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Research Article

Personality and Risk of Arthritis in Six Longitudinal Samples

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Abstract

Objectives: Personality traits are broadly related to medical conditions, but there is limited research on the association with the risk of arthritis. This multicohort study examines the concurrent and prospective associations between personality traits and arthritis risk.

Methods: Participants ($N > 45{,}000$) were mostly middle-aged and older adults from 6 established longitudinal cohorts. Baseline assessments of personality traits, covariates (age, sex, education, race, ethnicity, depressive symptoms, body mass index, and smoking), and arthritis diagnosis were obtained in each sample. Arthritis incidence was assessed over 8–20 years of follow-up.

Results: The meta-analyses identified an association between higher neuroticism and an increased risk of concurrent (odds ratio = 1.20, 95% confidence interval [CI] = 1.16–1.24; $p < .001$, $I^2 = 40.27$) and incident (hazard ratio = 1.11, 95% CI = 1.08–1.14; $p < .001$, $I^2 = 0$) arthritis and between higher conscientiousness and a decreased risk of concurrent (odds ratio = 0.88, 95% CI = 0.86-0.90; $p < .001$, $I^2 = 0$) and incident (hazard ratio = 0.95, 95% CI = 0.92–0.98; $p = .002$, $I^2 = 41.27$) arthritis. Higher extraversion was linked to lower risk of concurrent (odds ratio = 0.92, 95% CI = 0.88–0.96; $p < .001$, $I^2 = 76.09$) and incident (hazard ratio = 0.97, 95% CI = 0.95–0.99; $p = .018$, $I^2 = 0$) arthritis, and openness was related to lower risk of concurrent arthritis (odds ratio = 0.96, 95% CI = 0.93–0.99; $p = .006$, $I^2 = 35.86$). Agreeableness was unrelated to arthritis. These associations were partially accounted for by depressive symptoms, body mass index, and smoking. There was no consistent evidence of moderation by age or sex.

Discussion: Findings from 6 samples point to low neuroticism and higher conscientiousness as factors that reduce the risk of arthritis.

Keywords: Conscientiousness, Neuroticism, Musculoskeletal disease

Arthritis, including its common forms osteoarthritis and rheumatoid arthritis, is a prevalent age-related chronic musculoskeletal disease with substantial societal and individual costs (GBD 2021 Osteoarthritis Collaborators, 2023). In addition to causing pain and stiffness, arthritis is one primary cause of disability and functional limitations (Baker et al., 2017; GBD 2021 Osteoarthritis Collaborators, 2023), as well as a financial burden (Hsieh et al., 2020; Puig-Junoy & Zamora, 2015). Furthermore, arthritis is related to a higher risk of incident dementia (Weber et al., 2019), cardiovascular disease (Løgstrup et al., 2021), and mortality (Provan et al., 2020; Veronese et al., 2016). Therefore, there is great interest in the factors associated with the risk of arthritis. There is evidence that an older age, fewer years of education, a higher body mass index (BMI), smoking, and higher depressive symptoms are related to a higher risk of arthritis (Brennan-Olsen et al., 2017; GBD 2021 Osteoarthritis Collaborators, 2023; Mohammed et al., 2020; Poole & Jackowska, 2019; Poole & Steptoe, 2018). However, there is limited research on the extent to which fundamental psychological dispositions, such as personality traits, are associated with the risk of arthritis.

The Five-Factor Model (FFM; McCrae & John, 1992) postulates that personality traits are organized into five broad dimensions: neuroticism (the propensity to experience negative emotions and distress), extraversion (the propensity to be energetic and sociable), openness to experience (the propensity to be unconventional and to entertain new ideas), agreeableness (the propensity to be altruistic, empathetic, and cooperative), and conscientiousness (the propensity to be organized and self-disciplined). Existing models and research indicate that personality is a robust predictor of health across adulthood (Chapman et al., 2014; Friedman & Kern, 2014; Strickhouser et al., 2017). In particular, higher levels of neuroticism and lower levels of conscientiousness are associated with a higher risk of chronic conditions (Leger et al., 2021; Stephan et al., 2023b; Weston et al., 2020), lower functional health (Stephan et al., 2022), higher limitations in activities of daily living (IADL; (Canada et al., 2021), and geriatric syndromes such as frailty (Gale et al., 2017; Stephan et al., 2017) and falls (Canada et al., 2020). Furthermore, these traits are related to steeper memory decline (Sutin et al., 2023), higher risk of incident dementia (Aschwanden et al., 2021), and mortality (Graham et al., 2017).

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Personality traits may be associated with arthritis through a range of risk factors. Higher levels of neuroticism and lower levels of conscientiousness, for example, are linked to depressive symptoms (Hakulinen, Elovainio et al., 2015), higher BMI (Sutin & Terracciano, 2016; Vainik et al., 2019), smoking (Hakulinen, Hintsanen et al., 2015), allostatic load (Yoneda et al., 2023), immunosenescence (Stephan et al., 2023a), and mitochondrial dysfunction (Oppong et al., 2022), which are implicated in pathways leading to arthritis (Chalan et al., 2015; GBD 2021 Osteoarthritis Collaborators, 2023; Mohammed et al., 2020; Poole & Steptoe, 2018; Schwetlik et al., 2022; Svendsen et al., 2019). In addition, these traits are associated with a heightened stress reactivity to daily stressors, which may mediate their link with the development of chronic conditions (Leger et al., 2021). Given that higher stress has been implicated in arthritis risk (Schwetlik et al., 2022), it is possible that the higher stress reactivity associated with these traits may also amplify the risk of arthritis.

There is, however, limited evidence for the link between personality and arthritis. To the best of our knowledge, only one study examined this association. Using 4 years of follow-up in the Health and Retirement Study (HRS), higher neuroticism and lower conscientiousness were associated with an increased arthritis risk in cross-sectional and longitudinal analyses (Weston et al., 2015). Higher agreeableness and openness were associated with lower risk of arthritis (concurrent and incident), whereas higher extraversion was associated with lower risk of arthritis (concurrent but not incident; Weston et al., 2015). The strongest associations with arthritis were found for neuroticism and conscientiousness in cross-sectional and longitudinal analyses (Weston et al., 2015). However, whether these findings replicate across different samples and over longer follow-ups remain to be tested.

This large-scale multicohort study examined data from six large longitudinal samples to test the concurrent and prospective associations between personality and arthritis. Using the same analytic approach across multiple samples allows for testing the replicability, generalizability, and heterogeneity of results across cohorts with different characteristics (Graham et al., 2017, 2022; Hofer & Piccinin, 2009; Willroth et al., 2022). Based on past research (Leger et al., 2021; Stephan et al., 2023a; Weston et al., 2015), it was predicted that higher neuroticism would be related to an increased risk of concurrent and incident arthritis, whereas it was hypothesized that higher conscientiousness would be related to a decreased risk of concurrent and incident arthritis. No specific predictions were made for extraversion, openness, and agreeableness. Sensitivity analyses tested if the association between personality and arthritis was accounted by psychological (depressive symptoms), clinical (BMI), and behavioral (smoking) factors. These factors could be confounding but also mediator variables of this association, suggesting potential pathways that link personality to arthritis risk. Finally, exploratory analysis tested whether age and sex moderated the link between personality and arthritis to evaluate generalizability across age and sex.

Method

Participants

Six samples were used in the present study: Midlife in the United States Study (MIDUS); HRS; Wisconsin Longitudinal Study (WLS); National Health and Aging Trends Study (NHATS); English Longitudinal Study of Ageing (ELSA); and Longitudinal Internet studies for the Social Sciences (LISS). These six studies were selected because they included a measure of the FFM personality traits, repeated assessment of arthritis over time, and were freely available. Although these datasets have been used to examine the association between personality and various health outcomes in past research (Stephan et al., 2021, 2022, 2023b), the link with arthritis has never been tested in the MIDUS, the WLS, the NHATS, and ELSA. Weston et al. (2015) used only the 2006 subsample of the HRS with a 4-year follow-up to the 2010 wave to test this relationship. All participants in the six samples provided written informed consent. The present study was exempt from Institutional Review Board (IRB) review because it used publicly available de-identified data. Table 1 includes descriptive statistics for the six samples.

MIDUS is a longitudinal survey of noninstitutionalized Americans. A total of 6,078 individuals (53% women; age range = 20–75 years; mean age = 46.80; standard deviation [*SD*] = 12.90) had full baseline data on personality, demographic factors, and arthritis diagnosis in 1995–1996. From this sample, 3,965 participants had information about arthritis in 2004–2006 and 2013–2014. MIDUS data can be accessed at http://midus.wisc.edu/index.php.

HRS is a nationally representative cohort study of Americans (age ≥50). Baseline data on personality traits, demographic factors, and arthritis were obtained in 2006/2008 from a total of 12,648 participants (58% women; age range = 50–104 years; mean age = 68.58; *SD* = 9.90). Follow-up data on arthritis was obtained every 2 years up to 2020. From the initial sample, information on arthritis at follow-up was obtained from 11,737 participants. HRS data can be accessed at https://hrs.isr.umich.edu/data-products.

WLS recruited Wisconsin high school graduates and their selected siblings and has followed them over time. Personality, demographic factors, and arthritis data were obtained in 1992–1994 from 10,008 participants (53% women; age range = 29–79 years; mean age = 53.30; *SD* = 4.30). Information about arthritis at follow-up was obtained in 2003–2007 and 2011 from 8,648 participants. WLS data can be accessed at: https://researchers.wls.wisc.edu/.

NHATS is a longitudinal survey of a nationally representative sample of Medicare enrollees aged 65 and older. A total of 2,770 individuals (59% women, age range = 67–103 years; mean age = 79.49, *SD* = 7.52) had data on personality, demographic factors, and arthritis in 2013/2014. Follow-up information on arthritis was collected annually up to 2022 from 2,395 individuals. NHATS data can be accessed at: http://www.nhats.org.

ELSA is a cohort study that recruited a nationally representative sample of people aged ≥50 in England. At Wave 5 in 2010/2011, 8,115 individuals (55% women, age range = 50–89 years; mean age = 66.10; *SD* = 8.69) provided complete data on personality, demographic factors, and arthritis. Information on arthritis was collected every 2 years up to Wave 9 (2018/2019) and was obtained from 7,502 participants. ELSA data can be accessed at: https://www.ukdataservice.ac.uk/.

The LISS panel is a representative longitudinal sample of the Dutch population. In 2007, 5,794 individuals (54% women; age range = 16–94 years; mean age = 45.81; *SD* = 15.66) had data on personality, demographic factors, and arthritis. From

this sample, 4,964 participants had information about arthritis at follow-up. LISS data can be accessed at www.lissdata.nl.

Measures

Personality

The "Midlife Development Inventory" (MIDI) was used to assess personality in the MIDUS (25-item version), HRS (26-item version), NHATS (10-item version), and ELSA (26-item version; Zimprich et al., 2012). A scale from 1 (*not at all*) to a value of 4 (*a lot*) for participants to evaluate how many adjectives measuring neuroticism (nervous), extraversion (outgoing), openness (curious), agreeableness (caring), and conscientiousness (organized) described them. The "Big Five Inventory" was used in the WLS (John et al., 1991). Respondents chose from 1 (*disagree strongly*) to 6 (*agree strongly*) on 29 brief descriptive statements, like: "To what extent do you agree that you see yourself as someone who gets nervous easily?" (neuroticism), "To what extent do you agree that you see yourself as someone who is full of energy?" (extraversion), "To what extent do you agree that you see yourself as someone who has an active imagination?" (openness), "To what extent do you agree that you see yourself as someone who likes to cooperate with others?" (agreeableness) and "to what extent do you agree that you see yourself as someone who does things efficiently?" (conscientiousness). The "International Personality Item Pool" (IPIP) was used in the LISS (Goldberg et al., 2006). Participants used a scale from 1 (*very inaccurate*) to a value of 5 (*very accurate*) to rate 50 items. Examples are "get stressed out easily" (neuroticism), "talk to a lot of different people at parties" (extraversion), "have a vivid imagination" (openness), "have a soft heart" (agreeableness), and "like order" (conscientiousness). Mean scores were calculated for each trait in the six samples, with higher means indicating higher neuroticism, extraversion, openness, agreeableness, and conscientiousness. Each trait score was *z*-scored (mean = 0, *SD* = 1) within each sample so that all scores would be on the same metric and thus the estimates comparable across studies.

Arthritis

In the MIDUS, participants indicated whether they had experienced or been treated for arthritis, rheumatism, or other bone or joint diseases in the past 12 months. In the HRS and WLS, participants indicated whether a clinician ever communicated that they had arthritis or rheumatism. Participants in ELSA indicated whether a physician ever communicated that they had arthritis (including osteoarthritis or rheumatism). In NHATS, participants indicated whether a doctor communicated that they had arthritis (including osteo or rheumatoid arthritis) since the last interview. Finally, participants in the LISS indicated whether a clinician communicated this last year that they had arthritis (including osteoarthritis, rheumatism, bone decalcification, or osteoporosis). In the six samples, arthritis was coded as 1 and no arthritis as 0.

Covariates

Analyses were adjusted for age (in years), sex (1 = female, 0 = male), and education in the six samples because of their association with arthritis (GBD 2021 Osteoarthritis Collaborators, 2023; Mohammed et al., 2020). Education was assessed in years in the HRS and the WLS; education was coded from 1 (no grade school) to 12 (doctoral level degree) in the MIDUS; education was coded from 1 (no schooling completed) to 9 (Master's, professional, or doctoral degree) in the NHATS, and in ELSA from 1 (no qualification) to 7 (NVQ4/NVQ5/Degree or equivalent). Because of their link with arthritis (Mohammed et al., 2020), race and ethnicity were also controlled in samples with relevant data. Analyses of the MIDUS, HRS, ELSA, and NHATS included race (0 = not African American/Black, 1 = African American/Black). Analyses of HRS and NHATS included ethnicity (1 = Hispanic or Latinx and 0 = non-Hispanic/Latinx). Sensitivity analyses further controlled for depressive symptoms, BMI, and smoking because of their link with arthritis (GBD 2021 Osteoarthritis Collaborators, 2023; Mohammed et al., 2020; Poole & Steptoe, 2018; see Supplementary Material).

Data Analysis

Personality associations with both concurrent and incident arthritis were first examined in each dataset separately. Meta-analyses were then used to combine the estimates from each sample. The association between personality traits and the concurrent risk of arthritis was examined using logistic regression. In each sample, arthritis was regressed on personality traits, controlling for age, sex, and education. Race (MIDUS, HRS, ELSA, and NHATS) and ethnicity (HRS and NHATS) were also covariates. Personality traits were examined in separate analyses. Sensitivity analyses further included depressive symptoms, BMI, and smoking as covariates.

Cox proportional hazard models (survival analyses) tested the association between personality traits and incident arthritis. These analyses excluded participants with arthritis at baseline. The time (years) between baseline and the first reported diagnosis of arthritis was used to compute time-to-incidence. The last available assessment was used to censor participants without incident arthritis. Personality traits were examined separately; demographic covariates included age, sex, education, race, and ethnicity (where relevant). Sensitivity analyses further included depressive symptoms, BMI, and smoking.

Exploratory analyses tested whether age and sex moderated the association of personality traits with both concurrent and incident arthritis by testing the interaction of age or sex with each personality trait. Analyses were conducted using the JAMOVI 2.3.18 software. Example scripts for the main analyses are provided in Supplementary Material.

Random-effect meta-analyses (with the Comprehensive Meta-Analysis software) were used to combine results from each sample. Between-sample heterogeneity was indexed by the I^2 and the Cochran Q indicators. According to Higgins et al. (2003), I^2 values around 0%, 25%, 50%, or 75% indicated no, little, modest, and elevated heterogeneity.

Results

The percentage of individuals with arthritis at baseline was 19% (N = 1,181; MIDUS), 62% (N = 7,854; HRS), 26% (N = 2,559; WLS), 65% (N = 1,788; NHATS), 38% (N = 3,090; ELSA), and 7% (N = 409; LISS; Table 1). As expected, cross-sectional analyses revealed a significant association between higher neuroticism and an increased risk of concurrent arthritis (odds ratio = 1.20, 95% confidence interval [CI] = 1.16–1.24, $p < .001$, $I^2 = 40.27$, $Q = 8.37$, $p = .14$) and between higher conscientiousness and a decreased risk of concurrent arthritis (odds ratio = 0.88, 95% CI = 0.86–0.90, $p < .001$, $I^2 = 0$, $Q = 4.52$, $p = .48$),

Table 1. Descriptive Statistics for the Six Samples

Variables	MIDUS (*N* = 6,078)		HRS (*N* = 12,648)		WLS (*N* = 10,008)		NHATS (*N* = 2,270)		ELSA (*N* = 8,115)		LISS (*N* = 5,794)	
	M/%	*SD*	*M*/%	*SD*	*M*/%	*SD*	*M*/%	*SD*	*M*/%	*SD*	*M*/%	*SD*
Age (years)	46.80	12.90	68.58	9.90	53.30	4.30	79.49	7.52	66.10	8.69	45.81	15.66
Sex (% women)	53%	—	58%	—	53%	—	59%	—	55%	—	54%	—
Race (% African American/Black)	5%	—	11%	—	0%	—	20%	—	2%[a]	—	—	—
Ethnicity (% Hispanic)	—	—	7%	—	0%	—	5%	—	—	—	—	—
Education	6.88	2.47	12.90	2.92	13.73	2.39	5.20	2.26	4.17	2.23	3.43	1.51
Neuroticism	2.24	0.66	2.05	0.61	3.21	0.97	2.22	0.86	2.10	0.59	2.58	0.68
Extraversion	3.20	0.56	3.19	0.56	3.81	0.90	3.13	0.76	3.15	0.56	3.29	0.63
Openness	3.02	0.53	2.94	0.56	3.63	0.78	2.81	0.84	2.88	0.55	3.51	0.50
Agreeableness	3.49	0.49	3.53	0.48	4.73	0.74	3.57	0.56	3.51	0.48	3.91	0.49
Conscientiousness	3.42	0.44	3.36	0.48	4.84	0.69	3.20	0.75	3.30	0.49	3.73	0.52
Baseline arthritis (%)	19%	—	62%	—	26%	—	65%	—	38%	—	7%	—
Incident arthritis[b] (%)	25%	—	41%	—	44%	—	37%	—	19%	—	10%	—
Measurement occasions	3	—	8	—	3	—	10	—	5	—	15	—
Maximum follow-up time (in years)	19	—	15	—	20	—	9	—	9	—	15	—

Notes: ELSA = English Longitudinal Study of Ageing; HRS = Health and Retirement Study; LISS = Longitudinal Internet studies for the Social Sciences; MIDUS = Midlife in the United States Study; NHATS = National Health and Aging Trends Study; WLS = Wisconsin Longitudinal Study.
[a]Percent of non-White participants.
[b]Individuals who reported arthritis at baseline were excluded.

adjusted for demographic factors (Table 2). Significant associations were found in the six samples for neuroticism and in four samples for conscientiousness (Table 2). A 1-*SD* higher neuroticism and a 1-*SD* higher conscientiousness were, respectively, related to a 20% higher risk (range across the samples was 15%–28%) and a 14% lower risk of concurrent arthritis (range across the samples with significant effects: 12%–16%). Unexpectedly, higher extraversion (odds ratio = 0.92, 95% CI = 0.88–0.96, $p < .001$, $I^2 = 76.09$, $Q = 20.91$, $p < .001$) and openness (odds ratio = 0.96, 95% CI = 0.93–0.99, $p = .006$, $I^2 = 35.86$, $Q = 7.79$, $p = .17$) were related to a lower risk of concurrent arthritis, adjusting for demographic covariates (Table 2). These associations were apparent in three of six samples. A 1-*SD* higher extraversion and openness were related respectively to a 9% (range: 9%–20%) and a 4% (range: 5%–8%) decreased risk of concurrent arthritis. No association was found between agreeableness and concurrent arthritis in the meta-analysis (odds ratio = 1.00, 95% CI = 0.94–1.06, $p = .95$, $I^2 = 83.90$, $Q = 31.05$, $p < .001$).

The sensitivity analysis revealed that neuroticism (odds ratio = 1.11, 95% CI = 1.08–1.15, $p < .001$, $I^2 = 17.82$, $Q = 6.08$, $p = .30$) and conscientiousness (odds ratio = 0.96, 95% CI = 0.93–0.98, $p < .001$, $I^2 = 0$, $Q = 4.55$, $p = .47$) remained significant correlates of concurrent arthritis when adjusting for depressive symptoms, BMI, and smoking in addition to the demographic factors, but the associations were reduced by 45% and 67%, respectively ($[(HR_{model1} - HR_{model2})/(HR_{model1} - 1)] \times 100$; Elovainio et al., 2017; see Supplementary Table 1). The association between extraversion (odds ratio = 0.97, 95% CI = 0.93–1.01, $p = .095$, $I^2 = 51.48$, $Q = 10.30$, $p = .067$) and openness (odds ratio = 0.99, 95% CI = 0.96–1.03, $p = .61$, $I^2 = 47.85$, $Q = 9.59$, $p = .087$) and concurrent arthritis were not significant when these psychological, clinical, and behavioral covariates were controlled in addition to the demographic factors.

Among individuals without arthritis at baseline, 25% (*N* = 793; MIDUS), 41% (*N* = 1,853; HRS), 44% (*N* = 2,799; WLS), 37% (*N* = 322; NHATS), 19% (*N* = 874; ELSA), and 10% (*N* = 445; LISS) reported arthritis over time (Table 1). The median follow-up across the samples was 16.92 years (44,324 person-years) in MIDUS, 8.08 years (36,230 person-years) in HRS, 12.24 years (91,906 person-years) in WLS, 3.92 years (3,921 person-years) in NHATS, 7.83 years (28,968 person-years) in ELSA, and 7.66 years (37,220 person-years) in LISS. As hypothesized, higher neuroticism was significantly associated with an increased risk of incident arthritis (hazard ratio = 1.11, 95% CI = 1.08–1.14, $p < .001$, $I^2 = 0$, $Q = 4.46$, $p = .48$), and higher conscientiousness was significantly related to lower probability of incident arthritis (hazard ratio = 0.95, 95% CI = 0.92–0.98, $p = .002$, $I^2 = 41.27$, $Q = 8.51$, $p = .13$), controlling for demographic factors (Table 3). The association between neuroticism and incident arthritis was significant in the six samples, and the link with conscientiousness was significant in two of six samples (Table 3). A 1-*SD* higher neuroticism was associated with an 11% increased risk of incident arthritis (range: 8%–17%), whereas every 1-*SD* higher conscientiousness was related to a 5% decreased risk of incident arthritis (range across samples with significant effects: 8%–9%). An unexpected association between extraversion and incident arthritis was found in the meta-analysis (hazard ratio = 0.97, 95% CI = 0.95–0.99, $p = .018$, $I^2 = 0$, $Q = 4.34$, $p = .50$), adjusted for demographic factors (Table 3). However, this link was significant only in the LISS (Table 3), with 1-*SD* increase in extraversion associated with about 3% lower risk of incident arthritis. The meta-analysis discovered no association between openness (hazard ratio = 0.99, 95% CI = 0.97–1.02, $p = .61$, $I^2 = 0$, $Q = 1.90$, $p = .86$) or agreeableness (Hazard Ratio = 1.01, 95% CI = 0.97–1.05, $p = .53$, $I^2 = 56.06$, $Q = 11.38$, $p = .044$) and incident arthritis. Sensitivity analysis including demographic factors, depressive symptoms, BMI, and smoking

Table 2. Summary of Logistic Regression Analysis Predicting Risk of Concurrent Arthritis from Personality Traits in the Six Samples

Variable	MIDUS[a] (*N* = 6,078)	HRS [b] (*N* = 12,648)	WLS[c] (*N* = 10,008)	NHATS [b] (*N* = 2,770)	ELSA[a] (*N* = 8,115)	LISS[c] (*N* = 5,794)	Pooled odds ratio	Heterogeneity I^2	Cochran *Q*
Neuroticism	1.19 (1.11–1.28) *p* < .001	1.24 (1.20–1.29) *p* < .001	1.20 (1.14–1.26) *p* < .001	1.17 (1.07–1.27) *p* < .001	1.15 (1.09–1.20) *p* < .001	1.28 (1.15–1.41) *p* < .001	1.20 (1.16–1.24) *p* < .001	40.27	8.37 *p* = .137
Extraversion	0.91 (0.85–0.97) *p* = .004	0.92 (0.89–0.96) *p* < .001	0.96 (0.91–1.00) *p* = .051	0.97 (0.89–1.05) *p* = .440	0.83 (0.80–0.87) *p* < .001	0.97 (0.87–1.09) *p* = .619	0.92 (0.88–0.96) *p* < .001	76.09	20.91 p < .001
Openness	0.93 (0.87–1.00) *p* = .047	0.95 (0.91–0.99) *p* = .007	1.00 (0.96–1.06) *p* = .851	0.96 (0.88–1.04) *p* = .277	0.93 (0.89–0.97) *p* = .002	1.03 (0.92–1.15) *p* = .625	0.96 (0.93–0.99) *p* = .006	35.86	7.79 *p* = .168
Agreeableness	0.99 (0.92–1.06) *p* = .782	1.03 (0.99–1.07) *p* = .196	0.89 (0.85–0.93) *p* < .001	1.00 (0.92–1.08) *p* = .940	1.04 (1.00–1.09) *p* = .079	1.08 (0.96–1.21) *p* = .184	1.00 (0.94–1.06) *p* = .946	83.90	31.05 *p* < .001
Conscientiousness	0.86 (0.80–0.91) *p* < .001	0.87 (0.84–0.91) *p* < .001	0.89 (0.85–0.94) *p* < .001	0.95 (0.87–1.02) *p* = .193	0.88 (0.84–0.92) *p* < .001	0.91 (0.81–1.01) *p* = .094	0.88 (0.86–0.90) *p* < .001	0	4.52 *p* = .477

Notes: ELSA = English Longitudinal Study of Ageing; HRS = Health and Retirement Study; LISS = Longitudinal Internet studies for the Social Sciences; MIDUS = Midlife in the United States Study; NHATS = National Health and Aging Trends Study; WLS = Wisconsin Longitudinal Study.
[a]Adjusted for age, sex, education, and race.
[b]Adjusted for age, sex, education, race, and ethnicity.
[c]Adjusted for age, sex, and education.

Table 3. Summary of Cox Regression Analysis Predicting Incident Arthritis From Personality Traits in the Six Samples

Variable	MIDUS[a] (*N* = 3,194)	HRS[b] (*N* = 4,486)	WLS[c] (*N* = 6,425)	NHATS[b] (*N* = 861)	ELSA[a] (*N* = 4,633)	LISS[c] (*N* = 4,596)	Pooled odds ratio	Heterogeneity I^2	Cochran *Q*
Neuroticism	1.11 (1.03–1.19) *p* = .005	1.13 (1.07–1.19) *p* < .001	1.08 (1.04–1.13) *p* < .001	1.16 (1.03–1.29) *p* = .008	1.12 (1.04–1.20) *p* = .001	1.17 (1.06–1.27) *p* = .001	1.11 (1.08–1.14) *p* < .001	0	4.46 *p* = .485
Extraversion	0.99 (0.92–1.06) *p* = .746	0.96 (0.92–1.01) *p* = .124	0.99 (0.95–1.02) *p* = .502	1.01 (0.90–1.12) *p* = .888	0.96 (0.90–1.03) *p* = .241	0.90 (0.82–0.99) *p* = .033	0.97 (0.95–0.99) *p* = .018	0	4.34 *p* = .501
Openness	0.99 (0.92–1.06) *p* = .704	1.00 (0.95–1.05) *p* = .940	0.99 (0.95–1.03) *p* = .624	1.06 (0.95–1.18) *p* = .300	0.97 (0.91–1.04) *p* = .372	0.99 (0.90–1.10) *p* = .899	0.99 (0.97–1.02) *p* = .615	0	1.90 *p* = .862
Agreeableness	1.09 (1.01–1.18) *p* = .036	0.98 (0.94–1.03) *p* = .497	0.97 (0.93–1.00) *p* = .071	1.06 (0.95–1.19) *p* = .276	1.02 (0.95–1.09) *p* = .581	1.05 (0.95–1.16) *p* = .356	1.01 (0.97–1.05) *p* = .533	56.06	11.38 *p* = .044
Conscientiousness	1.02 (0.95–1.09) *p* = .649	0.93 (0.88–0.98) *p* = .004	0.92 (0.89–0.96) *p* < .001	0.99 (0.88–1.11) *p* = .800	0.96 (0.89–1.02) *p* = .296	0.95 (0.86–1.04) *p* = .310	0.95 (0.92–0.98) *p* = .002	41.27	8.51 *p* = .130

Notes: ELSA = English Longitudinal Study of Ageing; HRS = Health and Retirement Study; LISS = Longitudinal Internet studies for the Social Sciences; MIDUS = Midlife in the United States Study; NHATS = National Health and Aging Trends Study; WLS = Wisconsin Longitudinal Study.
[a]Adjusted for age, sex, education, and race.
[b]Adjusted for age, sex, education, race, and ethnicity.
[c]Adjusted for age, sex, and education.

found a significant association between neuroticism and incident arthritis, but it was reduced by 27% (hazard ratio = 1.08, 95% CI = 1.05–1.11, $p < .001$, $I^2 = 0$, $Q = 4.27$, $p = .51$; see Supplementary Table 2). The associations between extraversion (hazard ratio = 0.99, 95% CI = 0.97–1.02, $p = .61$, $I^2 = 0$, $Q = 3.21$, $p = .67$) and conscientiousness (hazard ratio = 0.99, 95% CI = 0.96–1.02, $p = .49$, $I^2 = 0$, $Q = 4.44$, $p = .49$) and incident arthritis were reduced to nonsignificant when demographic factors, depressive symptoms, BMI, and smoking were included in the model. Figure 1 provides the forest plot of the estimates from the six samples and the overall meta-analytic estimate for the association between neuroticism and conscientiousness and concurrent (Figures A and B) and incident arthritis (Figures C and D).

Additional analyses revealed little replicable evidence of a moderating role of age or sex in the association between personality traits and arthritis controlling for demographic factors (see Supplementary Material).

Discussion

Using six longitudinal samples that included more than 45,000 individuals, the cross-sectional and prospective analyses found personality traits associated with arthritis risk. Consistent with the hypotheses, neuroticism was associated with concurrent and incident arthritis, and conscientiousness was associated with lower risk of concurrent and incident arthritis. Unexpectedly, higher extraversion was significantly associated with lower risk of concurrent and incident arthritis, and openness was associated with lower risk of concurrent arthritis. These associations, however, were weaker and less consistent across studies than for neuroticism and conscientiousness. As expected, agreeableness was unrelated to the risk of arthritis. The associations were generally consistent across several samples despite differences in culture, age, measure, and length of follow-up (ranging from 8 to 20 years). No systematic evidence of a moderating role of age or sex was found. This study extends research on personality and arthritis (Weston et al., 2015) by providing the largest and longest account to date on this association.

The most consistent and strongest relationships with arthritis were found with neuroticism and conscientiousness. These findings are broadly in line with evidence of an association between neuroticism and worse overall health, and the health-protective role of higher conscientiousness (Leger et al., 2021; Stephan et al., 2023b; Strickhouser et al., 2017; Weston et al., 2020). These associations are also consistent with one study conducted in the HRS with a smaller sample and shorter follow-up (Weston et al., 2015). Several mechanisms potentially explain the association between these two traits and risk of arthritis. Personality traits emerge early in life and can influence behavior, lifestyles, stress reactivity, health conditions, educational, and occupational factors that increase arthritis risk. For example, higher neuroticism has been linked with depressive symptoms (Hakulinen, Elovainio et al., 2015), higher BMI (Sutin & Terracciano., 2016; Vainik et al., 2019), and smoking (Hakulinen, Hintsanen et al., 2015), which are critical risk factors for arthritis (GBD 2021

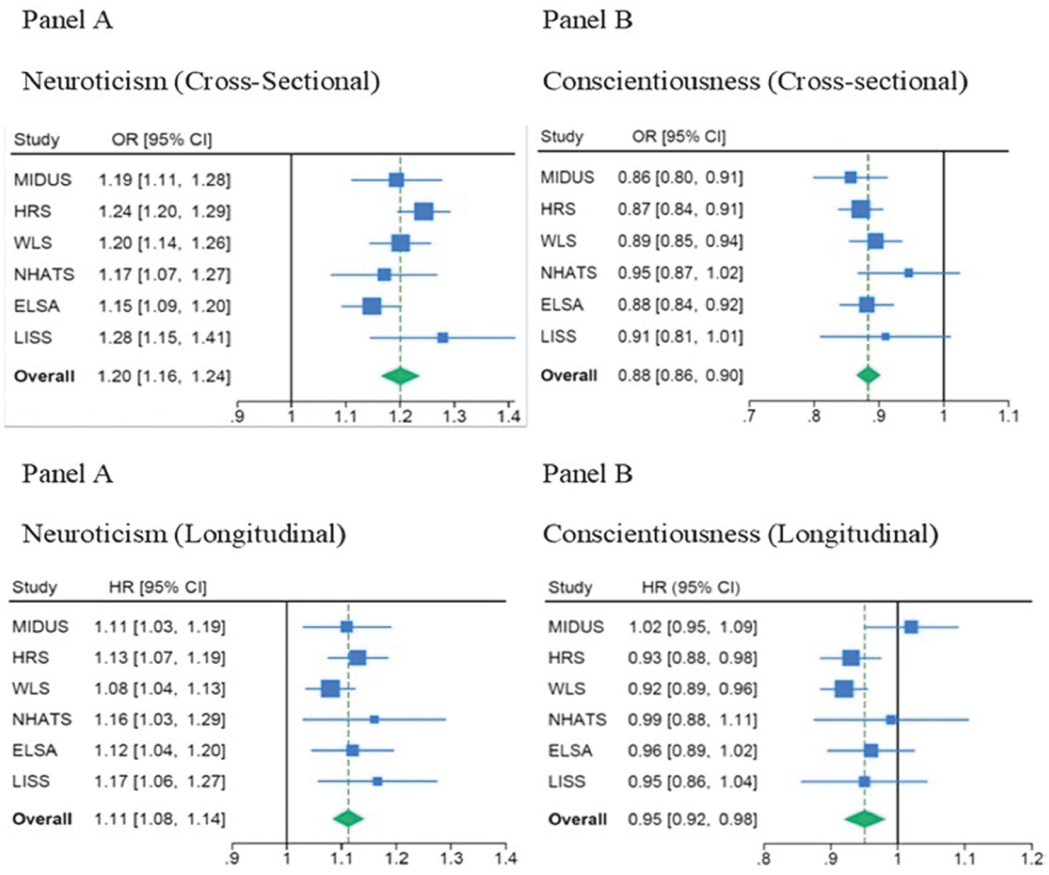

Figure 1. Forest Plot of the Association between Neuroticism and Conscientiousness with the Risk of Concurrent and Incident Arthritis

Osteoarthritis Collaborators, 2023; Mohammed et al., 2020; Poole & Steptoe, 2018). In contrast, higher conscientiousness is associated with fewer depressive symptoms (Hakulinen, Elovainio et al., 2015), lower BMI (Sutin & Terracciano, 2016; Vainik et al., 2019), and decreased smoking risk (Hakulinen, Hintsanen et al., 2015), which may lead to a reduced risk of arthritis. Consistent with this model, depressive symptoms, BMI, and smoking attenuated the associations of neuroticism and conscientiousness with concurrent and incident arthritis, which support the argument that these factors may be pathways between neuroticism and conscientiousness and arthritis. Furthermore, these traits are related to higher stress reactivity (Leger et al., 2021), higher allostatic load (Yoneda et al., 2023), higher immunosenescence (Stephan et al., 2023a), and mitochondrial dysfunction (Oppong et al., 2022), which have been found to increase risk of arthritis (Chalan et al., 2015; Poole & Jackowska, 2019; Schwetlik et al., 2022; Svendsen et al., 2019). Furthermore, lower conscientiousness is associated with higher inflammation (Luchetti et al., 2014), which may result in higher risk of arthritis (Yoshida & Tanaka, 2014). Thus, the evidence supports a model in which higher neuroticism and lower conscientiousness are distal risk factors that may contribute the risk of arthritis through more proximal risk factors. Of note, although conscientiousness was related to a lower risk of incident arthritis in the meta-analysis, the effect was mainly driven by the significant effects observed in two (HRS and WLS) out of the six samples.

Unexpectedly but consistent with the previous study (Weston et al., 2015), extraversion and openness were related to lower risk of concurrent arthritis. Higher extraversion was also associated with a lower risk of incident arthritis in the meta-analysis, which was mainly driven by the significant association in the LISS. Although significant, these associations had smaller effect sizes than neuroticism and conscientiousness. Extraversion and openness are associated with lower BMI (Sutin & Terracciano, 2016) and fewer depressive symptoms (Hakulinen et al., 2015a), which may lead to lower risk of arthritis. This interpretation is partly supported by the finding that BMI and depressive symptoms accounted for the association between extraversion and openness and arthritis. Finally, the lack of significant association between agreeableness and arthritis risk is in line with existing research that found no link with chronic conditions (Leger et al., 2021; Stephan et al., 2023b).

The present study broadly contributes to the literature on personality and health (Chapman et al., 2014; Friedman & Kern, 2014) by identifying replicable evidence that personality traits are implicated in a highly prevalent musculoskeletal condition. This association could inform about the mechanisms linking personality to other health-related outcomes. Arthritis could partly explain why higher neuroticism and lower conscientiousness are related to lower grip strength (Stephan et al., 2022), slower gait speed (Stephan et al., 2018), higher frailty (Gale et al., 2017), more limitations in IADL (Canada et al., 2021), pain (Sutin et al., 2019), and healthcare utilization (Willroth et al., 2023). From a practical perspective, the personality traits assessment could help identify people at risk of arthritis and comorbid conditions; these individuals may benefit from preventive interventions. Emerging research also suggests that personality traits can be changed by interventions, such as reducing neuroticism and improving conscientiousness (Stieger et al., 2021), to reduce the risk of arthritis and other detrimental health outcomes.

The present study had strengths, like six large samples of middle-aged and older adults, the testing of concurrent and prospective associations, the longitudinal data spanning up to 20 years, the examination of the five personality dimensions, the adjustment in the analyses of demographic, psychological, clinical, and behavioral covariates, and the quantitative meta-analytic synthesis of effect sizes across samples. Several limitations are also worth mentioning. The correlational design prevents drawing conclusions about causality. Although personality could be considered a predictor of arthritis, arthritis incidence may also contribute to personality change (Jokela et al., 2014). Furthermore, arthritis was self-reported and did not differentiate between specific forms of arthritis, such as osteoarthritis and rheumatoid arthritis. More studies are needed to test whether the association between personality and arthritis is moderated by the type of arthritis. The five broad domains of personality were examined in this study, and more research focusing on facets is needed to provide a more detailed understanding of the association between personality and arthritis. Finally, the present study used samples from the United States and two European countries (United Kingdom and The Netherlands). More research is needed to test whether the pattern of results generalizes to other countries, especially from middle- and low-income nations.

In sum, the present study indicates that personality is related to the risk of arthritis. Older adults who have higher neuroticism and lower conscientiousness are more likely to have or develop arthritis.

Supplementary Material

Supplementary data are available at *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences* online.

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Conflict of Interest

None.

Data Availability

This study was not preregistered. MIDUS data can be accessed at: http://midus.wisc.edu/index.php. HRS data can be accessed at: https://hrs.isr.umich.edu/data-products. WLS data can be accessed at: https://researchers.wls.wisc.edu/. NHATS data can be accessed at: http://www.nhats.org. ELSA data are available from the UK Data Service (UKDS, https://www.ukdataservice.ac.uk/). LISS data can be accessed at: www.lissdata.nl

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