The Moderating Effect of Chronological Age on the Relation Between Neuroticism and Physical Functioning: Cross-Sectional Evidence From Two French Samples

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Abstract

Objectives. Prior studies of age-restricted samples have demonstrated that, in older adulthood, neuroticism is negatively associated with difficulties performing specific daily activities. No studies of neuroticism and physical functioning have been conducted on life-span samples. This study tested the hypothesis that the relationship between neuroticism and physical functioning is stronger in older people compared with younger and middle-aged adults.

Method. Data were obtained from 2 independent French samples (n = 1,132 and 1,661 for Samples 1 and 2, respectively) ranging in age from 18 to 97. In addition to reporting sociodemographics, participants completed the Big Five Inventory, the physical functioning scale of the 36-Item Short Form Health Survey, and measures of disease burden.

Results. In both samples, regression analysis indicated that neuroticism is more negatively associated with physical functioning with advancing age, controlling for gender, marital status, disease burden, and educational attainment.

Discussion. In life-span samples of more than 2,700 adults, neuroticism was more strongly associated with worse physical functioning among older people compared with younger and middle-aged adults. Longitudinal research is needed to confirm this finding and to identify potential mediators.

Key Words: Life span—Personality—Physical functioning.

The identification of factors associated with difficulties performing specific daily activities such as walking, standing, and climbing stairs (Ware & Sherbourne, 1992) deserves particular attention. Lower physical functioning is associated with negative outcomes in later life, including higher dementia and mortality risk (Hamer, Batty, Kivimaki, & Stamatakis, 2011; Zimmer, Martin, Jones, & Nagin, 2014). Studies have shown that personality is independently associated with physical functioning (Goodwin & Friedman, 2006; Suchy, Williams, Kraybill, Franchow, & Butner, 2010). Among the traits defined by the five-factor model (Digman, 1990), neuroticism, characterized by the tendency to experience distress (Costa & McCrae, 1992), is consistently associated with physical function and related constructs in older adulthood (Chapman, Duberstein, & Lyness, 2007; Duberstein et al., 2003; Jaconelli, Stephan, Canada, & Chapman, 2013; Suchy et al., 2010). There are reasons to expect that neuroticism...
may contribute more to physical functioning in older adulthood than earlier in the life span, but we are aware of no research on this issue.

Prior studies have explored whether age moderates the relation between neuroticism and indicators of subjective physical health, but they have been conducted on age-restricted samples (Duberstein et al., 2003; Löckenhoff, Sutin, Ferrucci, & Costa, 2008) or have studied perceived health, not function (Löckenhoff, Terracciano, Ferrucci, & Costa, 2012). If the pathogenic effects of neuroticism accrue over time, one might expect that the effects of neuroticism will be amplified with increasing age. Individuals high in neuroticism are more likely to engage in health-damaging behaviors such as smoking, eating an unhealthy diet, or getting inadequate exercise (e.g., Rhodes & Smith, 2006; Sutin, Ferrucci, Zonderman, & Terracciano, 2011; Terracciano & Costa, 2004). Deleterious consequences of health-damaging behaviors may accumulate over the lifetime, resulting in stronger negative contributions of neuroticism to physical functioning in advanced age. Beyond this cumulative effects argument, a declining physical functioning argument holds that, with increasing age, physical environments become increasingly challenging due to frailty and declines in physical vigor and balance. Psychological responses to these age-related challenges, such as negative affect (Windsor, Burns, & Byles, 2013), fear of falling, and reduced balance confidence (Hadjistavropoulos et al., 2012; Li, Fisher, Harmer, McAuley, & Wilson, 2003), could be compounded by neuroticism (Mann, Birks, Hall, Torgerson, & Watt, 2006), an indicator of long-standing distress.

In summary, based on prior research (Duberstein et al., 2003; Löckenhoff et al., 2012) as well as the cumulative effects and declining physical functioning arguments, it was hypothesized that neuroticism will exhibit a stronger negative relationship with physical functioning among older adults compared with younger and middle-aged adults. We tested this hypothesis using cross-sectional data from two large life-span samples.

### Method

#### Participants

**Sample 1**

Participants were French community-dwelling adults located principally in the Rhône-Alpes region, France. They were recruited in person through senior organizations, university, and associations from September 2011 to February 2012. A questionnaire was distributed to each voluntary participant meeting inclusion criteria of being at least 18 years old and free from severe functional, mental, or cognitive impairment. Overall, 1,421 individuals agreed to participate. Participants returned the questionnaire to the authors’ university address by post in a prepaid envelope or they left the questionnaire with an official of the organization from which they were recruited. Two hundred eighty-nine respondents with incomplete questionnaires on the variables of interest were excluded from data analysis. The final sample consisted of 1,132 individuals aged from 18 to 90 years (61% women, mean age = 48.63, standard deviation [SD] = 20.40). There were three hundred eleven 18- to 29-year olds (young adults), five hundred seventy-one 30- to 67-year olds (middle-aged adults), and 250 older adults aged 68 and older. The mean level of education was 13.36 years (SD = 2.93). Participants had a mean physical functioning score (mean = 89.90, SD = 14.36) higher than published French norms (mean = 84.45, SD = 21.19) (Leplège, Ecosse, Pouchot, Coste, & Perneger, 2001).

**Sample 2**

Participants were French individuals belonging to a health insurance organization who were contacted in person through the managers of the organization from March 2012 to July 2012. Overall, 2,585 individuals meeting the inclusion criteria noted previously agreed to participate and returned the questionnaire by post in a prepaid envelope to the authors’ university address. Nine hundred twenty-four respondents with incomplete data on the variables of interest were excluded from data analysis. The final sample consisted of 1,661 individuals aged 18–97 (63% women, mean age = 48.37, SD = 17.34). There were 339 young adults, 1,097 middle-aged adults, and 225 older adults. They had an average of 14.92 years of education (SD = 2.85) and a mean physical functioning score (mean = 87.97, SD = 17.46) slightly higher than published French norms.

### Measures

#### Personality

Participants completed the French version (Plaisant, Courtois, Réveillère, Mendelsohn, & John, 2010) of the Big Five Inventory (BFI-Fr; John, Donahue, & Kentle, 1991). The BFI-Fr contains 45 self-descriptive statements that assess neuroticism, conscientiousness, extraversion, openness to experience, and agreeableness. Each item was rated on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Cronbach alphas for Samples 1 and 2, respectively, were .73 and .72 for agreeableness, .76 and .78 for openness, .78 and .77 for conscientiousness, .80 and .83 for extraversion, and .82 and .84 for neuroticism.

#### Physical functioning

Ten items from the Medical Outcomes Study 36-Item Short Form Health Survey (Ware & Sherbourne, 1992) assessed the extent to which health-related problems interfered with basic physical activities such as walking and climbing stairs. Participants used a 3-point scale from 1 (limited a
lot) to 3 (not limited at all). Each item was transformed to a range from 0 to 100, with higher scores indicating better physical functioning. Cronbach alphas for Samples 1 and 2 were .85 and .89.

Covariates

Age (in years), gender (coded as 0 for women and 1 for men), living arrangements (coded as 0 for living with a partner and 1 for living alone), educational attainment (in years), and number of diseases/conditions served as covariates. Consistent with prior research (e.g., Kempen, Jelicic, & Ormel, 1997; Löckenhoff et al., 2008), participants were asked to report whether they currently suffered from any particular diseases or conditions diagnosed by a physician. Scores can range from 0 to 26.

Data Analysis Strategy

Regression analyses predicting physical functioning tested for an interaction between personality traits and age in each sample. Covariates, personality traits, and personality traits by age interactions were entered in regression analysis. When significant interactions emerged, the simple slopes for the association between the predictor and the outcome at three levels of chronological age, that is, middle age (the mean age of the sample: Samples 1 and 2 = 48 years), younger age (1 SD below the mean: Sample 1 = 28 years and Sample 2 = 31 years), and older age (1 SD above the mean: Sample 1 = 68 years and Sample 2 = 65 years), were plotted and tested for significance (see Aiken & West, 1991). Continuous variables were mean centered. Given the relationship between disease burden and age, sensitivity analyses were conducted without adjusting for disease burden. A supplementary analysis combining both samples was also conducted.

Results

Descriptive statistics are presented in Table 1.

Sample 1

The hypothesized neuroticism by age interaction was supported ($\beta = -.05, p < .05$; Table 2). The equation was significant, $F(15,1116) = 28.03, p < .001$, $R^2 = .26, p < .001$. Follow-up analysis revealed that neuroticism was negatively associated with physical functioning in older individuals, $b = -2.60$, $t(1645) = -3.88, p < .001$ and in middle-aged individuals, $b = -1.51, t(1645) = -3.15, p < .01$, whereas no significant relationship was found for younger individuals, $b = -0.42, t(1645) = -0.65, p = .51$ (Figure 2).

In both samples, the neuroticism by age interaction remained significant ($\beta = -.06, p < .01$ and $\beta = -.08, p < .01$ for Samples 1 and 2, respectively) without adjusting for disease burden. Supplementary analysis combining both samples revealed a significant neuroticism by age interaction ($\beta = -.05, p < .01$), with associations between neuroticism and worse physical functioning observed in older individuals, $b = -2.41, t(2777) = -4.93, p < .001$, and middle-aged individuals, $b = -1.34, t(2777) = -3.81, p < .001$, but not among younger individuals, $b = -0.28, t(2777) = -0.58, p = .56$. The effect size for neuroticism by age in both samples and in the combined sample is much smaller than the effects of disease burden but only slightly smaller than the effects of gender or education.

Sample 2

Again, the hypothesized interaction was significant ($\beta = -.05, p < .05$; Table 2) as was the equation $F(15,1645) = 40.80, p < .001, R^2 = .26, p < .001$. Follow-up analysis revealed that neuroticism was negatively associated with physical functioning in older individuals, $b = -2.81, t(1116) = -2.81, p < .01$ and marginally associated in middle-aged individuals, $b = -0.92, t(1116) = -1.82, p = .06$, whereas no significant relationship was found for younger individuals, $b = 0.08, t(1116) = 0.12, p = .90$ (Figure 1).

Discussion

The present research confirms the expectation that neuroticism is more strongly associated with difficulties performing basic daily physical activities among older adults. Furthermore, this finding was replicated across two independent samples while controlling for demographics, disease burden, and other personality traits. The magnitude of the neuroticism by age effect, although relatively modest, is a fraction of the overall effect of personality and personality by age. In line with the cumulative effects argument (Löckenhoff et al., 2012; Sutin et al., 2011), the stronger negative association between neuroticism and physical functioning in older adulthood may reflect a lifetime of health-damaging behaviors (e.g., smoking and sedentary lifestyle), leading individual high in neuroticism to experience worse function, perhaps due to lower

**Table 1. Samples Characteristics**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sample 1 ($n = 1,132$)</th>
<th>Sample 2 ($n = 1,661$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age</td>
<td>48.63 (20.40)</td>
<td>48.37 (17.34)</td>
</tr>
<tr>
<td>Gender (% female)</td>
<td>61.13</td>
<td>63.99</td>
</tr>
<tr>
<td>Living arrangements (% partner)</td>
<td>64.31</td>
<td>69.05</td>
</tr>
<tr>
<td>Educational attainment</td>
<td>13.36 (2.93)</td>
<td>14.92 (2.85)</td>
</tr>
<tr>
<td>Disease burden</td>
<td>0.83 (1.14)</td>
<td>0.83 (1.15)</td>
</tr>
<tr>
<td>Extraversion</td>
<td>3.15 (0.77)</td>
<td>3.12 (0.85)</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>4.00 (0.53)</td>
<td>4.07 (0.52)</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>3.79 (0.64)</td>
<td>3.96 (0.62)</td>
</tr>
<tr>
<td>Openness to experience</td>
<td>3.42 (0.63)</td>
<td>3.53 (0.65)</td>
</tr>
<tr>
<td>Neuroticism</td>
<td>2.79 (0.82)</td>
<td>2.85 (0.87)</td>
</tr>
<tr>
<td>Physical functioning</td>
<td>89.90 (14.36)</td>
<td>87.97 (17.46)</td>
</tr>
</tbody>
</table>

Note. Standard deviations are shown in parentheses.
muscle strength (Tolea et al., 2012), physical conditions (Charles, Gatz, Kato, & Pedersen, 2008), or deconditioning. Alternatively, it is possible that age-related frailty and declines in physical vigor render the physical environment increasingly likely to elicit fear of falling or reduced balance confidence (Li et al., 2003; Scheffer, Schuurmans, van Dijk, van der Hooft, & de Rooij, 2008). Fears and shaken confidence might be more readily elicited in people who are constitutionally distress prone on account of elevated neuroticism. From this perspective, declines in perceived physical function are not a direct result of deconditioning per se but are instead a direct result of the psychological challenges (Hadjistavropoulos et al., 2012) that are exacerbated by elevated neuroticism. Weaker associations between neuroticism and physical function among younger people may also reflect the lower prevalence of disease-related physical limitations in younger adulthood.

This study is consistent with prior research on age-restricted samples demonstrating that the relation between neuroticism and worse perceived health becomes stronger with increasing age (Duberstein et al., 2003; Löckenhoff et al., 2012). As the first study to address this phenomenon across the adult life span, our cross-sectional study was designed to explore whether the associations between personality and physical functioning exist and when, in the course of the life span, they are most evident. Although the relationship between neuroticism and physical function is most pronounced in older adulthood, it is also present in middle-aged adults. Several limitations should be considered. The cross-sectional design precludes causal or temporal inference. Observed age differences may be due to birth cohort differences, selection effects, or both. Our study is based entirely on self-reported function. Future studies could utilize performance indicators of function. Participants in both samples were well educated and

Table 2. Summary of Regression Analysis Predicting Physical Functioning From Covariates, Personality Traits, and Personality Traits by Age Interactions for Each Sample

<table>
<thead>
<tr>
<th>Variables</th>
<th>Sample 1 (n = 1,132)</th>
<th>Sample 2 (n = 1,661)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β</td>
<td>B</td>
</tr>
<tr>
<td>Gender</td>
<td>.07**</td>
<td>2.22</td>
</tr>
<tr>
<td>Age</td>
<td>−.19***</td>
<td>−0.13</td>
</tr>
<tr>
<td>Living arrangements</td>
<td>−.06*</td>
<td>−1.88</td>
</tr>
<tr>
<td>Educational attainment</td>
<td>.08***</td>
<td>0.58</td>
</tr>
<tr>
<td>Disease burden</td>
<td>−.34***</td>
<td>−4.30</td>
</tr>
<tr>
<td>Extraversion</td>
<td>.06*</td>
<td>1.19</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>.03</td>
<td>0.87</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>.05</td>
<td>1.23</td>
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<tr>
<td>Openness to experience</td>
<td>−.01</td>
<td>−0.38</td>
</tr>
<tr>
<td>Neuroticism</td>
<td>−.05</td>
<td>−0.92</td>
</tr>
<tr>
<td>Extraversion × age</td>
<td>.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Agreeableness × age</td>
<td>−.04</td>
<td>−0.05</td>
</tr>
<tr>
<td>Conscientiousness × age</td>
<td>.02</td>
<td>0.02</td>
</tr>
<tr>
<td>Openness × age</td>
<td>.01</td>
<td>0.01</td>
</tr>
<tr>
<td>Neuroticism × age</td>
<td>−.05*</td>
<td>−0.04</td>
</tr>
</tbody>
</table>

Note. SE = standard error. *p < .05. **p < .01. ***p < .001.

Figure 1. Moderating effect of age on the relationship between neuroticism and physical functioning in Sample 1 (n = 1,132). **p < .01.
relatively healthy. Future studies could examine whether this pattern of associations can be generalized to more diverse samples, including relatively unhealthy individuals. Finally, future studies could control for objective indicators of health (Duberstein et al., 2003). The influence of personality on physical functioning may depend on objectively assessed health status, as disease-related biological changes could easily overwhelm the effect of personality on health outcomes (Jerant, Chapman, Duberstein, & Franks, 2010). Nonetheless, it is quite expensive to collect data on objective health, and the self-reported indicators used in this study are good proxies.

In conclusion, this study indicates that neuroticism exhibits a stronger negative relationship with physical functioning among older people compared with younger and middle-aged adults. Longitudinal research is now needed to confirm this finding and to identify potential mediators.

References


association between NEO-PI-R and SF-36 in advanced age is influenced by health status. *Journal of Research in Personality, 42*, 1334–1346. doi:10.1016/j.jrp.2008.05.006


