**Table S1. Baseline characteristics of study participants by menopausal stage**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Characteristics** | **Overall** | **Menopausal stages** | | | | ***p* for trend** |
| **Pre-menopause** | **Early transition** | **Late transition** | **Post-menopause** |
| Number of participants | 45,177 | 22,454 | 7,001 | 3,924 | 11,788 |  |
| Age (years)e | 47.3 (6.5) | 43.5 (2.7) | 44.3 (3.1) | 47.1 (3.8) | 56.2 (4.9) | <0.001 |
| Early menarche (%) a | 3.0 | 4.0 | 3.4 | 2.6 | 0.9 | <0.001 |
| Parity (%)b | 92.7 | 91.7 | 90.4 | 91.3 | 96.7 | <0.001 |
| Current smoker (%) | 1.8 | 1.8 | 2.1 | 1.7 | 1.7 | 0.425 |
| Alcohol intake (%)c | 10.8 | 11.4 | 12.2 | 10.5 | 8.9 | <0.001 |
| HEPA (%) | 15.2 | 13.3 | 13.6 | 13.8 | 20.1 | <0.001 |
| Education level (%)d | 70.3 | 80.6 | 80.4 | 74.8 | 42.6 | <0.001 |
| Diabetes (%) | 4.1 | 1.9 | 2.1 | 3.4 | 9.6 | <0.001 |
| Hypertension (%) | 9.6 | 4.5 | 5.3 | 9.5 | 22.0 | <0.001 |
| Dyslipidemia medication (%) | 4.7 | 1.1 | 1.6 | 2.9 | 14.1 | <0.001 |
| Poor sleep quality (%) | 19.2 | 16.1 | 21.5 | 21.2 | 23.2 | <0.001 |
| Sleep duration (h/day) | 6.56 (1.13) | 6.63 (1.07) | 6.53 (1.11) | 6.40 (1.12) | 6.49 (1.23) | <0.001 |
| Body mass index (kg/m2) e | 22.6 (3.1) | 22.2 (3.0) | 22.2 (3.1) | 23.0 (3.4) | 23.3 (3.1) | <0.001 |
| Systolic BP (mmHg) e | 106.7 (12.7) | 104.3 (11.3) | 104.8 (11.7) | 107.8 (13.6) | 112.0 (13.8) | <0.001 |
| Diastolic BP (mmHg) e | 67.8 (9.2) | 66.5 (8.8) | 66.8 (9.0) | 68.7 (9.8) | 70.6 (9.3) | <0.001 |
| Glucose (mg/dl) e | 94.5 (14.2) | 92.8 (11.9) | 93.0 (12.1) | 94.3 (14.7) | 98.8 (17.8) | <0.001 |
| Total cholesterol (mg/dl)e | 195.7 (34.0) | 189.8 (30.8) | 191.3 (30.9) | 201.5 (34.5) | 207.7 (37.7) | <0.001 |
| LDL-C (mg/dl) e | 124.9 (32.8) | 118.5 (29.1) | 119.7 (29.3) | 129.8 (33.1) | 138.7 (36.6) | <0.001 |
| HDL-C (mg/dl) e | 66.3 (16.3) | 67.1 (15.9) | 67.3 (16.3) | 66.5 (16.3) | 64.1 (16.8) | <0.001 |
| Triglycerides (mg/dl)f | 79 (59–109) | 75 (57–100) | 75 (57–102) | 83 (62–118) | 90 (65–125) | <0.001 |
| ALT (u/l) f | 15 (12–20) | 13 (11–17) | 14 (11–18) | 15 (12–21) | 19 (15–26) | <0.001 |
| GGT (u/l) f | 14 (11–20) | 13 (11–18) | 13 (11–19) | 15 (11–21) | 18 (13–26) | <0.001 |
| hsCRP (mg/L) f | 0.04 (0.02–0.07) | 0.03 (0.02–0.06) | 0.04 (0.02–0.07) | 0.04 (0.03–0.09) | 0.05 (0.03–0.09) | <0.001 |
| HOMA-IRf | 1.22 (0.81–1.82) | 1.21 (0.81–1.78) | 1.17 (0.78–1.74) | 1.17 (0.79–1.80) | 1.28 (0.83–1.98) | <0.001 |
| Total energy intake (kcal/d)f, g | 1119.1 (804.6–1481.3) | 1089.6 (784–1444.5) | 1100.8 (793.2–1462.2) | 1079.7 (785.1–1447.7) | 1228.6 (891.3–1592.3) | <0.001 |

a<12 years; b≥3 times; c≥10 g of ethanol per day; d≥college graduate; data are expressed as emeans (standard deviations), fmedian (interquartile ranges), or percentages gamong 45,177 participants with plausible estimated energy intake levels (within three standard deviations from the log-transformed mean energy intake).

Abbreviations: ALT, alanine aminotransferase; BP, blood pressure; HDL-C, high-density lipoprotein-cholesterol; HEPA, health-enhancing physical activity; HOMA-IR, homeostasis model assessment of insulin resistance; LDL-C, low-density lipoprotein cholesterol.

**Table S2.** **Prevalence ratiosa (95% CI) of depression by menopausal stage after further adjustment for the history of suicidal behavior**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Menopausal stages | | | | *p* for trend |
| Pre-menopause | Early transition | Late transition | Post-menopause |
| Number | 22,454 | 7,011 | 3,924 | 11,788 |  |
| CESD score 16-24 |  |  |  |  |  |
| Multivariate-adjusted PRa | 1.00 (reference) | 1.28 (1.16-1.42) | 1.21 (1.05-1.38) | 1.58 (1.36-1.84) | <0.001 |
| CESD score ≥25 |  |  |  |  |  |
| Multivariate-adjusted PRa | 1.00 (reference) | 1.31 (1.11-1.55) | 1.39 (1.13-1.73) | 1.86 (1.46-2.37) | <0.001 |

aEstimated from multinomial logistic regression models using CESD scores as outcomes categorized as <16, 16 – 24, and ≥25. Multivariable Model 1 was adjusted for age, center, year of screening examination, smoking status, alcohol intake, physical activity level, total energy intake, body mass index, educational level, antihypertensive medication, parity, age at menarche, sleep duration, sleep quality and history of suicidal behavior

Abbreviation: CESD, Center for Epidemiological Studies-Depression; CI, confidence interval; PR, prevalence ratio

**Table S3. Odds ratiosa (95% CI) of suicidal ideation by menopausal stage after further adjustment for history of suicidal behavior**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Menopausal stages | | | | *p* for trend |
| Pre-menopause | Early transition | Late transition | Post-menopause |
| Number | 22,454 | 7,011 | 3,924 | 11,788 |  |
| Multivariate-adjusted ORa | 1.00 (reference) | 1.25 (1.12-1.39) | 1.07 (0.93-1.24) | 1.45 (1.24-1.69) | <0.001 |

aEstimated from binomial logistic regression models. Multivariable Model was adjusted for age, center, year of a screening exam, smoking status, alcohol intake, physical activity level, total energy intake, body mass index, educational level, parity, age at menarche, sleep duration, sleep quality, and history of suicidal behavior.

Abbreviation: CI, confidence interval; OR, odds ratio

**Table S4.** **Odds ratiosa (95% CI) of suicidal behavior by depression and suicidal ideation according to menopausal stage**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Multivariate-adjusted ORa (95% CI) of suicidal behavior | | | | | | | |
| Cases (%) | Pre-menopause  (N=22,454) | Cases (%) | Early transition  (N=7,011) | Cases (%) | Late transition (N=3,924) | Cases (%) | Post-menopause (N=11,788) |
| CESD score |  |  |  |  |  |  |  |  |
| <16 | 9 (0.04) | 1.00 (reference) | 2 (0.03) | 1.00 (reference) | 2 (0.06) | 1.00 (reference) | 41 (0.40) | 1.00 (reference) |
| 16-24 | 4 (0.29) | 3.01 (0.77-11.79) | 0 (0) | - | 0 (0) | - | 7 (0.60) | 1.37 (0.59-3.16) |
| ≥25 | 7 (1.46) | 15.55 (5.47-50.07) | 3 (1.39) | 67.14 (4.53-994.52) | 2 (1.63) | - | 7 (1.54) | 3.45 (1.42-8.36) |
| *p* for trend |  | <0.001 |  | 0.003 |  | - |  | 0.011 |
| Suicidal ideation |  |  |  |  |  |  |  |  |
| No | 0 (0) | 1.00 (reference) | 0 (0) | 1.00 (reference) | 0 (0) | 1.00 (reference) | 9 (0.08) | 1.00 (reference) |
| Yes | 20 (1.56) | - | 5 (0.94) | - | 4 (0.10) | - | 46 (3.97) | 47.55 (22.53-100.34) |

a Estimated from binomial logistic regression models. Multivariable Model was adjusted for age, center, year of a screening exam, smoking status, alcohol intake, physical activity level, total energy intake, body mass index, educational level, parity, age at menarche, sleep duration, and quality

Abbreviation: CESD, Center for Epidemiological Studies-Depression; CI, confidence interval; PR, prevalence ratio

**Table S5.** **Associations between menopausal stages, depression, and suicidal ideation among participants without excluding subjects with a history of mental illness diagnosis (n=2,357) or currently taking anxiety drugs (n=703), antidepressants, or other neuropsychological medications (n=869)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Menopausal stages | | | | *p* for trend |
| Pre-menopause  n = 23,238 | Early transition  n = 7349 | Late transition  n = 4118 | Post-menopause  n = 12519 |
| **Depressive symptoms** |  |  |  |  |  |
| CESD score 16-24 |  |  |  |  |  |
| Multivariate-adjusted PRa |  |  |  |  |  |
| **Without** adjustment for psychiatric historyb | 1.00 (reference) | 1.27 (1.15-1.41) | 1.21 (1.06-1.38) | 1.59 (1.38-1.84) | <0.001 |
| **With** adjustment for psychiatric historyc | 1.00 (reference) | 1.27 (1.15-1.40) | 1.21 (1.06-1.37) | 1.59 (1.38-1.84) | <0.001 |
| CESD score ≥25 |  |  |  |  |  |
| Multivariate-adjusted PRa |  |  |  |  |  |
| **Without** adjustment for psychiatric historyb | 1.00 (reference) | 1.26 (1.08-1.47) | 1.35 (1.12-1.64) | 1.67 (1.34-2.08) | <0.001 |
| **With** adjustment for psychiatric historyc | 1.00 (reference) | 1.26 (1.08-1.46) | 1.34 (1.10-1.62) | 1.69 (1.36-2.11) | <0.001 |
| **Suicidal ideation** |  |  |  |  |  |
| Multivariate-adjusted ORd |  |  |  |  |  |
| **Without** adjustment for psychiatric historyb | 1.00 (reference) | 1.26 (1.14-1.39) | 1.07 (0.93-1.22) | 1.43 (1.23-1.65) | <0.001 |
| **With** adjustment for psychiatric historyc | 1.00 (reference) | 1.26 (1.14-1.39) | 1.06 (0.93-1.22) | 1.43 (1.24-1.66) | <0.001 |

aEstimated from multinomial logistic regression models using CESD scores as outcomes categorized as <16, 16 – 24, and ≥25. Multivariable Model 1 was adjusted for age, center, year of screening examination, smoking status, alcohol intake, physical activity level, total energy intake, body mass index, educational level, antihypertensive medication, parity, age at menarche, sleep duration, and quality; b plus a further adjustment for a history of mental illness, anxiety drugs, and neuropsychological medications

dEstimated from binomial logistic regression models.

Abbreviation: CESD, Center for Epidemiological Studies-Depression; CI, confidence interval; OR, odds ratio; PR, prevalence ratio

**Table S6.** **Associations between menopausal stages, depression, and suicidal ideation comparing the early transition stage to postmenopausal stage with premenopausal stage**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Menopausal stages | | *p* value |
| Pre-menopause  n = 22,454 | Early transition to Post-menopause  n = 22,723 |
| **Depressive symptoms** |  |  |  |
| CESD score 16-24 |  |  |  |
| Multivariate-adjusted PR (95% CI)a | 1.00 (reference) | 1.30 (1.19-1.42) | <0.001 |
| CESD score ≥25 |  |  |  |
| Multivariate-adjusted PRa | 1.00 (reference) | 1.40 (1.22-1.61) | <0.001 |
| **Suicidal ideation** |  |  |  |
| Multivariate-adjusted ORb | 1.00 (reference) | 1.23 (1.12-1.35) | <0.001 |

aEstimated from multinomial logistic regression models using CESD scores as outcomes categorized as <16, 16 – 24, and ≥25.

bEstimated from binomial logistic regression models.

Multivariable Model was adjusted for age, center, year of screening examination, smoking status, alcohol intake, physical activity level, total energy intake, body mass index, educational level, antihypertensive medication, parity, age at menarche, sleep duration, and quality

Abbreviation: CESD, Center for Epidemiological Studies-Depression; CI, confidence interval; OR, odds ratio; PR, prevalence ratio

**Table S7.** **Associations between menopausal stages, depression, and suicidal ideation comparing post-menopasual stage to the earlier stages (from premenopausal stage to late transition stage)**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Menopausal stages | | *p*-value |
| Pre-menopause to late transition  n = 33,389 | Post-menopause  n = 11,788 |
| **Depressive symptoms** |  |  |  |
| CESD score 16-24 |  |  |  |
| Multivariate-adjusted PR (95% CI)a | 1.00 (reference) | 1.39 (1.21-1.60) | <0.001 |
| CESD score ≥25 |  |  |  |
| Multivariate-adjusted PRa | 1.00 (reference) | 1.56 (1.25-1.95) | <0.001 |
| **Suicidal ideation** |  |  |  |
| Multivariate-adjusted ORb | 1.00 (reference) | 1.35 (1.17-1.56) | <0.001 |

aEstimated from multinomial logistic regression models using CESD scores as outcomes categorized as <16, 16 – 24, and ≥25.

bEstimated from binomial logistic regression models.

Multivariable Model was adjusted for age, center, year of screening examination, smoking status, alcohol intake, physical activity level, total energy intake, body mass index, educational level, antihypertensive medication, parity, age at menarche, sleep duration, and quality

Abbreviation: CESD, Center for Epidemiological Studies-Depression; CI, confidence interval; OR, odds ratio; PR, prevalence ratio

**Table S8.** **Prevalence ratiosa (95% CI) of depression and suicidal ideation by menopausal stage**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Menopausal stages | | | | *p* for trend |
| Pre-menopause | Early transition | Late transition | Post-menopause |
| Number | 22,454 | 7,011 | 3,924 | 11,788 |  |
| Isolated depression (CESD score ≥16) |  |  |  |  |  |
| Multivariate-adjusted PRa | 1.00 (reference) | 1.25 (1.13-1.40) | 1.28 (1.11-1.46) | 1.61 (1.38-1.88) | <0.001 |
| Isolated suicidal ideation |  |  |  |  |  |
| Multivariate-adjusted PRa | 1.00 (reference) | 1.17 (1.02-1.35) | 1.02 (0.84-1.24) | 1.33 (1.08-1.64) | 0.014 |
| Both depression (CESD score ≥16) and suicidal ideation |  |  |  |  |  |
| Multivariate-adjusted PRa | 1.00 (reference) | 1.41 (1.21-1.64) | 1.20 (0.98-1.48) | 1.82 (1.46-2.27) | <0.001 |

aEstimated from multinomial logistic regression models using CESD scores as outcomes categorized as <16, 16 – 24, and ≥25. Multivariable Model 1 was adjusted for age, center, year of screening examination, smoking status, alcohol intake, physical activity level, total energy intake, body mass index, educational level, antihypertensive medication, parity, age at menarche, sleep duration, and quality

Abbreviation: CESD, Center for Epidemiological Studies-Depression; CI, confidence interval; PR, prevalence ratio

**Table S9.** **Odds ratiosa (95% CI) of depression (CESD score ≥25**) **by menopausal stage in clinically relevant subgroups**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Subgroup** | **Menopausal stages** | | | | ***p* for trend** | ***p* for interaction** |
| **Pre-menopause** | **Early transition** | **Late transition** | **Post-menopause** |
| **BMI** |  |  |  |  |  | 0.002 |
| < 25 kg/m2 (N=36,631) | 1.00 (reference) | 1.26 (1.05–1.52) | 1.36 (1.07–1.74) | 1.99 (1.57–2.53) | <0.001 |  |
| ≥25 kg/m2 (N=8,506) | 1.00 (reference) | 2.70 (1.87–3.89) | 2.42 (1.60–3.65) | 2.81 (1.96–4.02) | <0.001 |  |
| **Early menarche** |  |  |  |  |  | 0.617 |
| No (N=43,677) | 1.00 (reference) | 1.44 (1.22–1.71) | 1.57 (1.27–1.94) | 2.12 (1.68–2.67) | <0.001 |  |
| Yes (N=1,333) | 1.00 (reference) | 1.91 (0.85–4.32) | 0.99 (0.23–4.33) | 1.15 (0.26–5.08) | 0.587 |  |
| **Parity** |  |  |  |  |  | 0.124 |
| 0 times (N=3,130) | 1.00 (reference) | 1.44 (0.89–2.34) | 2.47 (1.46–4.18) | 1.54 (0.81–2.92) | 0.008 |  |
| ≥1 time (N=39,944) | 1.00 (reference) | 1.49 (1.24–1.77) | 1.48 (1.17–1.86) | 2.22 (1.74–2.81) | <0.001 |  |
| **Sleep quality** |  |  |  |  |  | 0.069 |
| Good (N=36,368) | 1.00 (reference) | 1.15 (0.88–1.50) | 1.33 (0.96–1.83) | 2.01 (1.53–2.64) | <0.001 |  |
| Poor (N=8,653) | 1.00 (reference) | 1.38 (1.11–1.72) | 1.41 (1.07–1.85) | 1.57 (1.20–2.06) | 0.001 |  |
| **Smoking** |  |  |  |  |  | 0.129 |
| Non-smoker (N=40,269) | 1.00 (reference) | 1.44 (1.20–1.71) | 1.64 (1.32–2.04) | 2.03 (1.60–2.58) | <0.001 |  |
| Ex- or current smoker (N=3,720) | 1.00 (reference) | 1.64 (1.05–2.56) | 0.86 (0.41–1.83) | 2.73 (1.72–4.34) | <0.001 |  |
| **Alcohol intake** |  |  |  |  |  | 0.743 |
| < 10 g /day (N=37,888) | 1.00 (reference) | 1.38 (1.15–1.66) | 1.54 (1.23–1.94) | 1.91 (1.50–2.44) | <0.001 |  |
| ≥ 10 g/day (N=4,594) | 1.00 (reference) | 1.64 (1.09–2.46) | 1.55 (0.90–2.68) | 2.32 (1.55–3.49) | <0.001 |  |
| **HEPA** |  |  |  |  |  | 0.461 |
| No (N=38,256) | 1.00 (reference) | 1.45 (1.22–1.73) | 1.63 (1.31–2.02) | 2.13 (1.68–2.69) | <0.001 |  |
| Yes (N=6,832) | 1.00 (reference) | 1.50 (0.92–2.45) | 0.91 (0.43–1.94) | 1.84 (1.21–2.79) | 0.005 |  |

aEstimated from the logistic regression models. Multivariable Model 1 was adjusted for age, center, year of screening examination, smoking status, alcohol intake, physical activity level, total energy intake, BMI, educational level, parity, and age at menarche.

Abbreviation: BMI, body mass index; CESD, Center for Epidemiological Studies-Depression; HEPA, health-enhancing physical activity

**Table S10.** **Odds ratiosa (95% CI) of suicidal ideation** **by menopausal stage in clinically relevant subgroups**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Subgroup** | **Menopausal stages** | | | | ***p* for trend** | ***p* for interaction** |
| **Pre-menopause** | **Early transition** | **Late transition** | **Post-menopause** |
| **BMI** |  |  |  |  |  | 0.285 |
| < 25 kg/m2 (N=36,631) | 1.00 (reference) | 1.31 (1.17–1.48) | 1.14 (0.97–1.34) | 1.54 (1.32–1.80) | <0.001 |  |
| ≥25 kg/m2 (N=8,506) | 1.00 (reference) | 1.43 (1.12–1.85) | 1.20 (0.90–1.61) | 1.88 (1.51–2.34) | <0.001 |  |
| **Early menarche** |  |  |  |  |  | 0.441 |
| No (N=43,677) | 1.00 (reference) | 1.59 (0.98–2.57) | 0.62 (0.24–1.59) | 1.83 (0.96–3.50) | 0.172 |  |
| Yes (N=1,333) | 1.00 (reference) | 1.32 (1.19–1.47) | 1.17 (1.01–1.35) | 1.61 (1.38–1.87) | <0.001 |  |
| **Parity** |  |  |  |  |  | 0.323 |
| 0 times (N=3,130) | 1.00 (reference) | 1.44 (1.04–1.97) | 1.24 (0.81–1.91) | 1.18 (0.77–1.81) | 0.222 |  |
| ≥1 times (N=39,944) | 1.00 (reference) | 1.35 (1.20–1.51) | 1.17 (1.00–1.36) | 1.68 (1.44–1.97) | <0.001 |  |
| **Sleep quality** |  |  |  |  |  | 0.263 |
| Good (N=36,368) | 1.00 (reference) | 1.32 (1.16–1.51) | 1.08 (0.90–1.30) | 1.55 (1.32–1.83) | <0.001 |  |
| Poor (N=8,653) | 1.00 (reference) | 1.14 (0.95–1.36) | 1.06 (0.85–1.34) | 1.32 (1.09–1.60) | 0.009 |  |
| **Smoking** |  |  |  |  |  | 0.413 |
| Non-smoker (N=40,269) | 1.00 (reference) | 1.36 (1.22–1.52) | 1.13 (0.97–1.31) | 1.55 (1.33–1.82) | <0.001 |  |
| Ex- or current smoker (N=3,720) | 1.00 (reference) | 1.10 (0.81–1.51) | 1.19 (0.79–1.79) | 1.72 (1.26–2.37) | 0.001 |  |
| **Alcohol intake** |  |  |  |  |  | 0.014 |
| < 10 g /day (N=37,888) | 1.00 (reference) | 1.36 (1.21–1.53) | 1.07 (0.91–1.26) | 1.46 (1.24–1.72) | <0.001 |  |
| ≥ 10 g/day (N=4,594) | 1.00 (reference) | 1.21 (0.92–1.59) | 1.45 (1.03–2.04) | 2.00 (1.55–2.60) | <0.001 |  |
| **HEPA** |  |  |  |  |  | 0.222 |
| No (N=38,256) | 1.00 (reference) | 1.35 (1.21–1.51) | 1.11 (0.95–1.29) | 1.57 (1.34–1.83) | <0.001 |  |
| Yes (N=6,832) | 1.00 (reference) | 1.21 (0.88–1.65) | 1.46 (1.01–2.11) | 1.81 (1.41–2.32) | <0.001 |  |

aEstimated from the logistic regression models. Multivariable Model 1 was adjusted for age, center, year of screening examination, smoking status, alcohol intake, physical activity level, total energy intake, BMI, educational level, parity, and age at menarche.

Abbreviation: BMI, body mass index; CESD, Center for Epidemiological Studies-Depression; HEPA, health-enhancing physical activity