991; Paykel, 1987) and are unrelated to personality traits (Ellenbogen & Hodgins, 2004; Liu & Kleiman, 2012; Powers et al., 2013).

Prospective studies have linked neuroticism, which represents the tendency to experience strong negative emotions, to later elevations in dependent SLE exposure (Ellenbogen & Hodgins, 2004; Fergusson & Horwood, 1987; Kendler et al., 2003; Magnus, Diener, Fujita, & Pavot, 1993; Poulton & Andrews, 1992; Whittington & Huppert, 1998). Kendler and colleagues (2003) found that, in a sample of more than 7,000 male and female adult twins, neuroticism most strongly predicted events that could be considered dependent on an individual's behavior (i.e., marital problems, job loss, financial

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problems, relationship problems). The level of neuroticism reported by the participant as well as by their co-twin about the participant predicted the participant's reported SLE (Kendler et al., 2003). These findings suggest independence of neuroticism and SLE reporting. A study utilizing a subset of the current sample also found such evidence (Gleason et al., 2012). SLE were assessed by a self-report checklist and then confirmed by an interview. Those participants scoring higher on neuroticism were *not* more likely to have their count of life events adjusted up or down after interviews, suggesting that those with higher levels of neuroticism are not more likely than those with lower levels to over-report SLE (Gleason et al., 2012).

Stress generation was first introduced in the depression literature where it was shown that depression history increases the occurrence of dependent, and not independent, SLE (Hammen, 1991). Research on personality-driven stress generation has shown that neuroticism predicts the occurrence of dependent SLE independent of psychiatric history (Ellenbogen & Hodgins, 2004; Whittington & Huppert, 1998). Whittington and Huppert (1998) analyzed data from 3,150 participants in the Health and Lifestyle Survey, and found that neuroticism predicted interviewer-rated SLE occurring 6 to 7 years later, independent of psychiatric symptoms at baseline (Whittington & Huppert, 1998). Indeed, the effect of neuroticism was stronger than the effect of psychiatric symptoms on SLE. Similarly, a study that examined parents with and without affective disorders found that those with higher levels of neuroticism experienced elevated occurrence of dependent SLE, but did not differ on the frequency of independent SLE (Ellenbogen & Hodgins, 2004). This pattern was found to persist regardless of the parent's psychiatric history.

Similar patterns have been found for other personality traits, specifically impulsivity and agreeableness. Liu and Kleiman (2012) reported that impulsivity, particularly negative urgency, predicted the occurrence of dependent, and not independent, SLE over 4 weeks in a college sample. This effect remained after controlling for other aspects of impulsivity (i.e., sensation seeking, lack of premeditation, lack of perseverance), baseline depression, and gender. Another set of analyses based on the current sample showed that symptoms of borderline personality disorder, which is associated with high neuroticism and low agreeableness (Saulsman & Page, 2004), predicted the occurrence of dependent, and not independent, SLE over 1.5 years (Powers et al., 2013).

The relationship between normal-range agreeableness and SLE has not been directly examined. Agreeableness represents the intention to maintain positive relationships (e.g., consideration and cooperativeness), and low agreeableness is associated with poorer interpersonal adjustment and less constructive responding to interpersonal conflict (Jensen-Campbell & Graziano, 2001). Thus, agreeableness would likely influence dependent SLE through its impact on social relationships.

The connection between stress generation and psychiatric outcomes (e.g., depression relapse) is well established (Hammen, Davila, Brown, Ellicott, & Gitlin, 1992; Hammen, Shih, &

Brennan, 2004; Rudolph, Flynn, Abaied, Groot, & Thompson, 2009; Whittington & Huppert, 1998; Zuroff, Mongrain, & Santor, 2004). However, to our knowledge no studies have examined whether stress generation influences physical health, even though SLE predict the onset of health problems (Loerbroks et al., 2009; Renzaho et al., 2014). Thus, the current study is novel in its investigation of the impact of stress generation on physical health, as well as its examination of agreeableness as a stress-generating personality trait.

The current study is also notable for its use of informant reports of personality. Past studies have tended to rely on self-report personality measures, even though informant reports enhance the strength of personality measurement (Huprich, Bornstein, & Schmitt, 2011). Informant reports are especially important when the traits being measured are evaluative and observable, such as impulsivity (Vazire, 2010). In the current study, we analyze the data with self- and informant-reported data combined, as well as with each source examined separately. This enables us to investigate the robustness of our conclusions and to identify differential predictive ability between self- and informant reports.

The present study investigated whether stress generation related to neuroticism, impulsivity, and agreeableness would predict the onset of new health problems over 1 year among late mid-life adults. Data was utilized from the St. Louis Personality and Aging Network (SPAN) (Oltmanns, Rodrigues, Weinstein, & Gleason, 2014), a longitudinal study concerned with a wide range of behavioral and experiential phenotypes among individuals in late mid-life. It was hypothesized that elevated neuroticism and impulsivity, and lower agreeableness would be associated with more frequent exposure to dependent, and not independent, SLE. Moreover, it was predicted that stress generation would indirectly link neuroticism, impulsivity, and agreeableness to the development of new health problems.

## METHODS

### Procedure

The SPAN study is an ongoing longitudinal protocol that assesses a wide range of personality, health, psychopathological, and social characteristics in a representative community sample of 1,630 older adults residing in the St. Louis, Missouri area (Oltmanns et al., 2014). Participants were recruited using listed phone numbers that were crossed with current census data in order to identify households with at least one member in the eligible age range. When more than one person in a household was in the target age range, the conservative Kish method (Kish, 1949) was used, which enables the random selection of one individual from the household (i.e., sampling without replacement). If the target refused to participate, other eligible residents were not included. Individuals were excluded if they lacked a permanent residence, could not read at a 6th-grade level, or had active psychotic symptoms.

Of relevance to the current analyses, each participant completed a 3-hour in-person assessment at baseline, as well as a

**Table 1** Demographic Characteristics of SPAN Participants and Informants

Demographic Variable	Participant	Informant
	Frequency (Percent)	Frequency (Percent)
<b>Race</b>		
White	715 (71.6%)	715 (71.8%)
Black	264 (26.5%)	263 (26.4%)
Other	19 (1.9%)	18 (1.8%)
<b>Gender</b>		
Male	445 (44.6%)	316 (31.7%)
Female	553 (55.4%)	681 (68.2%)
<b>Education</b>		
Less than high school	10 (1.0%)	
High school diploma or GED	274 (27.5%)	
Post-secondary degree	430 (43.1%)	
Graduate degree	283 (28.4%)	
<b>Annual Household Income*</b>		
Under \$20,000	99 (10.2%)	
\$20,000–\$39,999	157 (16.2%)	
\$40,000–\$59,999	222 (22.9%)	
\$60,000–\$79,999	134 (13.8%)	
\$80,000–\$99,999	110 (11.4%)	
Above \$100,000	247 (25.5%)	

\*n = 29 participants did not provide household income data.

short sequence of mailed or online follow-up (FU) self-report questionnaires every 6 months (FU1, FU2 and FU3). Informants completed mailed or online questionnaires about the participant at baseline. Written informed consent was obtained from participants and informants prior to the baseline assessment, and participants were compensated \$20 per hour of participation. All study procedures were in accordance with the Institutional Review Board policies of Washington University in St. Louis.

## Participants and Informants

Table 1 displays demographic characteristics for participants and their informants. Current analyses included 998 SPAN participants (mean age = 59.6 years, SD = 2.8). In addition to excluding participants who dropped out of the study ( $n = 118$ ; 7%), analyses do not include participants who had not yet completed FU2 and/or FU3 by July 2012 ( $n = 514$ ; 32% of the entire sample), when data collection was put on hold. The racial breakdown of the subsample is representative of the St. Louis, Missouri area. The median annual household income (\$60,000–80,000) is slightly higher than that of St. Louis residents (\$40,000–60,000). Informants were identified by participants as a “person who knows [them] best.” The majority (47.5%) of informants were significant others, followed by family members (24.6%), friends (21.1%), and others (e.g., co-workers; 2.3%). Participants and informants knew each other for an average of 32 years (SD = 15.3). Half of informants resided with the participant.

## Instruments

### Personality

We measured self- and informant-reported personality traits with the Revised NEO Personality Inventory (NEO-PI-R) (Costa & McCrae, 1992). The NEO-PI-R is a 240-item questionnaire based on the Five-Factor Model (FFM) of personality, widely used in psychological research (Ferguson, 2013). The FFM separates normal-range personality into 5 domains: Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness, each of which is further represented by 6 facets. Items are rated on a 5-point scale ranging from “strongly disagree” to “strongly agree.” We used parallel forms of the NEO-PI-R for self- and informant reports. For analyses, self- and informant-report scales were considered separately, and were also averaged to create composite personality scores for each trait. Descriptive statistics for neuroticism, impulsivity, and agreeableness are listed in Table 3.

**Neuroticism.** Neuroticism scores were composed of all NEO-PI-R Neuroticism facets (i.e., anxiety, depression, angry hostility, vulnerability, self-consciousness) except impulsiveness, which was included in impulsivity. All facets had moderate to large correlations .57–.90 (all  $p < .001$ ) with each other. Self- and informant-reported neuroticism were moderately correlated ( $r = .43, p < .001$ ). Cronbach’s  $\alpha$  values for the individual facets were  $> .76$ , and  $\alpha$  was .88 for the combined self-informant full scale (self: .91; informant: .93).

**Impulsivity.** Consistent with prior work (Iacovino, Powers, & Oltmanns, 2014; Whiteside & Lynam, 2001), we calculated impulsivity scores by taking the average of NEO-PI-R impulsiveness (from neuroticism), excitement-seeking (from extraversion), deliberation (from conscientiousness; reverse scored), and self-discipline (from conscientiousness; reverse scored). All facets had small to moderate correlations (.27–.57; all  $p < .001$ ), except for self-discipline with excitement-seeking ( $r = .02, p = .57$ ). Indeed, excitement-seeking had the lowest correlations with each facet. Internal consistency of the impulsivity scale excluding excitement-seeking was superior to that of the scale when it was included (.76 versus .67, respectively). Therefore, excitement-seeking was excluded from the scale in subsequent analyses (results were consistent regardless of whether excitement-seeking was included in the scale). This is consistent with prior work suggesting that excitement-seeking and impulsivity are separate constructs that have often been conflated (Steinberg et al., 2008). Self- and informant-reported impulsivity were moderately correlated ( $r = .44, p < .001$ ). Cronbach’s  $\alpha$  was .70 for the self-report scale and .80 for the informant-report scale. Cronbach’s  $\alpha$  values for the individual facet scores were  $> .76$ .

**Agreeableness.** Agreeableness scores were composed of all NEO-PI-R agreeableness facets (i.e., trust, straightforwardness, altruism, compliance, modesty, tender-mindedness). All facets had small to moderate correlations (.22–.55; all  $p < .001$ ). Self-

**Table 2** Prevalence of Stressful Life Events (SLE) Occurring Within 6 Months After Baseline

Event	Frequency (Percent of Total Sample)
<i>Independent SLE</i>	
Serious illness or injury to close other	127 (12.7%)
Death of a partner, parent, or child	37 (3.7%)
Death of a close friend or another relative	165 (16.5%)
<b>Total</b>	<b>329 (33.0%)</b>
<i>Dependent SLE</i>	
Separation due to marital difficulties	3 (0.3%)
Breaking off of a steady relationship	15 (1.5%)
Serious problem with a close other	51 (5.1%)
Unemployment for more than a month	34 (3.4%)
Fired from job	24 (2.4%)
Major financial crisis	50 (5.0%)
Problems with police/courts	7 (0.7%)
Something valuable lost/stolen	29 (2.9%)
Victim of serious crime	7 (0.7%)
Changes in family responsibilities	39 (3.9%)
<b>Total</b>	<b>259 (25.9%)</b>

and informant-reported agreeableness were moderately correlated ( $r = .37, p < .001$ ). Cronbach's  $\alpha$  values for the individual facet scores ranged from .60 (tender-mindedness) to .80 (trust). Cronbach's  $\alpha$  for the combined self-informant scale was .83 (self: .75; informant: .85).

### Stressful Life Events

At FU1 (6 months after baseline), participants completed the List of Threatening Experiences Questionnaire (LTE-Q) (Brugha, Bebbington, Tennant, & Hurry, 1985), which assesses the occurrence of 12 life events that are considered to be severely stressful. For current analyses, the item asking about serious personal illness or injury was excluded because it overlaps with the outcome variable. SLE were classified as either dependent or independent based on the work of Paykel (1987), which classifies dependent SLE as events that are potentially reliant, at least in part, on the behavior of the individual. Illness or death of a loved one or close other were classified as independent events, and all other events were classified as dependent events (Table 2).

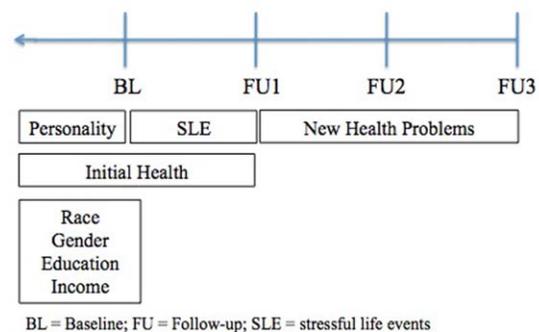
Participants were asked to endorse any events that had occurred within the previous 6 months (i.e., between baseline and FU1). In an effort to overcome some of the limitations of retrospective recall and self-report (e.g., recall bias, intracategory variability) that typically diminish the accuracy of life-event checklists (Dohrenwend, 2006; Lewinsohn, Rohde, & Gau, 2003; Monroe, 2008; Paykel, 1987), anyone reporting at least one SLE was called as soon as possible for a phone interview (mean = 4 weeks; range: 1 day–3 months). During phone calls, trained interviewers asked for a brief description of any reported event to determine whether it occurred within the specified time frame, whether it was independent from other endorsed events, and whether it had a significant impact on the participant's life.

Before interviews, approximately 59% of participants ( $n = 537$ ) had experienced at least one SLE by FU1. Following

the interviews, 46% of participants ( $n = 422$ ) had experienced at least one SLE. Events were dropped because either the participant did not remember the event, or it was judged by the interviewer not to have a significant impact on the participant's life. Those events coded as "Major" (i.e., acute, distinct from any other event, and caused distress) or "Main" (i.e., chief event that gave rise to other events marked) were included in the current analyses. Further details about the interviews can be found elsewhere (Gleason et al., 2012).

### Health

The total number of illnesses ever experienced by participants was assessed at baseline with the Computerized Diagnostic Interview Schedule (C-DIS) (Robins & Helzer, 1994). The physical health portion of the assessment includes participant reports of ever being under a doctor's care for any long-lasting physical illness (e.g., diabetes). The C-DIS also assessed the presence of a major depressive episode in the past 12 months (prevalence: 4.3%).

**Figure 1** Timeline of variables.

**Table 3** Intercorrelations of Study Variables

	M (SD)	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Neuroticism	11.69 (3.53)	—	.52**	-.20**	.17**	.05	.15**	.09**	-.14**	-.22**	-.05	.12**
2. Impulsivity	12.60 (3.34)		—	-.34**	.16**	.05	.14**	.09**	-.16**	-.13**	-.08*	-.03
3. Agreeableness	21.23 (2.70)			—	-.10**	.01	-.05	-.01	.11**	.06	-.07**	.23**
4. Dependent SLE	.22 (.48)				—	.02	.11**	.10**	-.14**	-.18**	.13**	.04
5. Independent SLE	.32 (.53)					—	.06	.06*	-.06	-.07*	.07*	.05
6. Baseline health problems	1.39 (1.27)						—	.26**	-.22**	-.23**	.15**	.10**
7. New health problems	—							—	-.05	-.04	-.01	.07*
8. Education	—								—	-.47**	-.28**	-.10**
9. Income	—									—	-.28**	-.19**
10. Race (0 = white)	—										—	—
11. Gender (0 = male)	—											—

\*p < .05. \*\*p < .01.

The presence of a new health problem at follow-up was assessed with a supplementary demographics questionnaire developed by the study team and administered at all FU with an item asking, “Have you been diagnosed with a new illness or condition in the past 6 months?” Participants also wrote a description of the new health problem. Some of the health problems endorsed include heart disease, hypertension, high cholesterol, cancer, stroke, diabetes, brain tumor or aneurism, hernia, broken bone/torn muscle, and thyroid problem.

A variable representing initial health problems was included as a covariate in analyses. It was computed as the sum of the total number of illnesses ever experienced (measured by the C-DIS) and the presence (1) or absence (0) of a new health problem at FU1. New health problems at FU1 were included in the initial health problems covariate in order to ensure appropriate temporality of the variables in the model (because SLE were measured at FU1; see Figure 1).

A variable representing new health problems across FU2 and FU3 (within the year following the occurrence of SLE) was used as the outcome in all analyses. A new health problem was counted as “present” only if the participant attended a doctor’s appointment within the same time period. Four participants did not meet these criteria. In addition, items were re-coded as “absent” if the participant’s written response described a symptom rather than a condition (e.g., low vitamin D, swelling in ankles) (*n* = 8) or surgery for an illness previously reported (*n* = 33). Approximately one-quarter of participants (*n* = 323) experienced the onset of a new health problem over this follow-up period. While actual physician diagnoses or objective assessments of health (e.g., blood pressure readings) were not collected, self-reports of illnesses are shown to be reliable and valid (Idler, Hudson, & Leventhal, 1999), and the steps described above improve the accuracy of current self-reports.

### Statistical Analyses

All analyses were conducted with SPSS v. 22. In regression analyses, covariates (i.e., initial health problems, race, gender, education, and annual household income) were entered in the

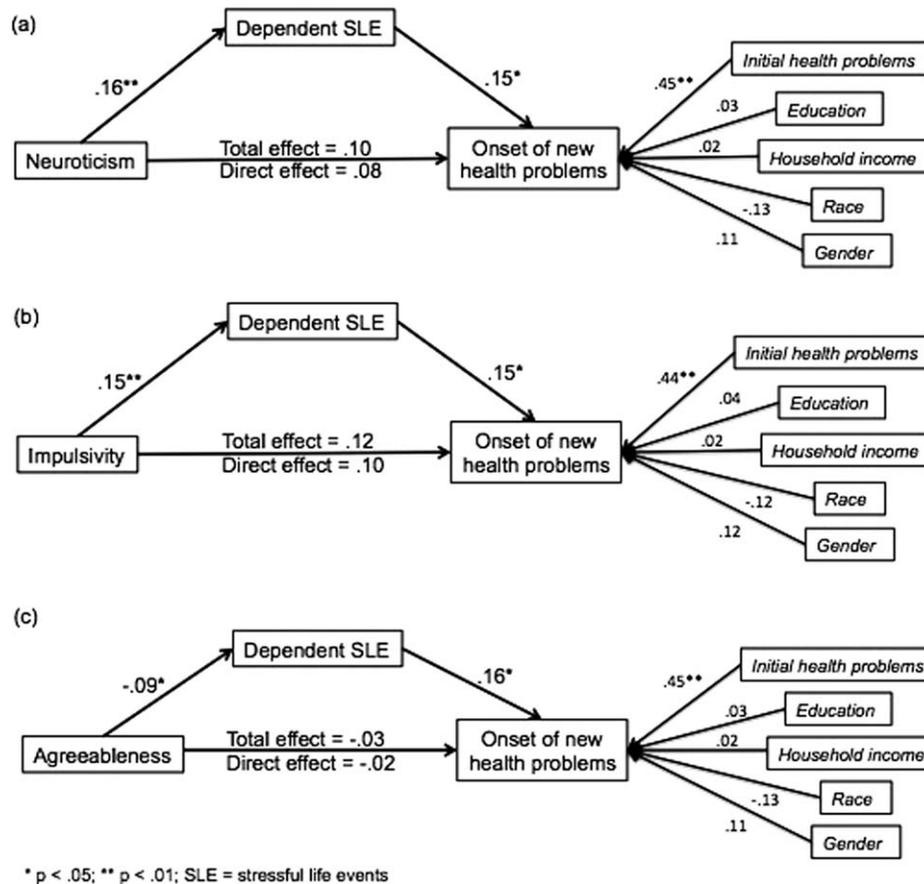
first step, followed by the predictor (i.e., neuroticism, impulsivity, or agreeableness) in step 2, and any intervening variables (e.g., SLE) in step 3. Indirect effects of each personality variable on health via SLE were examined using bootstrapping with 95% confidence intervals (CI) with PROCESS for SPSS (Hayes, 2008, 2012). Bootstrapping is a preferred method for interpretation because it does not assume that the sampling distributions of the indirect effects are normally distributed, and is preferable to the products-of-coefficients approach in terms of Type I error rate, power, and hypothesis testing (Preacher & Hayes, 2008). The point estimates of the indirect effects represent effect sizes (i.e., the product of the partial correlation between the predictor and the mediator, and the partial correlation of the mediator and the outcome). Because the size of the indirect effect is a product of two effect sizes, the standard effect size benchmarks are squared. Thus, .01 is considered a small effect size, .09 a medium effect, and .25 a large effect.

LTE-Q scores were skewed toward 0 and were log transformed. The new health problems variable was also skewed toward 0, and was recoded into a dichotomous variable, with 0 indicating no new health problems and 1 indicating one or more new health problems. All continuous variables were standardized prior to analyses. Separate regression and indirect effects models were examined for each personality variable.

## RESULTS

### Zero-Order Correlations

Zero-order correlations between all variables are included in Table 3. Briefly, neuroticism and impulsivity were moderately positively correlated, and each had small negative correlations with agreeableness. Greater neuroticism and impulsivity, and lower agreeableness were associated with elevated dependent, but not independent, SLE exposure. Neuroticism and impulsivity were associated with elevated initial and follow-up health problems, whereas agreeableness was not significantly associated with health. Moreover, dependent, but not independent, SLE were associated with elevated baseline health problems,



**Figure 2** (a) Neuroticism, (b) Impulsivity, and (c) Agreeableness predict the onset of new health problems through dependent SLE.

whereas both types of SLE were associated with new health problems. Lower agreeableness, and greater neuroticism, impulsivity, dependent SLE, and initial health problems were associated with lower education, and all but agreeableness were associated with lower income. Minority race was associated with more dependent and independent SLE, more baseline health problems, and lower education and income. Female gender was associated with more baseline health problems, and lower education and income.

## Does Personality-Driven Stress Generation Predict the Onset of Health Problems?

### Regression Analyses

We conducted separate hierarchical regression analyses for each personality predictor. Analyses revealed that each personality variable significantly predicted dependent SLE (neuroticism:  $B = .14$ ; impulsivity:  $B = .14$ ; agreeableness:  $B = -.10$ ; all  $p < .001$ ) after accounting for covariates (i.e., race, gender, annual income, education). Neuroticism and impulsivity were each significantly associated with initial health problems, above covariates (neuroticism:  $B = .12$ ; impulsivity:  $B = .15$ ; both  $p < .01$ ), whereas agreeableness was not ( $B = -.05$ ,  $p > .05$ ).

Logistic regression analyses suggested that none of the personality domains directly predicted new health problems, after controlling for covariates and initial health problems (neuroticism:  $B = .12$ ; impulsivity:  $B = .12$ ; agreeableness:  $B = -.02$ ; all  $p > .05$ ). Finally, logistic regression models to predict the onset of health problems were conducted that included all variables of interest (i.e., step 1: covariates, step 2: one of the personality traits, step 3: both SLE variables). Dependent SLE predicted the onset of new health problems in all models (all  $B = .18$ , all  $p < .05$ ), whereas independent SLE did not (all  $B = .10$ , all  $p > .05$ ). Initial health problems also predicted new health problems ( $B = .47$ ,  $p < .001$ ). In subsequent analyses, only the indirect effects of the personality traits through dependent SLE were examined.

### Indirect Effects Analyses

Supporting our hypotheses, there was evidence that each personality variable indirectly predicted the onset of new health problems through dependent SLE (neuroticism: indirect effect = .027, 95% CI: .001 to .051; impulsivity: indirect effect = .022, 95% CI: .004 to .050; agreeableness: indirect effect = -.015, 95% CI: -.044 to -.002). Each model explained a significant amount of variance in the outcome (neuroticism

and agreeableness  $R^2 = .10$ ; impulsivity  $R^2 = .12$ ; all  $p < .05$ ). These effects persisted above and beyond 12-month major depression, with similar effect sizes (neuroticism: .020; impulsivity: .019; agreeableness: .013).<sup>1</sup>

When self- and informant report were considered separately, the indirect effects for neuroticism and impulsivity remained significant across sources. The indirect effect of agreeableness was significant only for informant report. The magnitudes of these effects were similar to those for the combined scales. We also examined whether self-report personality maintained a significant indirect effect on new health problems when informant report was controlled, and vice versa. These analyses revealed that the indirect effect was significant for both sources of impulsivity, and informant-report neuroticism and agreeableness. When the other personality traits were controlled in each analysis (e.g., neuroticism as the predictor with agreeableness and impulsivity included as covariates), the indirect effects of neuroticism and impulsivity, but not agreeableness, remained significant.

Analysis of individual facet scores demonstrated that all neuroticism and impulsivity facets had a significant indirect effect on new health problems through dependent SLE (range: .012 to .026), with the largest indirect effects being for angry hostility (.026) and depression (.024) from neuroticism. For agreeableness, the indirect effects were only significant for trust, altruism, and compliance (range:  $-.015$  to  $-.017$ ). Effects of the majority of facet scores persisted above and beyond 12-month major depression, with the exception of the depression and self-consciousness facets of neuroticism.

## DISCUSSION

This longitudinal study of late mid-life adults examined whether personality indirectly predicts the emergence of new health problems via the occurrence of dependent stressful life events (SLE). Higher neuroticism and impulsivity, and lower agreeableness directly predicted the occurrence of dependent, but not independent, SLE. Indirect effects linked each personality trait to new health problems through dependent SLE, suggesting that personality-related stress generation contributes to the emergence of new physical health problems in late mid-life. Results were largely consistent when controlling for 12-month major depression diagnosis, suggesting that the effect of personality-driven stress generation on changes in physical health operates above and beyond the effect of depression.

Furthermore, findings were robust across self- and informant-report neuroticism and impulsivity, whereas informant report appeared to drive the indirect effect of agreeableness on new health problems. These results suggest that it is important to consider personality reports from both the participant and a close other when examining the impact of personality-driven stress generation on health. Informant reports may be particularly important for agreeableness.

All neuroticism and impulsivity facets produced indirect effects of similar magnitude to their respective scales. On the other hand, only half of the agreeableness facets (trust, altruism, and compliance) produced significant indirect effects. Findings support previous suggestions from personality researchers to focus work on the NEO personality facets. The NEO personality domains are somewhat heterogeneous, and thus distinct facets may operate differently on given outcomes. For example, the facets of agreeableness that appear to be most important to the impact of stress generation in health represent the characteristics of viewing others as having good intentions (trust), having courtesy and consideration for others (altruism), and having a willingness to cooperate and get along (compliance) (Costa, McCrae, & Dye, 1991). It may be that these traits play a bigger role in factors that influence dependent SLE, such as interpersonal harmony, than the other facets. However, this must be examined with more focused research, especially considering the lower reliability for some of the facets (e.g., tender-mindedness). Indeed, agreeableness is one of the least studied NEO domains (Jensen-Campbell & Graziano, 2001).

Decades of research have shown that personality influences health outcomes (Ferguson, 2013; Hampson, 2012). However, with few exceptions (e.g., health behaviors and education; Hampson, Goldberg, Vogt, & Dubanoski, 2007; Lodi-Smith et al., 2010), the mechanisms that are responsible for the link between personality and health are largely unknown. Present findings are in line with past studies demonstrating a cross-sectional effect of personality on illness prevalence (e.g., Goodwin & Friedman, 2006), but go further by examining the longitudinal mechanisms of the associations between personality traits and changes in health. Results suggest that dependent SLE are a mechanism by which neuroticism, impulsivity, and agreeableness impact the emergence of new health problems during late mid-life.

This report replicates prior work linking neuroticism and impulsivity to stress generation (e.g., Kendler et al., 2003; Liu & Kleiman, 2012). Most previous studies have been based on adult samples, but few have focused on this process during late mid-life. One set of analyses utilizing a subset of participants from the current sample found that neuroticism predicted the occurrence of SLE, without differentiating between dependent and independent SLE (Gleason et al., 2012). Another manuscript using SPAN data found that pathological personality traits associated with neuroticism and agreeableness were associated with elevated dependent SLE (Powers et al., 2013). The present paper goes beyond these previous reports to include additional longitudinal data and novel, integrated statistical analyses that document connections linking personality and physical health through the process of stress generation. In addition, no previous studies have examined the potential role of agreeableness in stress generation. Current findings demonstrate that agreeableness, particularly as reported by a close other, not only predicts the occurrence of dependent SLE, but also indirectly predicts new health problems through its impact on dependent SLE. Thus, this work identifies a constellation of distinct personality

attributes that may increase risk for stress and subsequent health problems.

Current findings suggest that people are not merely passive recipients of environmental stimuli, but also help to shape the contexts in which they live. Neuroticism, impulsivity, and (low) agreeableness are personality characteristics that may place individuals at risk for selecting environments that contribute to the occurrence of stressful events. Current findings suggest that these personality traits may be potential targets for preventive health interventions. Modifying behaviors and cognitions associated with these traits may lead to reductions in the occurrence of dependent SLE, in turn decreasing health risks (Magidson, Roberts, Collado-Rodriguez, & Lejuez, 2014). Intervention studies are needed to test this hypothesis and to identify treatments that are most effective for this purpose.

The associations among personality, SLE, and health are likely transactional across life-span development. Chronic experiences with poverty, traumatic environments, and poor relationships in childhood may shape personality in ways that increase risk for future stress, which in turn influences personality and behavior, leading to additional stress, and so on (Del Giudice, Ellis, & Shirtcliff, 2011; Miller, Chen, & Parker, 2011). Physiological responses to stress increase *allostatic load*, the accumulation of stress-related adaptations in biological systems that, over time, increase risk for disease (McEwen, 1998). Late mid-life may be the developmental period when the health consequences of allostatic load become most apparent (Miller et al., 2011). Current results capture a snapshot of this transactional process, which unfolds over the life span. Further longitudinal research, particularly with data that extend from childhood to adulthood, is needed to fully elucidate the reciprocal nature of the connection between stress generation and physical health, as well as the mediating and moderating roles of other behavioral, environmental, and biological/genetic factors.

## LIMITATIONS

It is important to consider the limitations of this study. Analyses focused on a single health outcome, that is, the onset of new health problems. It is important to clarify whether these results will extend to other aspects of health, such as disease progression, health perceptions, and mortality, as well as objective measures of health (e.g., blood pressure). In addition, only three SLE were considered independent, which may limit content validity. However, there are necessarily fewer independent SLE because we chose events that were *almost surely* independent, whereas dependent SLE were considered *potentially* dependent (if anything, this likely reduces the strength of association between dependent events and personality). We also did not code for the occurrence of multiple events occurring within one category, which may limit our understanding of the associations among personality, SLE, and health. Further, we examined only one measure of stress. The current measure of stress focuses on acute, major stressors. It may not adequately measure chronic

stress, which is likely influenced by personality and certainly contributes to physical health (Miller et al., 2011). The measure of stressful life events utilized in the SPAN study also does not assess the intensity of the participant's stress response, though such measures are more strongly confounded with personality (Dohrenwend, 2006). Indeed, one strength of this study is its focus on objective stressful events that are largely distinct from personality traits and psychopathology.

The current study did not measure and therefore was unable to consider potential biological mechanisms that may be responsible for the impact of personality on stress and health. For example, certain personality traits (e.g., extraversion, hostility) have been found to directly impact inflammation and cardiovascular risk (Chapman, Khan, & Harper, 2009; Smith, Glazer, Ruiz, & Gallo, 2004). Examining the interplay among personality, stress, and physiological processes related to health would be a major contribution to the study of personality and health.

Further, indirect effects of other dimensions of personality on health through SLE were not examined. For example, the domain of conscientiousness is strongly associated with health (Bogg & Roberts, 2013). Though two facets of conscientiousness were included as part of the impulsivity variable, we did not include the full conscientiousness domain, as we did not hypothesize that SLE would be a mechanism by which conscientiousness impacts health, outside of its contribution to the concept of impulsivity. Indeed, in the current sample, only the conscientiousness facets included in impulsivity (i.e., deliberation and self-discipline) were indirectly associated with changes in health through dependent SLE. Openness was found in a previous study to predict the occurrence of SLE (Headey & Wearing, 1989), but in the current sample, openness was neither associated with SLE nor with the onset of new health problems.

The current sample was restricted in age and geographical location. Focusing on later middle-age provides an opportunity to examine these issues because it is a time when personality traits may be relatively stable and the onset of new health problems is increasingly frequent. Nevertheless, future studies are required to determine whether current findings remain consistent across development and in more geographically and racially/ethnically diverse samples.

Perhaps most important is the fact that current results do not establish causality. Recent findings by Kendler and Gardner (2010) provided evidence for a causal relationship between dependent SLE and the onset of major depression by utilizing co-twin control and propensity score-matching methods (Kendler & Gardner, 2010). Future studies would benefit from this type of methodology to establish the causal impact of stress generation on health outcomes.

## CONCLUSIONS

Previous studies have demonstrated that stress generation impacts psychological health (e.g., Hammen et al., 2004), but less research has focused on its potential contribution to physical

health outcomes. The current study fills an important gap in the literature by providing insight into the mechanisms by which personality impacts physical health. Similar studies will aid in the development and refinement of health interventions for older adults, a rapidly growing population in the United States for whom health concerns are prominent. Specifically, health interventions may be aided by addressing the complex interplay between contextual factors such as psychosocial stress and dispositional characteristics such as personality.

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## Notes

We also examined the possible contribution of health behaviors (i.e., tobacco use, alcohol use, and lack of exercise) to our hypothesized models, considering their strong association with conscientiousness-related traits such as impulsivity (Hampson, 2012). Health behaviors were measured at follow-up 1 (6 months after baseline) and were modeled as a sum of these three health behavior variables (coded dichotomously). Health behaviors were not significantly associated with new health problems. This was true whether or not covariates were included. Thus, we did not examine poor health behaviors as an alternative indirect path from personality to health, nor from stress to health. Controlling for health behaviors in indirect effects analyses did not change results.

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