Personality and incident disability in older persons

K. R. Krueger1,2, R. S. Wilson1,2, R. C. Shah1,4, Y. Tang5,6, D. A. Bennett1,3

1Rush Alzheimer’s Disease Center, 2Department of Behavioral Sciences, 3Department of Neurological Sciences, 4Department of Family Medicine, 5Rush Institute for Healthy Aging, and 6Department of Internal Medicine, Rush University Medical Center, Chicago, IL, USA

Address correspondence to: K. R. Krueger, Rush Alzheimer’s Disease Center, Rush University Medical Center, Armour Academic Center, 600 South Paulina, Suite 1038, Chicago, IL 60612, USA. Tel: (+1) 312 942 8746. Fax: (+1) 312 942 2297. Email: kristin_krueger@rush.edu

Abstract

Objective: to examine the relation of personality to the development of disability in old age.

Methods: participants are 813 older Catholic nuns, priests and brothers without dementia or disability at study onset. As part of a uniform baseline evaluation, they completed standard measures of the five principal dimensions of personality. Disability was assessed at baseline and annually thereafter with the Katz scale. The relation of each trait to incident disability was assessed in proportional hazard models controlled for age, sex, education and selected clinical variables.

Results: during a mean of about 6 years of observation, 255 persons (31%) became dependent on at least one activity of daily living. Risk of becoming disabled was 85% [95% confidence interval (CI) = 80.5–89.6%] lower in persons with high (90th percentile) compared to low (10th percentile) extraversion and 50% (95% CI = 46.6–54.2%) lower in those with high compared to low conscientiousness, and controlling for chronic medical conditions, depressive symptoms or social and cognitive activity did not substantially affect these associations. By contrast, neuroticism had a marginal association with disability risk that was eliminated after controlling for depressive symptomatology, and openness and agreeableness were unrelated to disability risk.

Conclusions: the results suggest that higher levels of extraversion and conscientiousness may be associated with a reduced risk of incident disability in old age.

Keywords: extraversion, conscientiousness, neuroticism, personality, disability, longitudinal studies, elderly

Introduction

Because personality traits are relatively stable in adulthood and have widespread influences on behaviour, they have the potential to affect the disablement process [1]. Yet, there have been few prospective studies of the association of personality with disability risk, and cross-sectional studies have yielded inconsistent results. One obstacle to the progress is that such a diverse array of personality traits has been examined that it is difficult to integrate findings across studies. In the past decade, the big five taxonomy of personality has gained wide acceptance [2, 3]. Because the model is relatively new, however, few studies have related it to disability, and most of these have focused on neuroticism and extraversion to the exclusion of the other three traits.

We used data from the Rush Religious Orders Study [4] to investigate the association of personality traits with the risk of becoming disabled in old age. Participants are over 800 Catholic nuns, priests and brothers without disability or dementia at baseline. They completed standard self-report measures of the big five personality traits at baseline. Incidence of disability was assessed annually for a mean of nearly 6 years. In analyses, we examined the association of each personality trait with the risk of incident disability and whether these associations were mediated or modified by selected clinical variables.

Method

Participants

Participants are older Catholic clergy members from the Rush Religious Orders Study. They signed an informed
Personality and incident disability in older persons

consent to undergo annual clinical evaluations and signed an anatomical gift act for brain donation at death. The study was approved by the Institutional Review Board of Rush University Medical Center.

Enrolment began in January of 1994 and continues. At the time of these analyses, 953 people had completed the baseline evaluation. Of these, 69 met the criteria for dementia, and another 20 persons reported dependence on at least one activity of daily living on the Katz scale [5]. In the remaining 864 people, the mean age was 74.7 years (SD = 6.9), mean education was 18.2 years (SD = 3.3), 67.7% were women and 89.2% were white and non-Hispanic.

Clinical evaluation
At baseline and annually thereafter, participants had a uniform clinical evaluation, with examiners blinded to previously collected data. The evaluation included assessment of selected risk factors, medical history, cognitive testing and neurological examination. The diagnosis of dementia was made by an experienced physician using National Institute of Neurologic and Communicative Disorders and Stroke and the Alzheimer’s Disease and Related Disorders Association criteria [6], as reported in detail elsewhere [7].

Assessment of personality
We assessed five personality traits with the NEO Five-Factor Inventory [8]: neuroticism refers to proneness to experience negative emotions; extraversion indicates a tendency to be sociable and energetic; openness indicates an intellectual curiosity and a preference for varied experience; agreeableness is the tendency to be helpful and cooperative and conscientiousness indicates diligence and determination. Each trait measure consists of 12 statements that were rated from 0 to 4, with higher scores indicating more of the trait in question. Items scores were summed to yield trait scores that could range from 0 to 48, as previously described [9].

Assessment of disability
We assessed disability annually with the Katz scale [5] that addresses walking, bathing, dressing, eating, getting from bed to chair and toileting. Inability to perform one or more of these activities was the primary definition of disability.

Assessment of other variables
Seven medical conditions were identified in at least 5% of participants at baseline. Classification of heart disease, hypertension, diabetes, cancer, thyroid disease and head injury with loss of consciousness was based on the self-report that a health care worker had identified the condition. Stroke was diagnosed based on history and neurological examination, as previously reported [10]. We used the number of these conditions as an indicator of chronic illness, as described elsewhere [9].

Participants were divided into those who never smoked tobacco, current smokers and former smokers. Alcohol use was expressed as mean drinks per day in the previous year and at the previous time of heaviest intake.

Depressive symptomatology was assessed with the 10-item version [11] of the Center for Epidemiologic Studies Depression Scale [12]. The score is the number of symptoms experienced in the past week, and it corresponds well with the original scale [11].

Social activity was assessed with three questions about part-time or full-time employment, participation in social groups or organisations and visiting museums. Item scores were summed to yield a measure of social engagement that could range from 0 to 6.

Frequency of participation in cognitively stimulating activities (e.g. reading and playing checkers) was assessed on a five-point scale [13]. Item scores were averaged to yield a composite measure of which has been previously associated with cognitive decline and dementia [14].

Data analysis
Cronbach’s coefficient alpha was used to assess the internal consistency of each trait scale. Cox proportional hazards models [15] were used to test the association of each personality trait with risk of becoming disabled. All analyses included terms for age, sex and education. Each personality trait was examined separately in the initial models. In separate subsequent analyses, we added terms for chronic illness, tobacco use and alcohol use; for depressive symptoms and for social activity and cognitive activity. Analyses were repeated with terms added for the interaction of a given trait with chronic illness and use of tobacco and alcohol; with depressive symptoms and with social and cognitive activity. Analyses were validated graphically and analytically. Programming was done in SAS [16].

Results

Development of disability during follow-up
Of 864 eligible persons at the baseline evaluation, 22 died before the first annual follow-up evaluation and 14 had not reached the first-year follow-up point. Of the remaining 828 persons, 813 (98%) completed at least one follow-up evaluation, with a mean of 6.8 annual evaluations per person (range: 2–11), 95% of possible evaluations in survivors.

During a mean of about 6 years of annual evaluations, 255 persons (31%) became dependent on at least one activity of daily living. Those who became disabled were older, more apt to have a chronic medical condition, more depressed and less socially and cognitively active than those who did not become disabled. Please see Appendix 1 in the supplementary data on the journal website (http://www.ageing.oxfordjournals.org\/).

Personality and incident disability
The personality measures administered at baseline had approximately normal distributions. Neuroticism scores ranged from 0 to 36 (mean = 16.6, SD = 5.6, \( \alpha = 0.80 \)), extraversion ranged from 11 to 47 (mean = 27.9, SD = 5.7, \( \alpha = 0.78 \)), openness ranged from 4 to 42 (mean = 26.4, SD = 5.2, \( \alpha = 0.69 \)), agreeableness ranged from 19 to 48 (mean = 34.2, SD=3.8, \( \alpha = 0.69 \)) and conscientiousness ranged from 11 to 47 (mean = 34.1, SD = 4.9, \( \alpha = 0.81 \)), with higher scores indicating higher levels of each trait. Neuroticism was inversely correlated with the other...
four traits, education and level of social and cognitive activity and positively correlated with level of depressive symptoms; by contrast, the remaining four traits had, with some exceptions, positive associations with one another, education, and social and cognitive activity and inverse associations with depressive symptomatology. Please see Appendix 2 in the supplementary data on the journal website (http://www. ageing.oxford-journals.org).

To examine the relation of personality traits to disability risk, we constructed a series of proportional hazard models separately for each trait (Table 1). All analyses controlled for the potentially confounding effects of age, sex and education. In the initial analyses (Table 1, model A), higher levels of extraversion and conscientiousness were related to lower risk of incident disability. By contrast, there was a nearly significant association of higher neuroticism with increased disability risk and no effect for openness or agreeableness. Thus, as shown in Figure 1 which is based on these analyses, risk of disability was 85% [95% confidence interval (CI) = 80.5–89.6%] lower in a person with high (solid line, score = 35, 90th percentile) compared to low (dotted line, score = 20, 10th percentile) extraversion (upper panel) and 50% (95% CI = 46.6–54.2%) lower in a person with high (solid line, score = 40, 90th percentile) compared to low (dotted line, score = 28, 10th percentile) conscientiousness (lower panel).

To see whether findings depended on the cut-off point used to define disability, we repeated the initial analysis of each trait twice, first with disability defined as dependence in at least two activities on the Katz (Table 1, model B) and then again requiring dependence in at least three activities (Table 1, model C). The results of these analyses were comparable to the original models (Table 1, model A).

**Potential mediators and modifiers of the personality–disability association**

We first considered the possibility that chronic medical conditions or health-related behaviours might affect the relation of personality to incident disability. To this end, we repeated the initial analysis of each trait with a term for the number of chronic medical conditions present at baseline, for current or past tobacco use and for current and past level of alcohol use. In these analyses (Table 2, model A), the relation of each trait to disability was comparable to the original analyses except that the relation of neuroticism to risk of disability was now significant. To see whether health-related factors modified the association of personality with incident disability, we repeated each analysis with a term for the interaction of a given trait with chronic illness, then with terms for the interaction of the trait with current and past tobacco use and finally with terms for the interaction of the trait with current and past levels of alcohol use. No strong evidence of an interaction was observed (all P>0.01).

Because depressive symptomatology is related to both personality [17] and disability risk [18], we repeated the original analysis of each trait with a term for baseline depressive symptomatology. In these analyses, the association of neuroticism with incident disability was substantially reduced and no longer significant, but the associations of extraversion and conscientiousness with disability were essentially unchanged (Table 2, model B). In subsequent analyses, there was no evidence that depressive symptomatology modified the relation of any trait to risk of disability.

### Table 1. Relation of personality traits to incident disability

<table>
<thead>
<tr>
<th>Personality trait</th>
<th>Model A [RR (95% CI)]</th>
<th>Model B [RR (95% CI)]</th>
<th>Model C [RR (95% CI)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuroticism</td>
<td>1.022 (0.999–1.046)</td>
<td>1.041 (1.012–1.070)</td>
<td>1.042 (1.008–1.077)</td>
</tr>
<tr>
<td>Extraversion</td>
<td>0.960 (0.937–0.984)</td>
<td>0.966 (0.938–0.995)</td>
<td>0.964 (0.930–0.999)</td>
</tr>
<tr>
<td>Openness</td>
<td>0.994 (0.968–1.021)</td>
<td>0.988 (0.956–1.021)</td>
<td>0.972 (0.936–1.011)</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>0.994 (0.961–1.027)</td>
<td>0.980 (0.941–1.020)</td>
<td>0.983 (0.937–1.031)</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>0.936 (0.943–0.991)</td>
<td>0.954 (0.926–0.984)</td>
<td>0.941 (0.909–0.975)</td>
</tr>
</tbody>
</table>

*From proportional hazards models adjusted for age, sex and education. In model A, disability is defined as Katz score >0, in model B, as Katz score >1 and in model C as Katz score >2.*
The relation of personality traits to incident disability is shown in Table 2. Given the inverse association between frequency of various lifestyle activities and disability risk in old age [19–21], we repeated the initial analysis of each trait with terms added for baseline frequency of social activity and cognitive activity to determine whether they mediated the association of personality with incident disability. In these analyses, higher levels of social and cognitive activity were associated with reduced risk of disability ($P<0.01$ for each variable in each model); the relation of neuroticism to incident disability was not significant, but the effects of extraversion and conscientiousness on incident disability were not substantially changed (Table 2, model C). We repeated these analyses with terms for the interaction of each activity measure with each trait and did not find strong evidence of an interaction.

### Discussion

We examined the relation of personality to risk of developing disability in more than 800 older persons without disability during a mean of nearly 6 years of observation. Higher levels of extraversion and conscientiousness were associated with reduced risk of incident disability. There was mixed evidence, suggesting that higher level of neuroticism was associated with an increased disability risk. By contrast, openness and agreeableness were not related to disability. The results remained stable even after varying the cut-off score used to define disability and suggest that personality may affect the risk of becoming disabled in old age.

The relation of the five-factor model of personality to the risk of disability in old age has not been extensively investigated. Most previous research has been cross-sectional and focused on neuroticism and extraversion only. Higher level of neuroticism has been associated with a higher level of self-reported disability in some studies [22, 23] but not in others [24–26], with no apparent association between extraversion and disability [24–26]. The only prospective study of which we are aware found neither neuroticism nor extraversion to be associated with 2-year change in self-reported disability in a population-based sample that included persons with cognitive impairment and disability at baseline [25].

The bases of the association between personality and incident disability are uncertain. Because neuroticism is a risk factor for depressive symptomatology [17] and depressive symptomatology is a risk factor for disability [18], depressive symptomatology might account for the association of neuroticism with disability. Indeed, we found that adding a term for depressive symptoms attenuated the association of neuroticism with disability which is consistent with the hypothesis that depressive symptoms mediate the association. By contrast, depressive symptoms did not substantially affect the associations of extraversion or conscientiousness with disability.

Level of social activity was inversely related to risk of disability, consistent with prior research [19, 21]. We observed a similar independent association between level of cognitive activity and risk of disability, which to the best of our knowledge has not been previously described. Yet neither social nor cognitive activity mediated or modified the associations of extraversion and conscientiousness with disability.

Another issue is that individuals differ in how much physical impairment must be present before they report a functional limitation [27]. The observed association between personality and the development of disability might be explained, therefore, by personality differences in labelling the same levels of functional limitations rather than with true underlying differences. That neuroticism, extraversion and conscientiousness are also related to mortality in this cohort [9] makes this explanation less likely, however.

A unique feature of this study is that the participants are all Catholic clergy members who have relatively homogeneous lifestyles and socioeconomic status through much of adulthood. Because socioeconomic status is related to personality [28], disability [19, 21, 29] and thresholds for reporting disability [27], this homogeneity may have reduced residual confounding due to socioeconomic status and thereby enhanced our ability to identify associations between personality traits and disability.

At the same time, the selected nature of the cohort and its differences from older persons in the US population in socioeconomic and related variables are important study limitations. Prospective studies of personality and disability in population-based samples of older persons are needed.

Confidence in these findings is strengthened by several factors. The prospective study design allowed us to assess personality in persons without disability at study onset and to test the relation of each trait to subsequent risk of becoming disabled. Application of widely accepted criteria following a uniform clinical evaluation permitted identification and exclusion of persons with dementia, enhancing our ability to assess personality at baseline. We assessed each of the big five personality traits with standard measures. Persons were evaluated annually for nearly 6 years with a high rate of follow-up participation, minimising bias because of selective attrition. A relatively large number of participants

<table>
<thead>
<tr>
<th>Personality trait</th>
<th>Model A [RR (95% CI)]</th>
<th>Model B [RR (95% CI)]</th>
<th>Model C [RR (95% CI)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuroticism</td>
<td>1.024 (1.000–1.048)</td>
<td>0.992 (0.966–1.018)</td>
<td>1.016 (0.993–1.040)</td>
</tr>
<tr>
<td>Extraversion</td>
<td>0.960 (0.936–0.985)</td>
<td>0.971 (0.947–0.996)</td>
<td>0.973 (0.948–0.998)</td>
</tr>
<tr>
<td>Openness</td>
<td>0.993 (0.967–1.020)</td>
<td>0.993 (0.968–1.019)</td>
<td>1.012 (0.985–1.040)</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>0.995 (0.962–1.030)</td>
<td>1.009 (0.976–1.044)</td>
<td>0.997 (0.964–1.031)</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>0.963 (0.938–0.988)</td>
<td>0.973 (0.949–0.998)</td>
<td>0.972 (0.948–0.997)</td>
</tr>
</tbody>
</table>

*From proportional hazards models adjusted for age, sex and education. In addition, model A controlled for chronic medical conditions, model B for depressive symptoms and model C for social and cognitive activity.*
were studied, permitting control of multiple covariates while maintaining adequate statistical power.

**Key points**
- Higher levels of extraversion are associated with a reduced risk of incident disability in old age.
- Higher levels of conscientiousness are associated with a reduced risk of incident disability in old age.
- An association of neuroticism with disability risk was eliminated after controlling for depressive symptomatology.
- Openness and agreeableness were unrelated to disability risk.

**Acknowledgements**

This research was supported by National Institute on Aging grants P30 AG10161 and RO1 AG15819. The authors thank the hundreds of nuns, priests and brothers from the following groups participating in the Religious Orders Study: Archdiocesan priests, Chicago, IL, Dubuque, IA and Milwaukee, WI, Benedictine monks, Lisle, IL, an Collegeville, MN, Benedictine Sisters, Erie, PA: Benedictine Sisters of the Sacred Heart, Lisle, IL, Capuchins, Appleton, WI, Christian Brothers, Chicago, IL, and Memphis, TN, diocesan priests, Gary, IN, Dominicans, River Forest, IL, Felician Sisters, Chicago, IL, Franciscan Handmaids of Mary, New York NY; Franciscans Chicago, IL, Holy Spirit Missionary Sisters, Techny IL, Maryknolls, Los Altos, CA, and Maryknolls, NY, Norbertines, De Pere, WI, Oblate Sisters of Providence, Baltimore, MD, Passionists, Chicago, IL, Presentation Sisters, BVM, Dubuque, IA, Servites, Chicago, IL, Sinsinawa Dominican Sisters, Chicago, IL, an Sinsinawa WI, Sisters of Charity, BVM, Chicago, IL, and Dubuque IA, Sisters of the Holy Family, New Orleans, LA, Sisters of the Holy Family of Nazareth, Des Plaines, IL, Sisters of Mercy of the Americans, Chicago, IL, Aurora, IL, and Erie, Pa, Sisters of St. benedict, ST. Cloud, MN And St. Joseph, MN, Sisters of St. Casimir Chicago, IL, Sisters of St. Francis of Mary Immaculate, Joliet, IL, Sisters of St. Joseph of La Grange, LaGrange Park, IL, Society of Divine Word, Techny, IL, Trappists, Gethsemane, KY and Peosta, IA and Wheaton Franciscan Sisters, Wheaton, IL. They also thank Julie Bach, MSW, Tracy Colvin, MPH and George Hoganson for co-ordinating the Religious Orders Study, George Dombrowski, MS and Greg Klein for data management, Todd Beck, MS for analytic programming and Valerie J. Young for preparing the manuscript.

**Conflict of interest**

The authors have no conflict of interest.

**References**


Received 9 August 2005; accepted in revised form 27 March 2006