Neuroticism and Sudden Cardiac Death:

A prospective cohort study from UK Biobank

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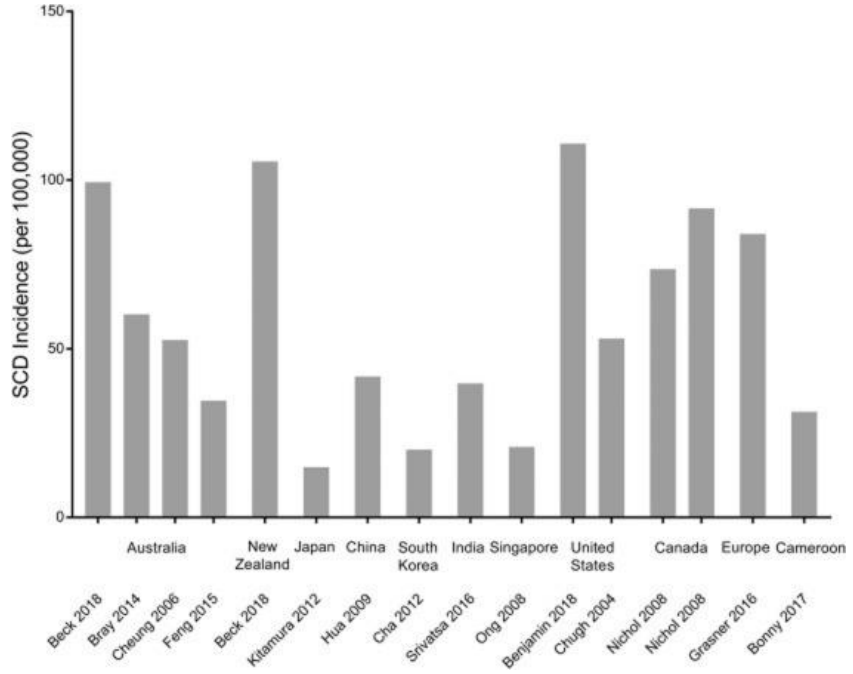
COI Disclosure

Kyung Yeon Lee

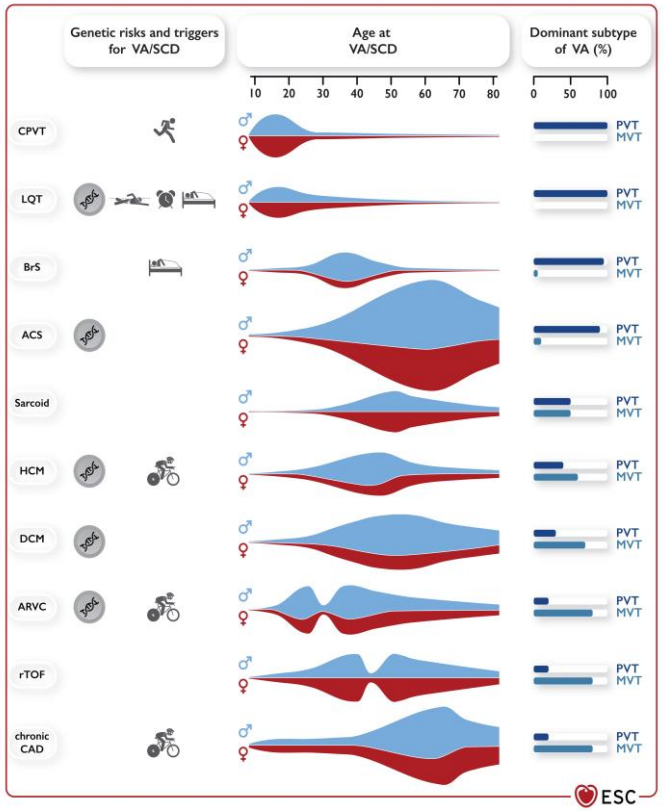
The authors have no financial conflicts of interest to disclose concerning the presentation

Sudden Cardiac Death

- Accounts for approximately **50%** of all cardiovascular deaths
- Up to 50% being **the first manifestation of cardiac disease**
- The incidence of SCD is approximately **50 per 100 000 person-years** in middle-aged individuals (in the fifth to sixth decades of life).

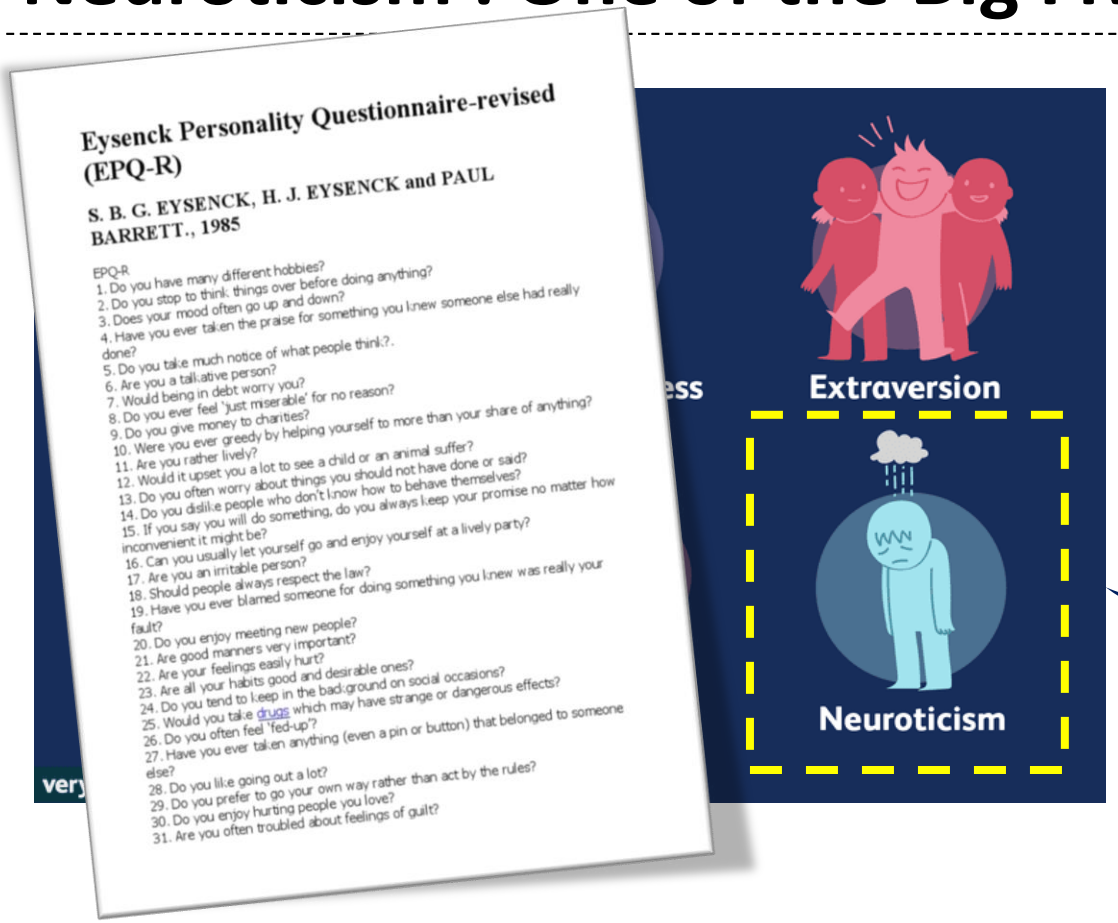


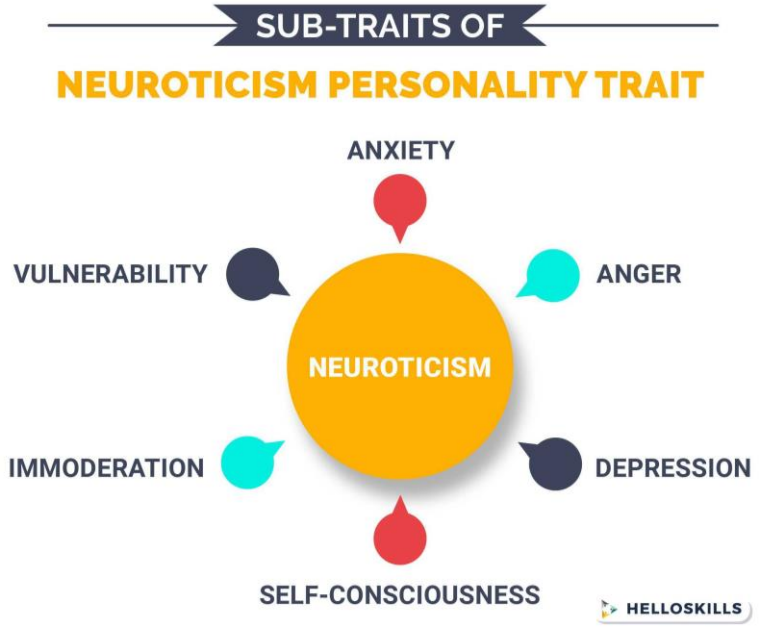
Global incidence of SCD



Heart, Lung and Circulation (2019) 28, 6–14; *EHJ*, Volume 43, Issue 40, 21 October 2022, Pages 3997–4126

Neuroticism : One of the Big Five Personality Traits





Increasing data suggests that …

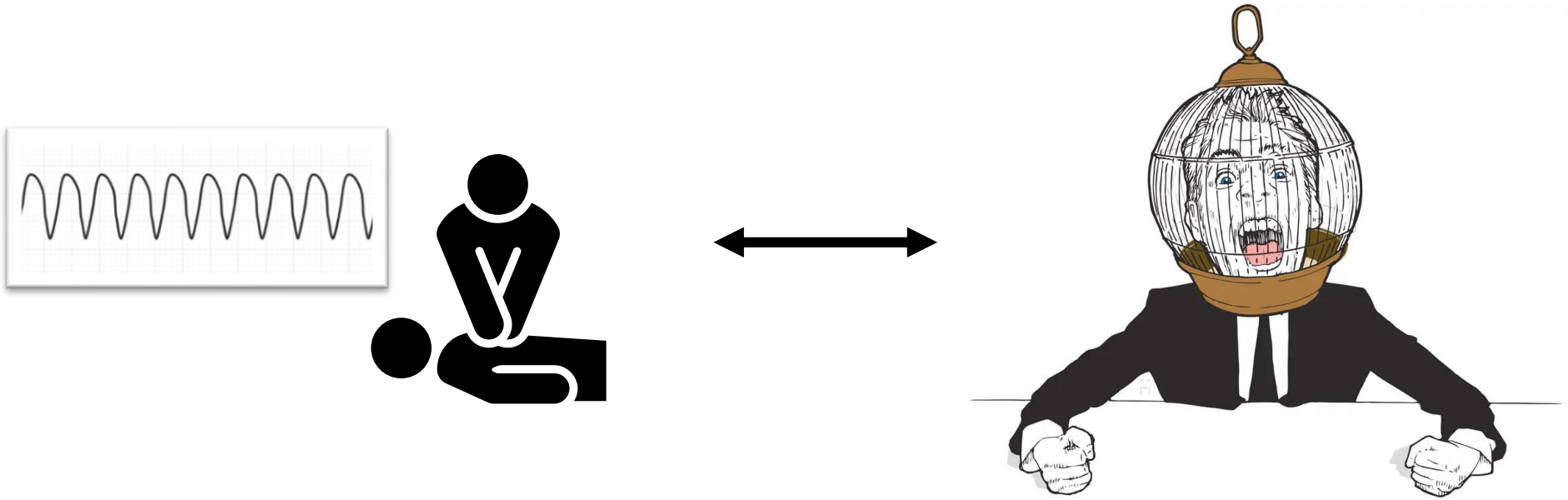
Related to harmful lifestyle factors (smoking, alcohol abuse, illicit drug use, and lack of physical activity)

More neuroticism traits have a higher risk of cardiovascular and all-cause mortality

Verywell / Joshua Seong

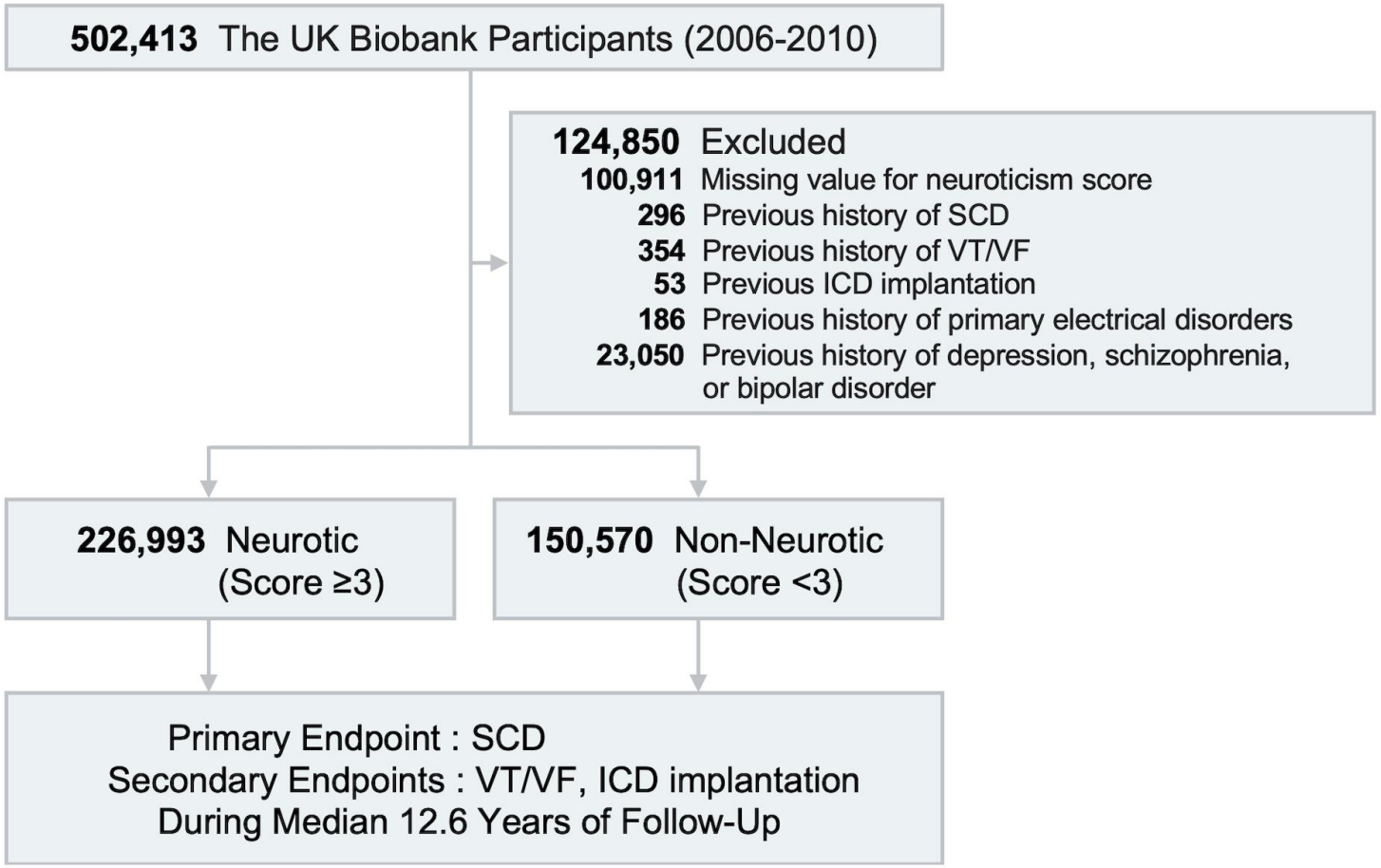
Aim of the study

To investigate the risk of **SCD and fatal ventricular arrhythmias**
according to **the degree of Neuroticism**



Study Flow

Figure 1. Study Flow



Methods

Assessment of neuroticism & Definition of groups by neuroticism score

- The 12-item scale from the summarized form of the revised Eysenck Personality Questionnaire (EPQ-R) was used to measure neuroticism
- High neuroticism group: Neuroticism scores ≥3
  Low neuroticism group: Neuroticism scores <3

Outcomes

- Primary outcome: Sudden cardiac death, including VF
- Secondary outcomes
  (1) Fatal ventricular arrhythmia, including VT or VF
  (2) ICD implantation

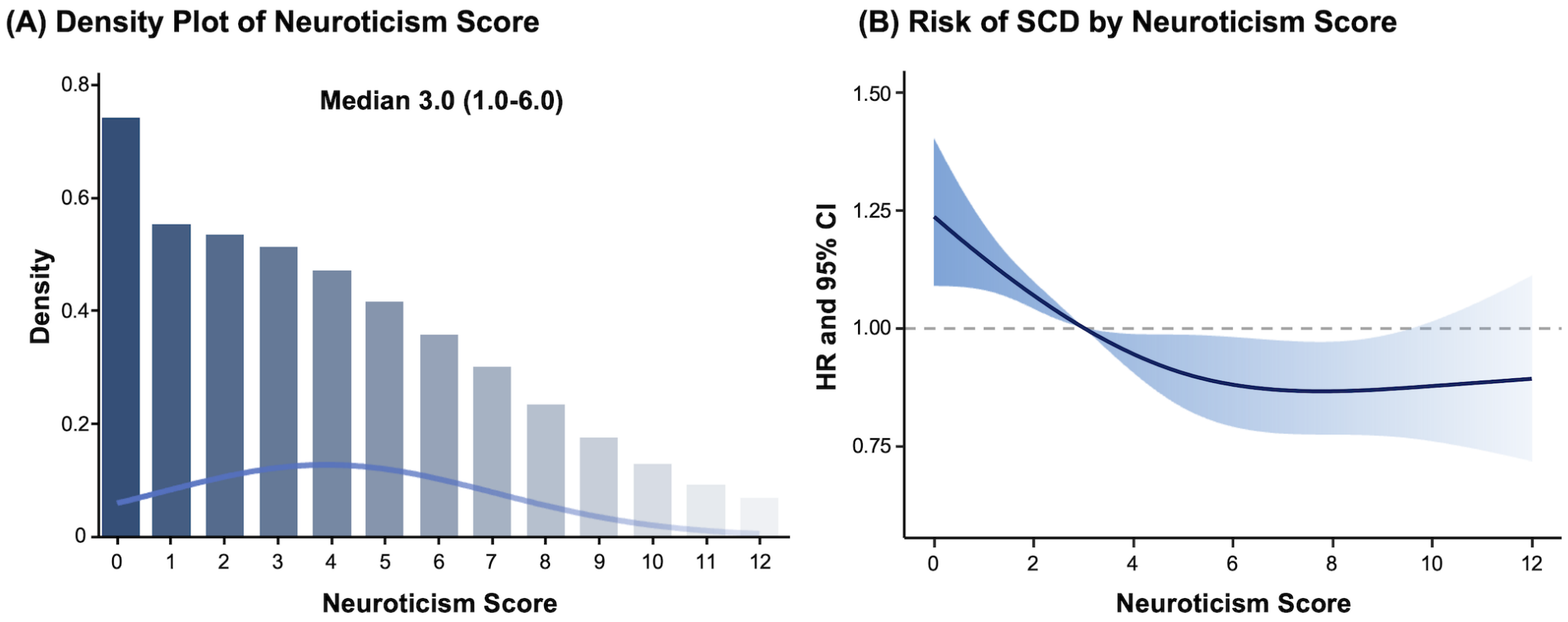
Results

Table 1. Baseline characteristics

		High Neuroticism Score (≥3)	Low Neuroticism Score (<3)	P
		N=226,993	N=150,570	
	Age, years	56.0 ± 8.1	57.2 ± 8.0	<0.001
	Male sex, % (n)	41.2% (93,498)	55.6% (83,671)	<0.001
	Ethnicity, % (n)			<0.001
	White	95.4% (216,542)	95.0% (143,094)	
	Asian	1.8% (4,005)	1.8% (2,764)	
	Black	1.3% (2,883)	1.6% (2,439)	
	Mixed	0.6% (1,348)	0.5% (783)	
	Others	1.0% (2,215)	1.0% (1,490)	
	Townsend deprivation index	-1.3 ± 3.1	-1.6 ± 2.9	<0.001
Socioeconomic status	Household income before tax, pound			<0.001
	<18,000	19.1% (43,308)	15.7% (23,686)	
	18,000 - 30,999	21.7% (49,145)	21.6% (32,489)	
	31,000 - 51,999	23.0% (52,107)	23.5% (35,448)	
	52,000 - 100,000	18.0% (40,968)	20.4% (30,669)	
	>100,000	4.5% (10,257)	6.4% (9,644)	
	Body mass index, kg/m^2	27.3 ± 4.8	27.4 ± 4.5	<0.001
	Current smoker, % (n)	10.6% (24,049)	9.0% (13,610)	<0.001
	Daily drinking, % (n)	20.4% (46,236)	22.0% (33,115)	<0.001
	Moderate-to-vigorous physical activity over recommendation, % (n)	53.4% (100,110)	57.2% (73,417)	<0.001
	Diabetes mellitus, % (n)	5.2% (11,762)	5.2% (7,883)	0.47
	Hypertension, % (n)	29.9% (67,809)	27.9% (41,992)	<0.001
	Dyslipidemia, % (n)	19.0% (43,132)	19.4% (29,282)	<0.001
	Previous history of myocardial infarction, % (n)	2.3% (5,137)	2.3% (3,476)	0.36
	Previous history of heart failure, % (n)	0.5% (1,070)	0.5% (716)	0.86
	Previous history of stroke, % (n)	1.8% (3,974)	1.5% (2,321)	<0.001
	Previous history of atrial fibrillation, % (n)	1.6% (3,520)	1.7% (2,564)	<0.001
	Neuroticism score	5.9 ± 2.5	0.9 ± 0.8	<0.001

Results

Figure 2. Distribution of Neuroticism Score and Association of Neuroticism Score with Sudden Cardiac Death



Results

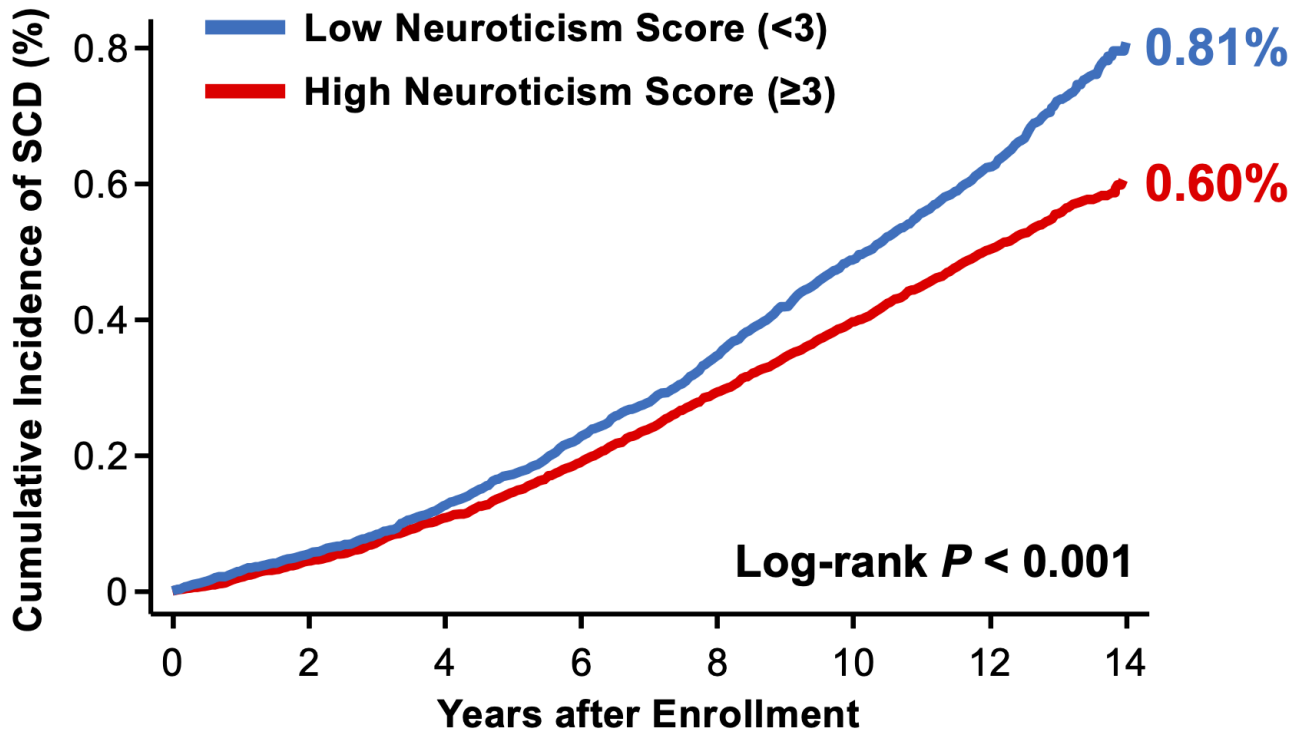
Table 2. Incidence and risk of fatal arrhythmia-related outcomes according to neuroticism score

	Neuroticism Score	Event / N	Rate, %	Unadjusted HR (95% CI)	P	*Adjusted HR (95% CI)	P	IPTW-adjusted HR (95% CI)	P
SCD	Per 1 increase	-	-	0.96 (0.95-0.98)	<0.001	**0.97 (0.96-0.99)**	**0.002**	**0.97 (0.96-0.99)**	**0.008**
	Low (<3)	998 / 150570	0.81	1 (ref)	-	1 (ref)	-	1 (ref)	-
	High (≥3)	1181 / 226993	0.6	0.78 (0.72-0.85)	<0.001	**0.87 (0.79-0.96)**	**0.007**	0.87 (0.77-0.97)	0.016
VT/VF	Per 1 increase	-	-	0.97 (0.96-0.99)	0.001	0.99 (0.97-1.01)	0.307	0.99 (0.97-1.01)	0.29
	Low (<3)	711 / 150570	0.57	1 (ref)	-	1 (ref)	-	1 (ref)	-
	High (≥3)	949 / 226993	0.48	0.88 (0.80-0.97)	0.011	0.98 (0.87-1.10)	0.683	0.96 (0.85-1.10)	0.568
ICD	Per 1 increase	-	-	0.98 (0.96-1.00)	0.015	0.99 (0.97-1.01)	0.25	0.98 (0.96-1.01)	0.224
	Low (<3)	472 / 150570	0.36	1 (ref)	-	1 (ref)	-	1 (ref)	-
	High (≥3)	630 / 226993	0.30	0.88 (0.78-0.99)	0.04	0.99 (0.86-1.14)	0.891	0.97 (0.83-1.14)	0.723

*Adjusted HR was calculated in the multivariable Cox regression model including age, sex, enrollment center, ethnicity, Townsend deprivation index, income level, body mass index, current smoking, daily drinking, moderate-to-vigorous physical activity over recommendation, diabetes mellitus, hypertension, dyslipidemia, previous atrial fibrillation, previous myocardial infarction, previous heart failure, and previous stroke as covariates.

Results

Figure 3. Comparison of Cumulative Incidence of Sudden Cardiac Death by Neuroticism Score Group

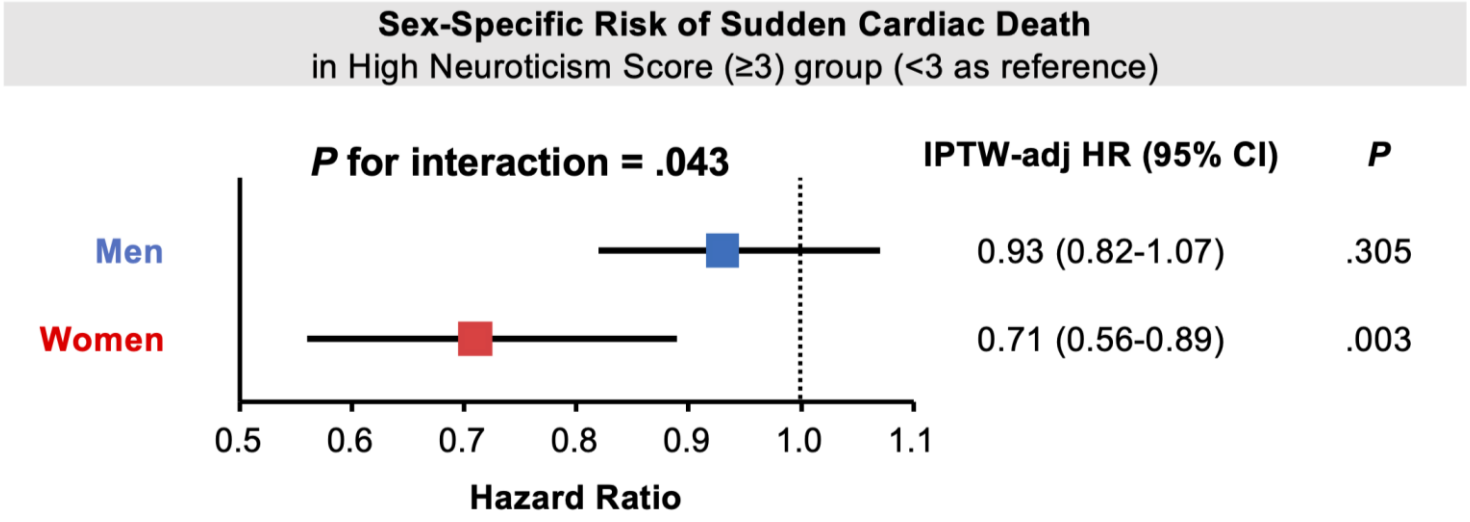


Number at Risk

Score <3	150570	149782	148430	146719	144833	142626	104233	7829
Score ≥3	226993	225817	223943	221626	219014	215939	158646	11953

Results

Figure 4. Sex Difference on Association between Neuroticism and Risk of Sudden Cardiac Death



Results

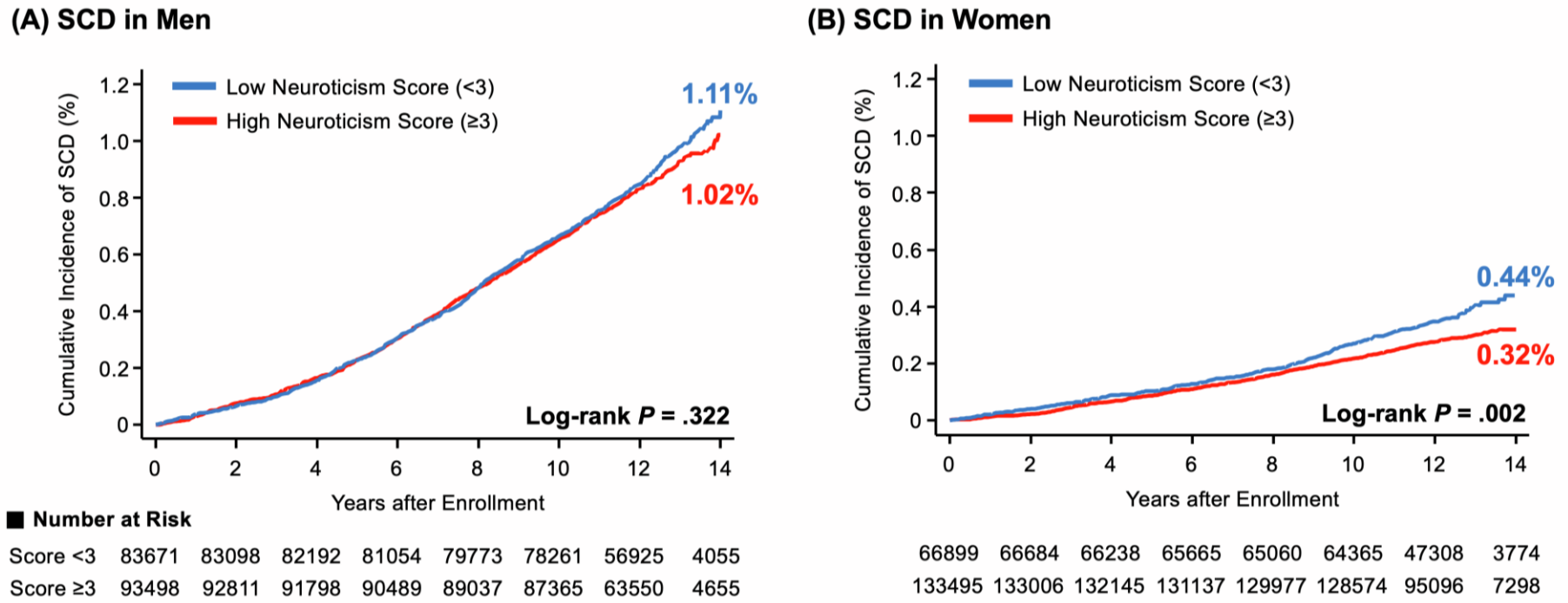
Table 3. Sex-specific independent predictors of sudden cardiac death

Men	Adjusted HR (95% CI)	P	Women	Adjusted HR (95% CI)	P
Predictors with positive association					
Previous heart failure	2.70 (2.04-3.58)	<0.001	Previous heart failure	6.36 (3.55-11.39)	<0.001
Previous myocardial infarction	2.41 (2.00-2.89)	<0.001	Current smoking	2.46 (1.89-3.21)	<0.001
Previous atrial fibrillation	1.82 (1.45-2.27)	<0.001	Previous stroke	2.28 (1.44-3.62)	<0.001
Current smoking	1.65 (1.40-1.94)	<0.001	Diabetes mellitus	2.19 (1.60-3.00)	<0.001
Previous stroke	1.61 (1.24-2.08)	<0.001	Previous atrial fibrillation	2.12 (1.25-3.60)	0.005
Diabetes mellitus	1.56 (1.31-1.86)	<0.001	Hypertension	1.85 (1.50-2.29)	<0.001
Hypertension	1.31 (1.14-1.51)	<0.001	Age, per 1 year increase	1.05 (1.04-1.07)	<0.001
Dyslipidemia	1.19 (1.03-1.39)	0.022			
Age, per 1 year increase	1.06 (1.05-1.07)	<0.001			
Predictors with negative association					
Income level, per 1 grade increase	0.90 (0.86-0.95)	<0.001	**High neuroticism score ≥3 (vs. <3)**	0.76 (0.62-0.92)	0.006
			MVPA over recommendation	0.77 (0.63-0.93)	0.008

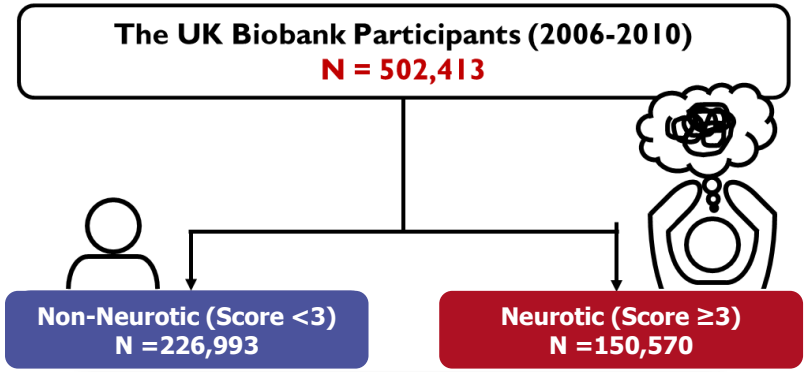
Sex-specific independent predictors of SCD were identified using stepwise selection from multivariable Cox proportional hazard model in men and women.

Results

Figure 5. Sex-Specific Cumulative Incidence of Sudden Cardiac Death by Neuroticism Score Group



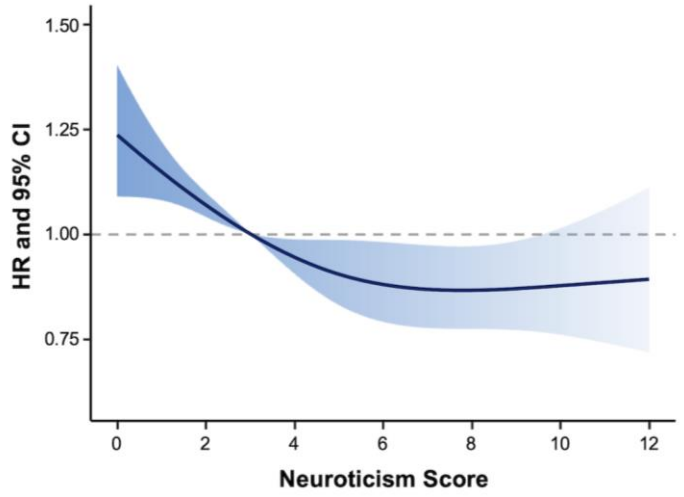
Summary of Results



Incident SCD

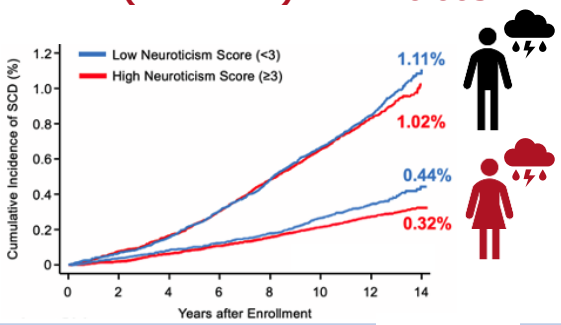
▼13% risk reduction in neurotic subjects

Risk of 10-Year SCD by Neuroticism Score



Sex differences in SCD risk according to the neuroticism score

	IPTW-adj HR (95% CI)	P
	0.93 (0.82-1.07)	0.305
	0.71 (0.56-0.89)	0.003



Discussion

Neurotic individuals

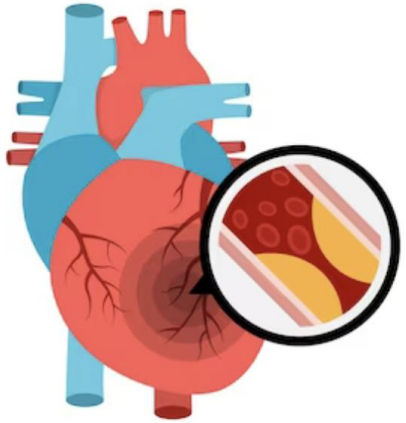
Negative emotions

Modulating physiological mechanisms

Activation of the sympathetic-adrenomedullary
& pituitary-adrenocortical systems

Exacerbates atherosclerosis (1)

Cardiovascular disease



Increased risk of mortality
caused by cardiovascular diseases

The extremely low incidence rate of SCD
Statistical power has been mostly inadequate

SCD risk?

SEOUL NATIONAL UNIVERSITY

KHRS 2023

(1) Psychosom Med. 1995 May-Jun;57(3):275-83

Discussion

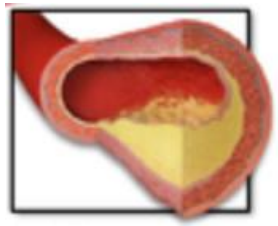
A high degree of Neuroticism → significantly linked to a **reduced risk** of SCD

Large & comprehensive population-based database

Neurotic people are more concerned about their health and use hospitals and clinics more frequently …(1)

↓

The chance of early detection and management of SCD risk factors ↑



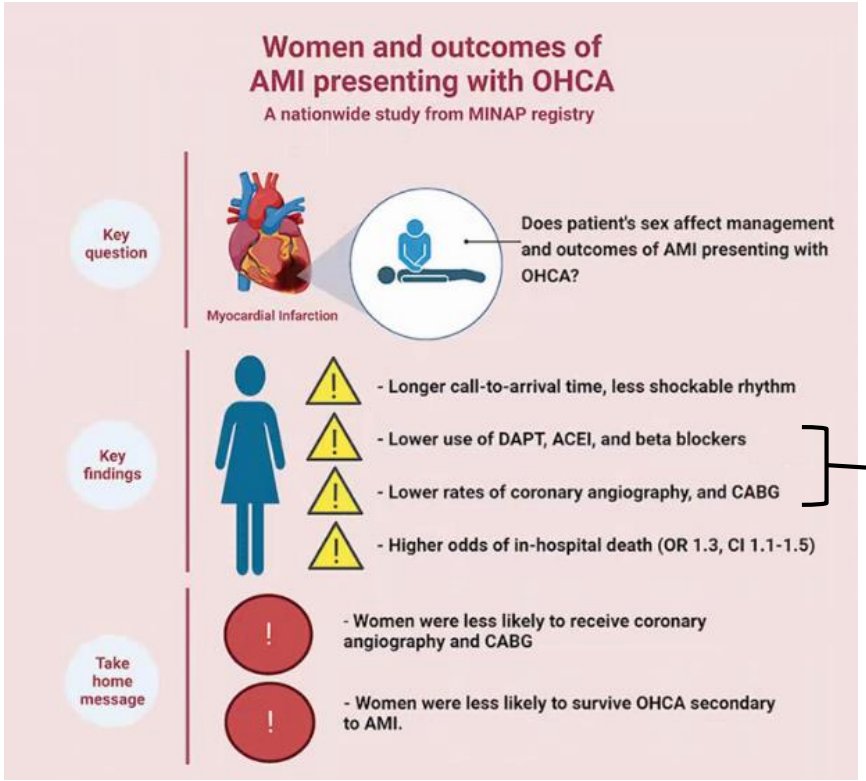
Coronary Artery Disease management

Sudden Cardiac Death

(1) J Pers. 2000 Dec;68(6):1089-107

Discussion

A significantly **lower risk of SCD in the high neuroticism score** group was observed **only in women**



(1)

One possible explanation...

Neurotic women may seek medical care more frequently ...(2)

↓

Increased the chances of being diagnosed with cardiovascular disease

↓

Could be managed properly

↓

The reduced risk of sudden cardiac death

(1) Mayo Clin Proc. 2022 Sep;97(9):1608-1618

Study limitations

- **The relatively healthy characteristics** of the UK Biobank population, with **a lower incidence rate of overall cardiovascular diseases**, may have **limited the statistical power** of this study.
- **The observational nature** of this study made it impossible to infer causality.
- **The lack of a validation cohort limits the generalizability** of the study results, which should be further evaluated in other ethnicities or populations.

Conclusions

- Individuals with **high neuroticism scores** had a significantly **lower risk** of future occurrence of **Sudden Cardiac Death**.
- This association was **more prominent in women** than in men.
- **Efforts to unveil the causal and mechanistic relationships between personality phenotypes**, including neuroticism and the risk of SCD, are needed.

THANK YOU!

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