

SUPPLEMENTARY TABLES

Supplementary Table 1. Detailed information on GWAS data for neurological disease.

| Neurological disease | Year | Sample size | Consortium | Link |
|---------------------------|------|-------------|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alzheimer's disease | 2019 | 455258 | Complex Trait Genetics lab | https://pubmed.ncbi.nlm.nih.gov/30617256/ |
| Multiple sclerosis | 2019 | 115803 | International Multiple Sclerosis Genetics Consortium | https://gwas.mrcieu.ac.uk/datasets/ieu-b-18/ |
| Parkinson's disease | 2019 | 482730 | International Parkinson's Disease Genomics Consortium | https://gwas.mrcieu.ac.uk/datasets/ieu-b-7/ |
| Myasthenia gravis | 2021 | 217288 | FinnGen consortium | https://gwas.mrcieu.ac.uk/datasets/finn-b-G6_MYASTHENIA/ |
| Generalized epilepsy | 2021 | 214313 | FinnGen consortium | https://gwas.mrcieu.ac.uk/datasets/finn-b-GE/ |
| Intracerebral haemorrhage | 2021 | 202833 | FinnGen consortium | https://gwas.mrcieu.ac.uk/datasets/finn-b-I9_ICH/ |
| Cerebral atherosclerosis | 2021 | 203172 | FinnGen consortium | https://gwas.mrcieu.ac.uk/datasets/finn-b-I9_CERATHER/ |
| Brain glioblastoma | 2021 | 218792 | FinnGen consortium | https://gwas.mrcieu.ac.uk/datasets/finn-b-C3_GBM/ |
| Benign meningeal tumor | 2021 | 218792 | FinnGen consortium | https://gwas.mrcieu.ac.uk/datasets/finn-b-CD2_BENIGN_MENINGES_CEREBRAL/ |

Supplementary Table 2. Detailed information on GWAS data for breast cancer.

| Outcome | Year | Sample size | Consortium | Link |
|-----------------------|------|-------------|--------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Overall breast cancer | 2017 | 106776 | Breast Cancer Association Consortium | https://gwas.mrcieu.ac.uk/datasets/ieu-a-1129/ |
| ER+ breast cancer | 2017 | 83691 | Breast Cancer Association Consortium | https://gwas.mrcieu.ac.uk/datasets/ieu-a-1132/ |
| ER- breast cancer | 2017 | 55149 | Breast Cancer Association Consortium | https://gwas.mrcieu.ac.uk/datasets/ieu-a-1135/ |

Supplementary Table 3. The MR analyses of neurological diseases and ER+ breast cancer risk from MR Egger and weighted median methods.

| Neurological diseases | Used SNPs | MR Egger | | Weighted median | | $P_{\text{heterogeneity}}$ | $P_{\text{pleiotropy}}$ |
|---------------------------|-----------|--------------------|------------|--------------------|------------|----------------------------|-------------------------|
| | | OR(95% CI) | P -value | OR(95% CI) | P -value | | |
| Alzheimer's disease | 86 | 0.884(0.809-0.965) | 0.007 | 0.875(0.802-0.954) | 0.003 | 0.100 | 0.284 |
| Multiple sclerosis | 192 | 1.006(1.001-1.012) | 0.019 | 1.005(0.999-1.011) | 0.113 | 0.061 | 0.791 |
| Parkinson's disease | 25 | 1.046(0.942-1.162) | 0.406 | 1.028(0.978-1.081) | 0.273 | 0.006 | 0.525 |
| Myasthenia gravis | 8 | 0.991(0.968-1.015) | 0.504 | 0.996(0.976-1.018) | 0.742 | 0.199 | 0.190 |
| Generalized epilepsy | 12 | 1.010(0.978-1.043) | 0.554 | 0.998(0.969-1.029) | 0.908 | 0.718 | 0.097 |
| Intracerebral haemorrhage | 5 | 1.005(0.940-1.075) | 0.891 | 1.031(0.977-1.087) | 0.265 | 0.409 | 0.728 |
| Cerebral atherosclerosis | 7 | 1.005(0.995-1.015) | 0.401 | 1.004(0.995-1.013) | 0.358 | 0.379 | 0.755 |
| Brain glioblastoma | 8 | 0.993(0.975-1.012) | 0.508 | 0.995(0.983-1.006) | 0.351 | 0.078 | 0.659 |
| Benign meningeal tumor | 12 | 0.994(0.960-1.029) | 0.742 | 1.008(0.980-1.038) | 0.572 | 0.107 | 0.266 |

Supplementary Table 4. The MR analyses of neurological diseases and ER- breast cancer risk from MR Egger and weighted median methods.

| Neurological diseases | Used SNPs | MR Egger | | Weighted median | | $P_{\text{heterogeneity}}$ | $P_{\text{pleiotropy}}$ |
|---------------------------|-----------|--------------------|-----------------|--------------------|-----------------|----------------------------|-------------------------|
| | | OR(95% CI) | <i>P</i> -value | OR(95% CI) | <i>P</i> -value | | |
| Alzheimer's disease | 86 | 0.978(0.852-1.123) | 0.756 | 0.981(0.854-1.126) | 0.783 | 0.194 | 0.921 |
| Multiple sclerosis | 192 | 0.998(0.990-1.006) | 0.608 | 0.996(0.987-1.006) | 0.455 | 0.081 | 0.709 |
| Parkinson's disease | 26 | 1.013(0.890-1.153) | 0.848 | 1.033(0.963-1.108) | 0.361 | 0.285 | 0.939 |
| Myasthenia gravis | 8 | 1.020(0.980-1.062) | 0.372 | 1.013(0.983-1.044) | 0.406 | 0.212 | 0.558 |
| Generalized epilepsy | 12 | 1.029(0.961-1.101) | 0.432 | 1.018(0.967-1.071) | 0.499 | 0.089 | 0.858 |
| Intracerebral haemorrhage | 5 | 1.072(0.975-1.179) | 0.245 | 1.065(0.982-1.154) | 0.129 | 0.976 | 0.834 |
| Cerebral atherosclerosis | 7 | 1.006(0.991-1.020) | 0.487 | 1.003(0.988-1.017) | 0.714 | 0.796 | 0.561 |
| Brain glioblastoma | 8 | 0.992(0.971-1.014) | 0.493 | 0.999(0.982-1.017) | 0.936 | 0.569 | 0.330 |
| Benign meningeal tumor | 12 | 1.006(0.960-1.053) | 0.817 | 1.010(0.966-1.056) | 0.666 | 0.840 | 0.952 |