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Personality nuances and mortality risk: A coordinated analysis of four longitudinal samples

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ABSTRACT

Objective: Personality nuances constitute the most specific level of the personality trait hierarchy and are often operationalized by individual questionnaire items. We examine whether these items are related to mortality to identify which specific personality characteristics are most related to length of life.
Method: Participants ($N > 22{,}000$) from the Health and Retirement Study, the Midlife in the United States Study, the National Social Life, Health, and Aging Project, and the National Health and Aging Trends Study completed 26-, 25-, 21- or 10-item measures of the Big Five personality traits using the Midlife Development Inventory. Mortality was tracked between 6 and 28 years.
Results: Across most samples and meta-analyses, higher neuroticism domain and item scores were related to a higher mortality risk, whereas higher extraversion, agreeableness, and conscientiousness domain and item scores were associated with a lower mortality risk. Less consistent associations were found for the openness domain and items. The extraversion item "active" had the strongest association with lower mortality risk (pooled hazard ratios [HR] = 0.79, 95 %CI = 0.73–0.85), followed by "lively" (extraversion), "organized", "responsible", "hardworking", and "thorough" (conscientiousness), and "helpful" (agreeableness) (HRs range from 0.87 to 0.91). These associations were partially accounted for by clinical, behavioral, and psychological factors.
Conclusion: This research deconstructs the five broad domains to identify the nuances most related to longevity. Specific personality items have replicable associations with mortality but little incremental predictive power compared to the corresponding domain. Still, the aggregated predictive value of items was stronger compared to the five broad personality domains.

1. Introduction

There is robust evidence that Five Factor Model personality trait domains [FFM], [1] are associated with mortality [2–5]. Conscientiousness (the tendency to be responsible and self-disciplined) is the strongest and most consistent personality predictor of mortality, with higher scores on this domain associated with a lower risk of mortality [2–5]. To a lesser extent, higher extraversion (the tendency to be sociable and to experience positive emotions) and higher agreeableness (the tendency to be empathetic and trusting) have been related to a lower mortality risk, whereas higher neuroticism (the tendency to be vulnerable to stress and to experience negative emotions) has been found to predict a higher risk of mortality [2–5]. Openness (the tendency to be curious and imaginative) is mostly unrelated to mortality [2–5]. Furthermore, recent research found limited evidence for replicable associations between personality trait change and mortality risk compared to personality level [6].

Existing research has focused primarily on the association between

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the five broad domains of personality and mortality. However, the FFM is a hierarchical model of personality traits that range from broad domains to specific, narrower traits such as facets and nuances [7,8]. Identifying the narrower traits associated with health-related outcomes, including mortality, is thought to provide a finer-grained understanding of the specific personality characteristics driving the association between personality domains and these outcomes. A few studies have examined the link between personality facets and mortality risk [9–13]. For example, higher scores on the conscientiousness facets of self-discipline, order, traditionalism, industriousness, virtue, and responsibility have been associated with a lower risk of mortality [11–13]. A recent systematic review on the neuroticism facets associated with mortality reported a link between higher vulnerability, cynicism, pessimism, anxiety, and depression and a higher risk of mortality, whereas the inadequacy and worried-vulnerable facets were protective [9]. The activity facet of extraversion has been related to increased survival time [10], as have higher scores on the agreeableness facets of altruism, compliance, straightforwardness, and tender-mindedness [11] and the creativity and openness to fantasy facets of openness [11,14].

Personality facets are not the lowest level of the personality hierarchy [7,15]. Indeed, there is a valid, distinct level composed of even more specific personality characteristics called nuances [7,15,16]. In other words, facets can be broken further down into more specific traits, or nuances, that refer to expressions of a facet [7,15,16]. Nuances are usually measured using single personality questionnaire items and have been found to demonstrate the hallmark properties of personality traits such as rank-order stability, agreement among raters, and heritability; this also applies to items' unique variance [15,16]. So, besides items being the basic units of personality assessment, item-nuances represent the most basic building blocks of the personality hierarchy [15] and can provide a more granular description and understanding of the link between personality and outcomes. A growing interest has been directed toward the nuances associated with a range of health-related outcomes such as body mass index (BMI) [17–19], vaccination [20] and dementia [21]. To our knowledge, only one study has examined the personality nuances associated with mortality [22]. The study examined 12 items of the Eysenck neuroticism scale and found that reporting loneliness, feeling fed-up, and mood swings were associated with a higher risk of all-cause mortality over 17 years. Interestingly, these associations between items and mortality were stronger than the effect of the neuroticism domain [22]. This study thus suggests that examining items could inform about the specific personality characteristics driving the associations between personality and mortality. This previous study [22], however, only focused on neuroticism, and little is known about the items – and thereby, nuances – of the four remaining domains and mortality risk. Further, the previous study was based on a single population sample, which needs replication.

Using four large longitudinal samples of older adults, the present study examined the association between personality nuances and mortality. In each sample, nuances were represented by the items of the Midlife Development Inventory [MIDI], [23]. This coordinated analysis of four samples with the harmonized personality measure allowed us to test the extent of replicability and generalizability of the association between nuances and mortality risk across samples with different demographic characteristics and lengths of follow-up. Building upon evidence on the link between personality domains and mortality [3,4], it was predicted that higher scores of items assessing extraversion, agreeableness, and conscientiousness would be related to a lower risk of mortality, whereas higher scores on neuroticism items would be related to a higher risk of mortality. However, it was considered likely that items within each domain would vary with respect to their relationship with mortality. No a priori hypotheses were made for associations between specific items and mortality. Consistent with existing research at the domain level [3–5], openness items were not expected to relate to mortality risk.

Additional analyses were conducted to test whether the associations between personality items and mortality were accounted by behavioral (smoking, physical activity), clinical (BMI, disease burden), and psychological (depressive symptoms) factors. Building upon recent research [2,3], these factors could be considered as potential mediators that link items to the risk of mortality rather than potential confounders of these associations. For comparison, additional analyses examined the associations between personality domains and mortality risk in the four samples.

2. Method

2.1. Participants

Samples were selected if they used a similar measure of personality, had information about mortality status, and were freely available. Based upon these criteria, four samples were included in the present study: The Health and Retirement Study (HRS), the Midlife in the United States study (MIDUS), the National Social Life, Health, and Aging Project (NSHAP), and the National Health and Aging Trends Study (NHATS). Participants in all samples provided written informed consent. The present study analyzed de-identified, publicly available data, and therefore IRB review was not required. Descriptive statistics for the four samples are in Table 1.

The HRS is a longitudinal study of a representative sample of American adults 50 years and older and their spouses. Half of the sample was randomised to complete the personality measure in 2006 and the other half was assessed in 2008. The combined 2006 and 2008 waves were the baseline measure. Information about vital status was available as of July 2024. Complete personality, demographic, and vital status data were obtained from 12,616 participants aged from 50 to 104 years (58 % women; mean Age = 68.57, SD = 9.89).

The MIDUS is a longitudinal study of a cohort of non-institutionalized, English-speaking US adults. Personality and demographic data were obtained at MIDUS I (1994–1995). Data on vital status were available up to December 2022. The final analyzed sample was composed of 4987 participants aged from 20 to 75 years at baseline (52 % women, mean Age = 47.93, SD = 12.88) with complete personality, demographic, and vital status data.

The NSHAP is a longitudinal population-based study of older Americans. The baseline assessment of personality and demographic factors was conducted at Wave 2 (2010−2011). Vital status was available up to November 2016. Analyses included 1744 participants aged from 62 to 90 years (53 % women, mean Age = 71.85, SD = 6.83) who had complete data on personality traits, demographic factors, and vital status.

The NHATS is a US nationally representative longitudinal study of Medicare beneficiaries aged 65 and older. Baseline assessments of personality and demographic factors were conducted for one third of the sample in 2013 and for the other third in 2014; the waves were aggregated. Information about vital status was obtained up to December 2022. The final analyzed sample had 2755 participants aged 67 to 103 years (59 % women, mean Age = 79.44, SD = 7.48) who had complete information on personality, demographic factors, and vital status.

2.2. Personality

Personality nuances were operationalized using the items from the MIDI [23] in the four samples. Participants were given a list of adjectives and were asked to rate how well each one described them. Each item was administrated using a 4-point Likert scale ranging from 1 (*not at all*) to 4 (*a lot*) in the four samples. A 26-item version of the MIDI was administered in the HRS, with 4 items for neuroticism, 5 items for extraversion, 7 items for openness, 5 items for agreeableness, and 5 items assessing conscientiousness. A 25-item version was used in the MIDUS. The main difference with the HRS was the use of four items to measure conscientiousness instead of five items. A 21-item version was used in the

Table 1
Descriptive statistics of the samples.

Variables	HRS		MIDUS		NSHAP		NHATS	
	M/%	*SD*	*M/%*	*SD*	*M/%*	*SD*	*M/%*	*SD*
Age	68.57	9.89	47.93	12.88	71.85	6.83	79.44	7.48
Sex (%female)	58 %	–	52 %	–	53 %	–	59 %	–
Education	12.81	2.97	6.98	2.49	2.84	1.33	5.20	2.26
Ethnicity (% Hispanic)	7 %	–	–	–	7 %	–	5 %	–
Race (% African American)	11 %	–	4 %[a]	–	10 %	–	20 %	–
BMI[c]	29.14	5.84	26.66	5.25	29.60	6.47	27.28	5.58
Disease burden[c]	1.99	1.33	2.45	2.51	2.11	1.44	2.56	1.47
Physical activity[c]	2.37	1.07	4.68	1.23	2.77	1.83	0.93	0.78
Smoking (% current/former)[c]	52 %	–	68 %	–	54 %	–	50 %	
Depressive symptoms[c]	1.36	1.91	0.72	1.85	1.41	0.42	1.47	0.68
Neuroticism	2.05	0.61	2.23	0.66	2.15	0.59	2.22	0.86
Extraversion	3.19	0.56	3.19	0.56	3.21	0.55	3.13	0.76
Openness	2.94	0.55	3.01	0.52	2.93	0.64	2.81	0.84
Agreeableness	3.53	0.48	3.48	0.49	3.46	0.51	3.57	0.55
Conscientiousness	3.36	0.48	3.43	0.44	3.37	0.54	3.20	0.75
Length of Follow-up (years)	11.33	4.66	17.29	5.90	4.76	0.88	5.55	3.02

Note. HRS: $N = 12{,}616$, MIDUS: $N = 4987$, NSHAP: $N = 1744$, NHATS: $N = 2755$; [a] % not white; [c] Ns differ due to missing data; See method section for differences in measures across the two samples.

NSHAP with 4 items for neuroticism, 5 items for extraversion, 4 items for openness, 4 items for agreeableness, and 4 items for conscientiousness. The NHATS used a 10-item version, with two items per trait. The complete list of items and descriptive statistics for the four samples are in supplementary material (Table S1).

2.3. Mortality

In the HRS, vital status was ascertained at each wave using core interviews and exit interviews with spouses or other proxy respondents. In the MIDUS, information about mortality was obtained using the National Death Index (NDI), informant reports, and longitudinal sample maintenance. Mortality status in the NSHAP was determined through a proxy interview with family members, other relatives, friends, or neighbors or examination of public records. Finally, proxy interviews were used to obtain information about mortality in the NHATS.

2.4. Covariates

Demographic covariates included age (in years), sex (coded as 1 for female and 0 for male), education, and race (coded as 1 for African-American and 0 for other). Ethnicity (coded as 1 for Hispanic and 0 for not Hispanic) was further controlled in the HRS, the NSHAP, and the NHATS. Education was assessed in years in the HRS, on a scale from 1 (no grade school) to 12 (doctoral level degree) in MIDUS, from 1 (none) to 6 (law, MD, or PhD) in the NSHAP, and from 1 (no schooling completed) to 9 (Master's, professional or doctoral degree) in NHATS.

Additional analyses further controlled for clinical (BMI, disease burden), behavioral (physical activity, smoking), and psychological factors (depressive symptoms). These covariates were collected at baseline. BMI (kg/m^2) was computed based on staff-assessed height and weight in HRS, MIDUS, and NSHAP, and based on participants' reported height and weight in NHATS. Disease burden was the sum of diagnosed conditions. In the HRS, physical activity was assessed by asking participants to indicate on a scale from 1 (hardly ever or never) to 4 (more than once a week) how often they participated in vigorous and moderate physical activity using two items. Answers to the two items were averaged. Participants in the MIDUS were asked to report on a scale from 1 (never) to 6 (several times a week or more) how often they participated in winter and summer vigorous and moderate leisure physical activity. The four items were averaged. Participants in the NSHAP were asked to indicate the frequency of their participation in vigorous physical activity or exercise over the last twelve months. Answers were given on a scale from 0 (never) to 5 (5 or more times per week). Participants in the NHATS indicated whether they ever went walking for exercise and whether they ever spent time on vigorous activities in the last month. The two items were answered yes (1) or no (0) and the responses summed. In the four samples, smoking was coded as 1 for current/former smoker and 0 for never smoker. In the HRS and the NSHAP, depressive symptoms were assessed using the Center for Epidemiologic Studies Depression (CES—D) [24,25]; An 8-item version was used in the HRS, and an 11-item version was used in the NSHAP. The sum of answers was taken in the HRS, and the average of answers was computed in the NSHAP. The MIDUS used the Composite International Diagnostic Interview Short Form (CIDI-SF) [26]. Participants answered seven items asking for their experience of depressive symptoms that lasted for two weeks of the last 12 months using a yes/no format. The sum of answers was taken. The Patient Health Questionnaire-2 (PHQ-2) [27] was used in the NHATS. Participants were asked to indicate how often they had little interest or pleasure in doing things and how often they felt down, depressed, or hopeless over the last month. Answers to the two items were given on a scale from 1 (not at all) to 4 (nearly everyday) and averaged.

2.5. Data analysis

In the four samples, Cox proportional hazard regressions were used to test the association between personality items and mortality risk. Survival time (in years) was computed as the time between the date of baseline assessment and death; the censoring date was the last available assessment for alive individuals. In each sample, items were z-scored and tested separately. Demographic factors were controlled in a basic model, and clinical, behavioral, and psychological factors were included in an additional model.

Additional analyses were conducted at the domain level to examine the link between the five personality domains and mortality risk. The HRS and the MIDUS samples included in these domain-level analyses partially overlapped with published research on personality domains and mortality [3]. However, both samples were updated with the latest available release of mortality data to have longer follow-ups than previous research. A first model controlled for demographic factors and a second model further included clinical, behavioral, and psychological factors. Results from item and domain-level analyses were combined using random-effect meta-analyses conducted with the Comprehensive Meta-analysis software.

Sensitivity analyses tested whether the association between personality and mortality is confounded by reverse causation processes in which deteriorating health in the years before death might influence

personality. Building on past research [4,5], mortality cases occurring during the first five years of follow-up in the HRS, MIDUS, and NHATS were excluded. These analyses were not performed in the NSHAP because of its shorter follow-up. Sensitivity analyses also examined the link between personality items and mortality controlling for their corresponding personality domain. In addition, analyses were conducted to compare the overall predictive value of personality domains and personality items, by testing models including the five domains and models including all personality items, controlling for covariates. These analyses aimed to test whether the items have incremental predictive validity beyond the effect of their personality domain.

3. Results

The proportion of participants who died was 46 % ($N = 5782$) over a follow-up of 18 years in the HRS (Mean Follow-up = 11.33, SD = 4.66, 142988 person-years), 36 % ($N = 1784$) over a follow-up of almost 28 years in the MIDUS (Mean Follow-up = 17.29, SD = 5.90, 86250 person-years), 13 % ($N = 223$) over a follow-up of 6 years in the NSHAP (Mean Follow-up = 4.76, SD = 0.88, 8306 person-years), and 38 % ($N = 1059$) over a follow-up of 9.50 years in the NHATS (Mean Follow-up = 5.55, SD = 3.02, 15290 person-years).

In line with expectations, the meta-analysis indicated that all items assessing conscientiousness and neuroticism were related to the risk of mortality (Table 2, Model 1). A one standard deviation (SD) higher score on each conscientiousness item was related to a 14 %, 12 %, 15 %, and 15 % lower risk of mortality respectively for the "organized", "responsible", "hardworking", and "thorough" items, whereas a one SD higher score on the item "careless" was associated with a 7 % higher risk of mortality. A one SD higher scores on the neuroticism items "moody", "worrying", and "nervous" was respectively related to a 9 %, 7 %, and 9 % higher mortality risk, whereas one SD higher score on the item "calm" was linked to a 5 % lower risk. The link between conscientiousness items and mortality replicated across most samples, whereas there was less consistency for the neuroticism items (Table 3, Model 1). All extraversion items, except the item "talkative", were associated with a lower risk of mortality (Table 2, Model 1). A one SD higher score on the items "outgoing", "friendly", "lively", and "active" was associated respectively with 8 %, 4 %, 12 %, and 27 % lower risk of mortality. Among agreeableness items, higher scores on the items "helpful", "warm", and "caring" were related to a reduced mortality risk (Table 2, Model 1). A one SD higher score on "helpful", "warm", and "caring" was associated with a 10 %, 3 %, and 5 % lower risk of mortality, respectively. The association between the items "active", "lively", "helpful", and mortality replicated across most samples (Table 3, Model 1). Although not hypothesized, higher scores on the openness items "creative", "broad-minded", and "adventurous" were related to a lower mortality risk in the meta-analysis (Table 2, Model 1). A one SD higher score on the items "creative", "broad-minded", and "adventurous", was related to 8 %, 3 %, and 6 % lower risk of mortality, respectively. However, there was little

Table 2
Summary of the meta-analysis.

	Model 1[a]	Heterogeneity I^2	Heterogeneity Tau	Model 2[b]	Heterogeneity I^2	Heterogeneity Tau
Personality domains						
Neuroticism	1.10*** (1.05–1.15)	63.09	0.03	0.98(0.93–1.04)	70.65	0.05
Extraversion	0.89*** (0.87–0.91)	0	0	0.95**(0.93–0.98)	17.05	0.01
Openness	0.93*(0.88–1.00)	80.92	0.05	0.96(0.89–1.03)	80.41	0.06
Agreeableness	0.94***(0.92–0.96)	0	0	0.98(0.95–1.00)	0	0
Conscientiousness	0.84***(0.80–0.88)	66.74	0.04	0.89***(0.85–0.93)	50.82	0.03
Personality items						
Neuroticism						
Moody	1.09***(1.07–1.12)	0	0	1.02(0.99–1.04)	0	0
Worrying	1.07***(1.04–1.10)	35.65	0.02	0.98(0.94–1.02)	46.31	0.03
Nervous	1.09***(1.04–1.14)	62.44	0.03	0.99(0.94–1.04)	63.46	0.04
Calm	0.95**(0.91–0.98)	38.55	0.02	1.00(0.96–1.04)	38.40	0.02
Extraversion						
Outgoing	0.93*(0.88–0.99)	76.16	0.05	0.97(0.92–1.02)	67.26	0.04
Friendly	0.96**(0.94–0.99)	0	0	1.00(0.97–1.02)	4.16	0.006
Lively	0.89***(0.87–0.92)	0	0	0.97(0.92–1.01)	44.23	0.03
Active	0.79***(0.73–0.85)	82.29	0.05	0.88***(0.84–0.91)	26.11	0.02
Talkative	1.00(0.96–1.03)	47.43	0.02	1.01(0.97–1.06)	62.63	0.04
Openness						
Creative	0.93*(0.88–0.98)	77.56	0.05	0.95(0.89–1.01)	75.20	0.05
Imaginative	0.96(0.92–1.01)	63.73	0.03	0.97(0.93–1.02)	55.40	0.03
Intelligent	1.00(0.97–1.02)	0	0	1.01(0.98–1.03)	0	0
Curious	1.00(0.94–1.07)	76.69	0.05	1.01(0.94–1.10)	80.87	0.06
Broad-minded	0.97*(0.95–1.00)	0	0	0.99(0.96–1.01)	0	0
Sophisticated	0.98(0.92–1.04)	82.14	0.04	0.97(0.94–1.00)	27.14	0.01
Adventurous	0.94*(0.89–0.99)	63.63	0.03	1.00(0.94–1.06)	65.66	0.04
Agreeableness						
Helpful	0.91***(0.89–0.93)	0	0	0.96**(0.93–0.98)	0	0
Warm	0.97**(0.95–0.99)	0	0	1.00(0.98–1.03)	0	0
Caring	0.95***(0.93–0.97)	0	0	0.97**(0.94–0.99)	0	0
Softhearted	1.00(0.97–1.03)	21.16	0.01	1.00(0.97–1.02)	0	0
Sympathetic	0.98(0.95–1.01)	13.20	0.01	1.01(0.97–1.06)	47.44	0.03
Conscientiousness						
Organized	0.88***(0.84–0.93)	75.48	0.04	0.93***(0.90–0.97)	44.83	0.03
Responsible	0.89***(0.86–0.92)	40.03	0.02	0.92***(0.90–0.95)	8.43	0.008
Hardworking	0.87***(0.82–0.92)	72.72	0.04	0.92***(0.90–0.94)	0	0
Careless	1.07**(1.03–1.12)	62.14	0.02	1.05(0.99–1.11)	75.45	0.04
Thorough	0.87***(0.81–0.94)	78.68	0.06	0.91*(0.83–1.00)	82.96	0.07

Note. [a] Model 1: Adjusted for demographic factors; [b] Model 2: Includes Model 1 covariates and disease burden, BMI, physical activity, smoking and depressive symptoms; * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 3
Summary of Cox regression analysis predicting risk of mortality from personality domains and items in the four samples.

	HRS		MIDUS		NSHAP		NHATS	
	Model 1[a]	Model 2[b]	Model 1[a]	Model 2[b]	Model 1[a]	Model 2[b]	Model 1[a]	Model 2[b]
Personality domains								
Neuroticism	1.14*** (1.11–1.17)	1.02 (0.99–1.06)	1.10*** (1.05–1.16)	1.02 (0.97–1.08)	1.01 (0.88–1.15)	0.82* (0.70–0.97)	1.06 (0.99–1.12)	0.95 (0.89–1.03)
Extraversion	0.89*** (0.87–0.91)	0.96** (0.93–0.99)	0.90*** (0.86–0.95)	0.95 (0.90–1.00)	0.89 (0.79–1.01)	1.07 (0.92–1.24)	0.89*** (0.84–0.94)	0.92** (0.87–0.98)
Openness	0.92*** (0.90–0.95)	0.96** (0.93–0.99)	1.00 (0.95–1.05)	1.02 (0.96–1.08)	1.00 (0.87–1.14)	1.04 (0.89–1.21)	0.86*** (0.81–0.91)	0.87*** (0.81–0.92)
Agreeableness	0.94*** (0.92–0.97)	0.98 (0.95–1.01)	0.97 (0.92–1.01)	0.98 (0.93–1.03)	0.94 (0.82–1.07)	1.03 (0.88–1.21)	0.92** (0.87–0.98)	0.97 (0.91–1.03)
Conscientiousness	0.84*** (0.82–0.86)	0.91*** (0.88–0.94)	0.88*** (0.84–0.92)	0.91** (0.87–0.96)	0.80*** (0.71–0.91)	0.85* (0.74–0.99)	0.79*** (0.75–0.84)	0.84*** (0.79–0.89)
Personality items								
Neuroticism Items								
Moody	1.09*** (1.07–1.12)	1.01 (0.98–1.04)	1.10*** (1.04–1.15)	1.04 (0.99–1.10)	1.09 (0.95–1.24)	0.95 (0.81–1.11)	–	–
Worrying	1.09*** (1.07–1.12)	1.01 (0.98–1.04)	1.06* (1.01–1.12)	1.00 (0.94–1.06)	0.98 (0.86–1.12)	0.87 (0.74–1.02)	1.05 (0.98–1.11)	0.95 (0.89–1.01)
Nervous	1.13*** (1.10–1.16)	1.03 (1.00–1.06)	1.09*** (1.04–1.14)	1.02 (0.96–1.07)	0.99 (0.86–1.13)	0.85* (0.72–0.99)	1.05 (0.99–1.12)	0.96 (0.90–1.03)
Calm	0.93*** (0.91–0.95)	0.99 (0.96–1.02)	0.96 (0.92–1.01)	1.00 (0.94–1.05)	1.03 (0.90–1.17)	1.13 (0.98–1.31)	–	–
Extraversion Items								
Outgoing	0.97* (0.94–0.99)	1.01 (0.98–1.04)	0.95* (0.91–1.00)	0.98 (0.93–1.03)	0.96 (0.85–1.10)	1.03 (0.88–1.19)	0.86*** (0.81–0.91)	0.91** (0.85–0.96)
Friendly	0.97* (0.95–1.00)	1.00 (0.97–1.03)	0.94** (0.89–0.98)	0.97 (0.92–1.02)	0.98 (0.87–1.12)	1.06 (0.92–1.23)	–	–
Lively	0.89*** (0.87–0.92)	0.97* (0.94–1.00)	0.89*** (0.85–0.94)	0.94* (0.89–0.99)	0.92 (0.81–1.05)	1.10 (0.94–1.28)	–	–
Active	0.77*** (0.75–0.79)	0.86*** (0.83–0.89)	0.84*** (0.80–0.88)	0.91*** (0.86–0.96)	0.73*** (0.65–0.83)	0.88 (0.76–1.02)	–	–
Talkative	1.02 (0.99–1.04)	1.02 (0.99–1.05)	1.01 (0.96–1.06)	1.01 (0.96–1.07)	1.03 (0.91–1.18)	1.20* (1.03–1.39)	0.94* (0.89–1.00)	0.96 (0.91–1.02)
Openness Items								
Creative	0.94*** (0.91–0.96)	0.96* (0.94–0.99)	0.97 (0.93–1.02)	1.00 (0.95–1.05)	0.99 (0.86–1.12)	0.97 (0.84–1.12)	0.85*** (0.80–0.90)	0.87*** (0.82–0.92)
Imaginative	0.95*** (0.92–0.97)	0.98 (0.95–1.01)	1.01 (0.96–1.06)	1.01 (0.96–1.07)	1.02 (0.89–1.16)	1.02 (0.88–1.19)	0.91** (0.86–0.97)	0.91** (0.86–0.97)
Intelligent	0.99 (0.97–1.02)	1.01 (0.98–1.04)	1.00 (0.96–1.05)	0.99 (0.94–1.05)	–	–	–	–
Curious	0.96** (0.93–0.98)	0.97* (0.94–0.99)	1.04 (0.99–1.09)	1.07* (1.01–1.13)	1.03 (0.91–1.17)	1.02 (0.88–1.18)	–	–
Broad-minded	0.97* (0.94–0.99)	0.98 (0.95–1.01)	0.99 (0.94–1.04)	1.01 (0.96–1.06)	–	–	–	–
Sophisticated	0.95*** (0.92–0.97)	0.96** (0.93–0.99)	1.01 (0.97–1.06)	0.99 (0.94–1.05)	–	–	–	–
Adventurous	0.91*** (0.89–0.94)	0.96** (0.93–0.99)	0.97 (0.93–1.02)	1.01 (0.96–1.07)	0.96 (0.84–1.16)	1.11 (0.95–1.29)	–	–
Agreeableness Items								
Helpful	0.91*** (0.88–0.93)	0.96** (0.93–0.99)	0.91*** (0.87–0.95)	0.94* (0.90–0.99)	–	–	–	–
Warm	0.98 (0.95–1.01)	1.01 (0.98–1.04)	0.96 (0.91–1.00)	0.98 (0.93–1.03)	0.94 (0.83–1.07)	1.08 (0.93–1.25)	0.94* (0.88–1.00)	0.99 (0.94–1.06)
Caring	0.96** (0.93–0.98)	0.98 (0.95–1.01)	0.97 (0.92–1.02)	0.96 (0.91–1.02)	0.89 (0.79–1.01)	0.91 (0.79–1.05)	0.94* (0.88–0.99)	0.95 (0.90–1.01)
Softhearted	0.99 (0.96–1.01)	0.99 (0.96–1.02)	1.03 (0.98–1.08)	1.02 (0.96–1.08)	0.96 (0.84–1.10)	0.97 (0.83–1.12)	–	–
Sympathetic	0.97* (0.94–1.00)	0.99 (0.96–1.02)	1.01 (0.96–1.06)	1.02 (0.97–1.08)	1.02 (0.89–1.17)	1.15 (0.98–1.35)	–	–
Conscientiousness Items								
Organized	0.89*** (0.87–0.92)	0.94*** (0.91–0.97)	0.94* (0.90–0.99)	0.98 (0.93–1.03)	0.84** (0.74–0.95)	0.90 (0.78–1.03)	0.83*** (0.78–0.88)	0.89*** (0.84–0.94)
Responsible	0.89*** (0.87–0.91)	0.93*** (0.90–0.95)	0.92*** (0.88–0.96)	0.92** (0.88–0.97)	0.83** (0.75–0.93)	0.84** (0.74–0.95)	–	–
Hardworking	0.85*** (0.83–0.87)	0.91*** (0.89–0.94)	0.91*** (0.87–0.95)	0.94* (0.90–0.99)	0.86* (0.76–0.96)	0.92 (0.81–1.06)	–	–
Careless	1.05*** (1.03–1.08)	1.02 (0.99–1.05)	1.10*** (1.05–1.15)	1.08** (1.03–1.14)	–	–	–	–
Thorough	0.91*** (0.89–0.93)	0.95** (0.92–0.98)	–	–	0.90 (0.79–1.02)	0.93 (0.80–1.09)	0.82*** (0.77–0.87)	0.84*** (0.79–0.90)

Note. [a] Model 1: Adjusted for demographic factors, HRS: N = 12,616, MIDUS: N = 4987, NSHAP: N = 1744, NHATS: N = 2755; [b] Model 2: Includes Model 1 covariates and disease burden, BMI, physical activity, smoking and depressive symptoms, HRS: N = 10,343, MIDUS: *N* = 3676, NSHAP: *N* = 1482, NHATS: *N* = 2672; * $p < .05$, ** $p < .01$, *** $p < .001$.

evidence of replication of these effects across samples (Table 3, Model 1).

The conscientiousness items "organized", "responsible", "hard-working", and "thorough", the extraversion item "active", and the agreeableness items "helpful" and "caring" remained significant predictors of mortality when clinical, behavioral, and psychological factors were included in the model (Table 2, Model 2). The association between these items and mortality was attenuated by 42 % (for "organized"), 27 % (for "responsible"), 38 % (for "hardworking"), 31 % (for "thorough"), 43 % (for "active"), 56 % (for "helpful"), and 40 % (for "caring").

The meta-analysis at the domain level indicated that a one SD higher score on neuroticism was associated with a 10 % higher mortality risk, whereas a one SD higher score on extraversion, openness, agreeableness, and conscientiousness was respectively associated with 12 %, 8 %, 6 %, and 19 % lower risk of mortality (Table 2, Model 1). The associations of extraversion and conscientiousness with mortality risk were respectively attenuated by 55 % and 31 % but remained significant with the inclusion of clinical, behavioral. and psychological factors (Table 2, Model 2). The associations of neuroticism, openness, and agreeableness with mortality were non-significant with the inclusion of clinical, behavioral and psychological factors. Results for each sample are in Table 3.

Sensitivity analyses indicated that the overall pattern of association was almost unchanged in the HRS, the MIDUS, and the NHATS when mortality cases occurring within the first five years were excluded. There were a few exceptions. In the HRS, the link between the items "curious" (Hazard Ratios [HR] = 0.98, 95 %CI = 0.95–1.01, $p = .29$) and "broad-minded" (HR = 0.97, 95 %CI = 0.94–1.00, $p = .07$) and mortality was non-significant. In the NHATS, openness (HR = 0.92, 95 %CI = 0.82–1.02, $p = .13$), the item "creative" (HR = 0.92, 95 %CI = 0.83–1.02, p = .13), the item "talkative" (HR = 0.95, 95 %CI = 0.86–1.05, $p = .33$), the item "caring" (HR = 0.95, 95 %CI = 0.85–1.05, $p = .31$), and the item "imaginative" (HR = 0.94, 95 %CI = 0.85–1.05, $p = .28$) were no longer significant predictors of mortality risk.

Additional analyses also indicated that controlling for extraversion domain, the association between the item "active" and mortality persisted in the HRS (HR = 0.72, 95 % CI = 0.70–0.75, $p < .001$), the MIDUS (HR = 0.83, 95 % CI = 0.78–0.88, p < .001), and the NSHAP (HR = 0.66, 95 % CI = 0.57–0.78, p < .001), the association between the item "lively" and lower mortality risk remained significant in the HRS (HR = 0.95, 95 % CI = 0.91–0.99, $p = .018$), and the MIDUS (HR = 0.92, 95 % CI = 0.85–1.00, $p = .041$), and the item "outgoing" was still related to mortality in the NHATS (HR = 0.86, 95 % CI = 0.77–0.97, $p = .011$). After accounting for agreeableness, the association between the item "helpful" and mortality remained significant in the HRS (HR = 0.89, 95 % CI = 0.86–0.92, p < .001) and the MIDUS (HR = 0.87, 95 % CI = 0.81–0.93, p < .001). The association between the item "hardworking" and mortality persisted in the HRS while controlling for conscientiousness (HR = 0.90, 95 % CI = 0.87–0.93, p < .001), and the item "creative" remained a significant predictor in the NHATS after accounting for openness (HR = 0.89, 95 % CI = 0.79–0.99, p = .041). Most other items were no longer significant or had effects in the opposite direction when their corresponding domains were controlled. Finally, analyses revealed that when entered together, items provided incremental prediction of mortality over and above the personality domains for each dataset (see Supplementary Table S2). Specifically, the overall set of items tend to more than double the (R-squared) predictive power than the five broad domains (Table S2).

4. Discussion

Based upon four longitudinal samples including more than 22,000 participants, the present study examined the association between personality nuances, operationalized by single personality questionnaire items, and mortality. With a few exceptions, the meta-analysis revealed that neuroticism, extraversion, agreeableness, and conscientiousness items were associated with mortality risk. Stronger effects were found for the conscientiousness items "organized", "responsible", "hard-working", and "thorough", the extraversion items "active" and "lively", and the agreeableness item "helpful". The associations between openness items and mortality were less consistent. The associations between items and mortality were robust because they replicated across at least two of the four samples despite their different demographic characteristics, over follow-ups that ranged from 6 to almost 28 years, and mostly persisted when clinical, behavioral, and psychological risk factors were controlled. Consistent with existing research including two overlapping samples [3], domain-level higher neuroticism and lower extraversion, openness, agreeableness, and conscientiousness were related to a higher risk of mortality. The item-level approach used in the present study adds to existing domain-level analyses and expands existing knowledge on the personality-mortality link [2–5]. Specifically, it provides a fine-grained, detailed identification of the specific personality characteristics implicated in mortality risk.

The present study supports and extends recent research on the association between neuroticism items and mortality [22]. Specifically, it replicates the previous association with mortality found for the item mood swings from the Eysenck Personality Questionnaire-Revised (EPQ-R) [22] using the MIDI item "moody". Furthermore, given that nuances are components of facets, their link with mortality could be interpreted in the context of existing knowledge on the personality facets associated with mortality risk [9–13]. For example, the items "nervous", "calm", and "worry" are part of the anxiety facet [1], which has been associated with higher mortality risk [9]. In addition, past research found that the extraversion facet of activity was related to a lower risk of mortality [10,28], which is consistent with the association found in the present study with the extraversion items "active" and "lively" This finding supports the association between similar extraversion-related constructs such as vigor and a lower risk of mortality [29]. The significant protective role of the items "friendly" and "outgoing" contrasts with the null association between their corresponding extraversion facet of warmth and mortality reported in past research [10]. The lower risk of mortality associated with the "responsibility" item of conscientiousness mirrors the association observed with the conscientiousness facet of responsibility [13]. In addition, the items "organized" and "thorough" are nuances of the order facet [1] and "hardworking" is a nuance of the achievement striving facet [1], which have been associated with lower mortality risk [10]. The finding for the item "careless" contrasts with the null association found between the self-control facet and mortality [13]. Being helpful, warm and caring are nuances of the agreeableness facet of altruism [1], which has been related to lower risk of mortality in one study [11]. However, this finding extends other research that found no link between agreeableness facets and mortality [10]. Finally, significant but small associations were found between the openness items "creative", "broad-minded", and "adventurous" and lower mortality risk. This overall pattern contrasts with the null association for openness facets in one study [10], but is in line with the significant link between the facet creativity and lower mortality risk found in another study but only among men [14].

Across the samples, the extraversion item "active", which refers to an individual's energy, vigor, fast tempo, and engagement with life, was the strongest item-level predictor of mortality. This result is consistent with past research that found the activity facet was the stronger personality facet associated with the risk of mortality compared to other facets within the FFM model [10,28]. The effect size found in the present study [HR = 0.79] was slightly stronger than the effect size previously found at the facet level [HR = 0.85, 10; HR = 0.98, 28]. Additional analyses indicated that the link between the item "active" and mortality was independent from the overall effect of the extraversion domain, which suggests that this item captures unique information that is relevant for the prediction of mortality beyond domain-level extraversion. In particular, higher activity is associated with objectively measured energy and cardiorespiratory fitness [30] and faster gait speed and higher physical activity [31], which may translate into longer life over

time. In contrast, lower activity may be a marker of a physiological deficit in energy and worsening cardiorespiratory function, which may reduce life expectancy.

The overall pattern of association between personality items and mortality was consistent with recent research on the prediction of other health outcomes such as dementia [21] and BMI [17]. Partially mirroring these findings [17,21], the present study found that being organized, responsible, and active were among the items with stronger associations with the risk of mortality. Therefore, it is likely that similar specific personality characteristics may be predictive of different health-related outcomes, such as dementia, BMI, and mortality risk. Also consistent with other health-related outcomes [20], this study provides evidence that mortality is a poly-nuanced outcome; indeed, several distinct items were found to predict mortality risk in the four samples.

The associations between some personality domains and mortality were partly driven by items. For example, the item "active" was found to drive the link between extraversion and mortality, whereas the association between agreeableness and mortality was mainly driven by the "helpful" item. However, there was limited evidence that specific personality items have stronger predictive value than their corresponding personality domains, contrary to the recent study based on the Eysenck neuroticism scale, but similar to previous research based on the MIDI [21]. The exceptions were the items "active" and "helpful" that were stronger predictors of mortality than their respective domains, extraversion, and agreeableness. This is an important finding, showing that, for the most part, the FFM domains are internally consistent in how they relate to mortality; this was not a given because many outcomes' associations with personality traits are mostly driven by narrow traits, replicably across diverse samples [32]. For example, vaccination behaviour's associations with personality traits were almost entirely due to selected items [20]. The present study suggests that an item-level analysis can deconstruct the contribution of the broad personality domains into their components. Such item-level analyses provide a more detailed understanding of what specific personality characteristics of a trait are related to mortality. Although there was essentially no evidence for stronger prediction of specific personality items over their corresponding domains, additional analyses indicated the combined overall set of items had greater explanatory power across samples than the five broad personality domains. This finding is consistent with existing research having found a stronger aggregated effect of nuances on outcomes than the personality domains or any of the specific nuances [21], although some have cautioned against using metrics like R^2 to evaluate the effect of psychological factors [33].

Prominent theoretical models and empirical research indicate that personality traits predict mortality through a range of biological, behavioral, clinical and psychological factors [2,3,34–37]. For example, conscientiousness has been linked to lower mortality risk through lower inflammation [35], lower likelihood of smoking and lower alcohol use [37], lower waist circumference [37], and better sleep quality [38]. Higher neuroticism has been associated with higher risk of mortality through its link with smoking [3] and worse sleep quality [38]. Individuals with higher conscientiousness are characterized by tendencies that are implicated in healthy life choices and better health management, such as higher self-discipline, deliberation, responsibility, and higher planfulness. In contrast, higher neuroticism is defined by a higher vulnerability to stress, negative emotions, and higher fear which may lead to unhealthy life choices and poor health management. It is likely that these pathways may also explain the link between personality items and mortality. Consistent with existing knowledge, additional analyses indicated that the link between personality items and mortality was accounted for by clinical (BMI, disease burden), behavioral (physical activity and smoking) and psychological factors (depressive symptoms), which suggests that these factors may act as mediators of this association. Specifically, moody, worry-prone, nervous, and less calm individuals may have higher risk of mortality because they have higher disease burden, higher BMI, higher risk of smoking and physical inactivity, and higher depressive symptoms. In particular, depressive symptoms could be considered as a facet of neuroticism [1], which could explain the association with mortality. In contrast, active, helpful, caring, organized, responsible, hardworking, and thorough individuals may have lower mortality risk in part because they have lower disease burden, BMI, lower risk of smoking, higher physical activity, and lower depressive symptoms. Although these factors completely accounted for the link between neuroticism-related nuances and mortality, the association between the items "active", "helpful", "caring", "organized", "responsible", "hardworking", and "thorough" and lower mortality risk was only partially explained by these factors, suggesting that other pathways may operate. For example, based upon existing models [2,36], it is likely that better biological functioning such as lower level of inflammatory markers (such as c-reactive proteins or interleukin-6), higher functional health including faster gait speed or higher grip strength, and lower stress reactivity may also explain why these items predict a lower risk of mortality.

The present research has several strengths, such as the use of four large longitudinal samples, a meta-analysis, and the inclusion of clinical, behavioral and psychological covariates. There are also limitations. The present study focused on the prediction of all-cause mortality. More research is needed to examine the association between personality items and specific causes of mortality. In addition, this study focused on the link between the level of items and mortality risk. Despite limited research suggesting change in personality traits as being predictive of mortality risk [6], it would be beneficial for future research to examine if changes in items may be associated with mortality risk. Although sensitivity analyses excluding mortality cases occurring within the first five years indicated almost no change in the overall pattern of association between nuances and mortality, it is not possible to exclude reverse causality. Personality nuances were assessed using self-report measures. Future research may test whether the pattern of association observed in this study is replicated using informant measures. Perhaps most importantly, however, the links between nuances and mortality may be underestimated by the limited number of items in the MIDI. The few items of the MIDI were carefully selected to represent the FFM trait domains with high internal consistency. Hence, they do not provide an extensive coverage of the broader ranges of nuances that define each domain, never mind the nuances not well covered by these domains. So, further research is needed with longer inventories, such as the 240-item NEO-PIR [1]. In addition, the MIDI does not assess personality facets. Therefore, it was not possible to examine whether personality nuances had stronger predictive values than their corresponding facets. Finally, the results are specific to US samples. Future research needs to test whether the pattern of association between nuances and mortality generalizes to other countries, including low and middle-income countries.

In sum, the coordinated analysis of four samples revealed replicable associations between personality items and mortality. In particular, being active, lively, organized, responsible, hardworking, thorough and helpful were related to a lower mortality risk. The link between the items "organized", "responsible", "hardworking", "thorough", "active", "helpful" "caring" persisted when clinical, behavioral, and psychological factors were controlled for in the analyses. Despite their replicable associations with mortality, specific items from a well validated short scale have limited incremental predictive power compared to their corresponding domain. In contrast, the aggregated contribution of items was stronger than the five broad domains of personality.

CRediT authorship contribution statement

Yannick Stephan: Writing – review & editing, Writing – original draft, Visualization, Supervision, Project administration, Methodology, Formal analysis, Conceptualization. **Angelina R. Sutin:** Writing – review & editing, Visualization, Methodology, Conceptualization. **René Mõttus:** Writing – review & editing, Methodology, Conceptualization.

Martina Luchetti: Writing – review & editing, Visualization, Methodology. **Páraic O'Súilleabháin:** Writing – review & editing, Visualization. **Antonio Terracciano:** Writing – review & editing, Writing – original draft, Visualization, Supervision, Methodology, Formal analysis, Conceptualization.

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Declaration of competing interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jpsychores.2025.112347.

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