# Supplementary Appendix

Figure S1. Visual representation of the network after controlling for age, sex, educational levels, and occupation.



Note: GAD: The seven-item Generalized Anxiety Disorder Scale; PSQI: The Pittsburgh Sleep Quality Index

Figure S2. The stability of centrality and bridge centrality indices using case-dropping bootstrap.
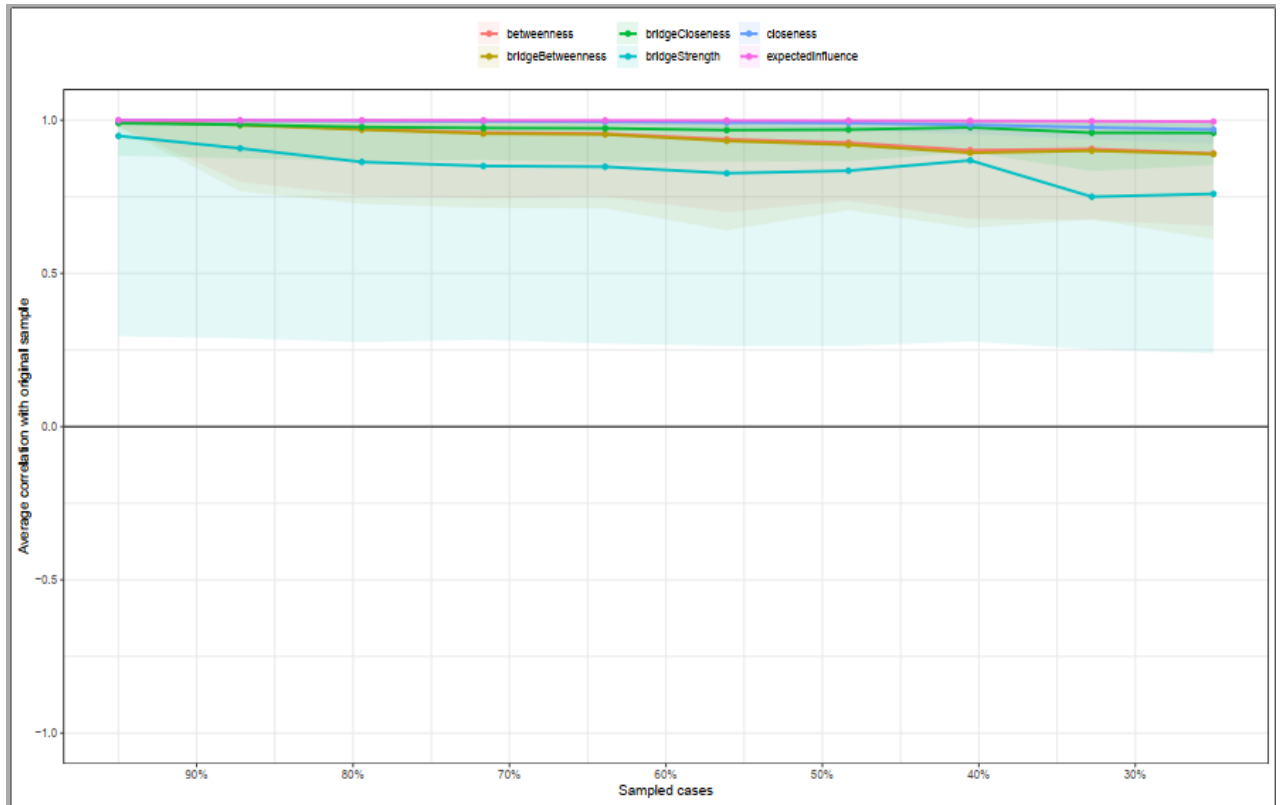
Figure S3. Bootstrapped range change of edge weights.
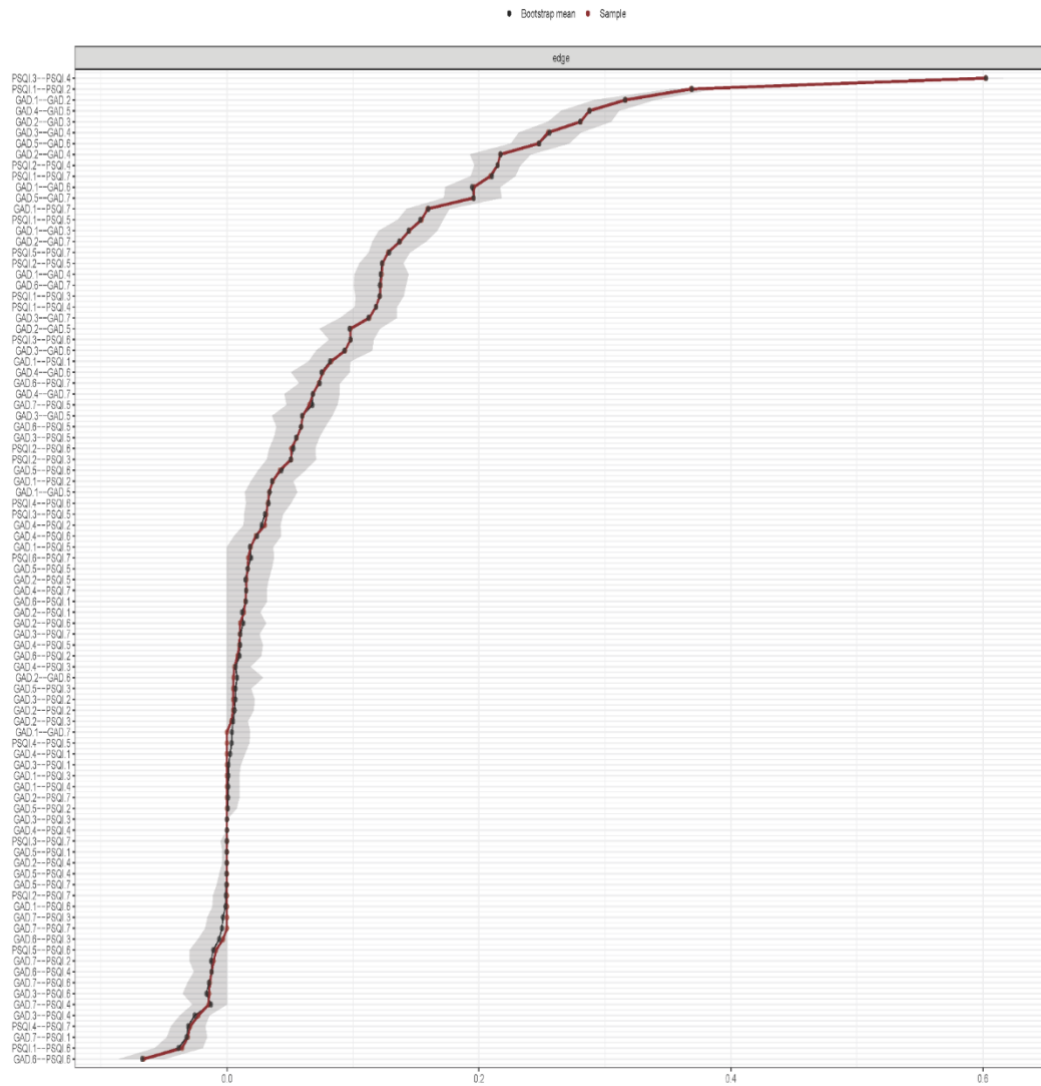
Figure S4. Estimation of edge weight difference by bootstrapped difference test.
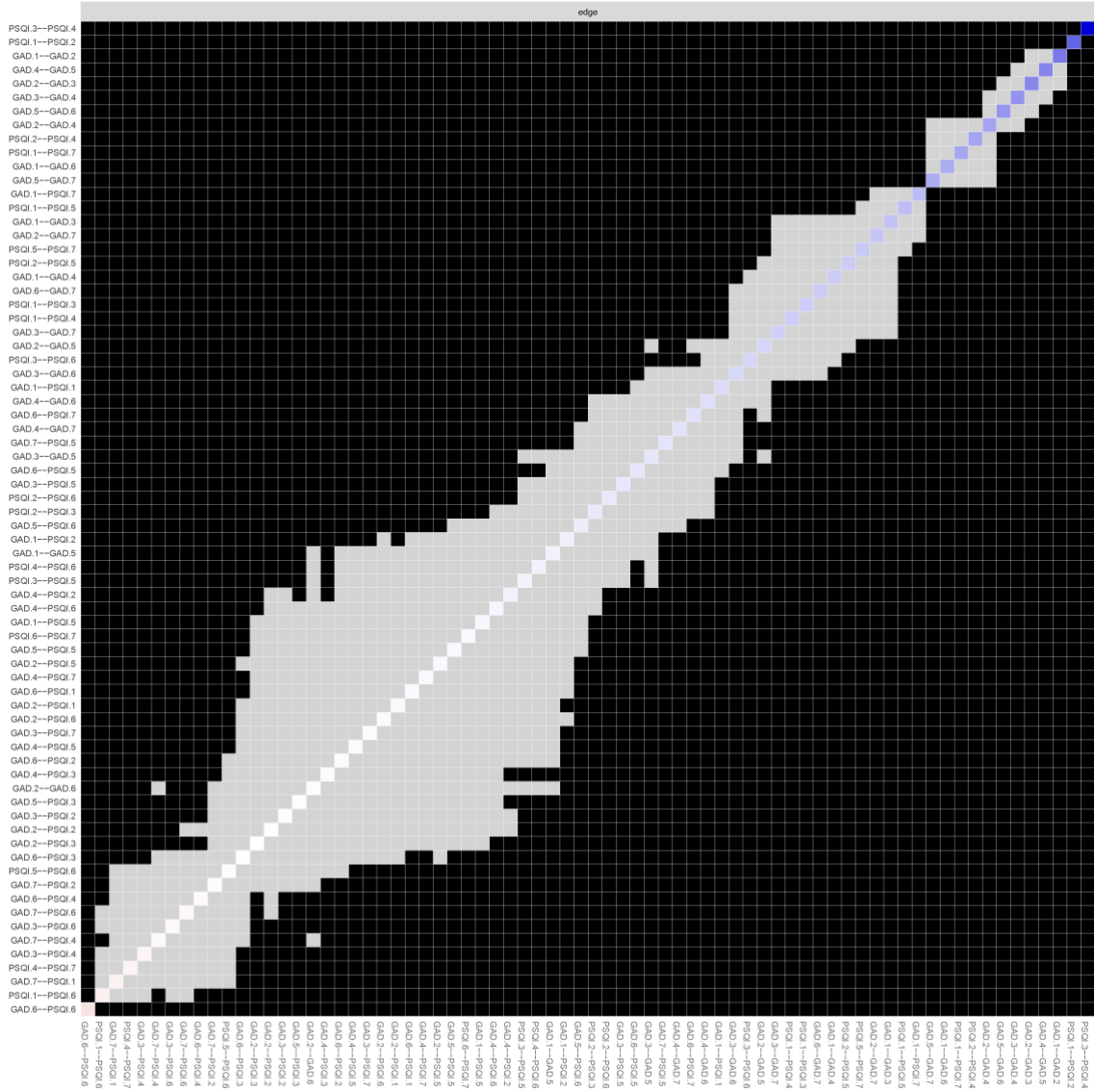
Figure S5. Network comparison of male (N=3,998) and female (N=7,171) participants.

Males (N=3,998).
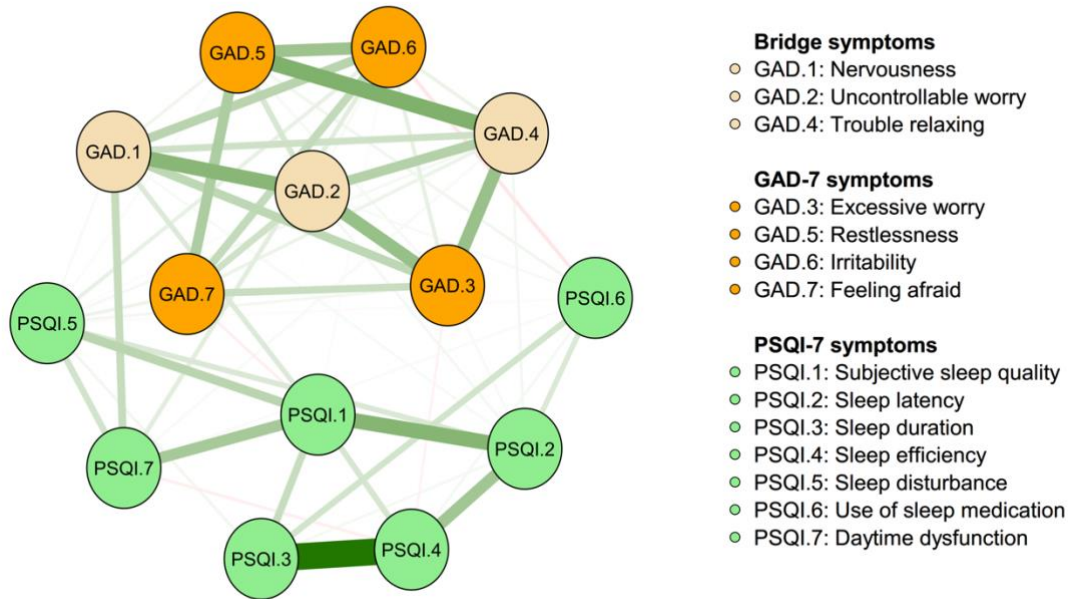


Females (N=7,171)
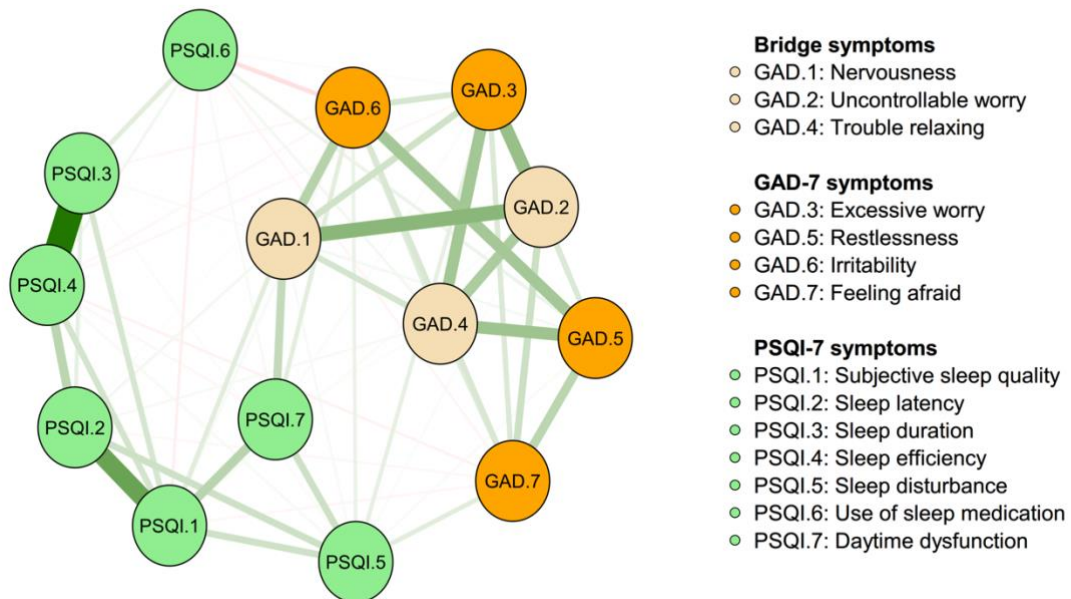


Note: GAD: The seven-item Generalized Anxiety Disorder Scale; PSQI: The Pittsburgh Sleep Quality Index

Figure S6. Comparison of network properties between females and males.
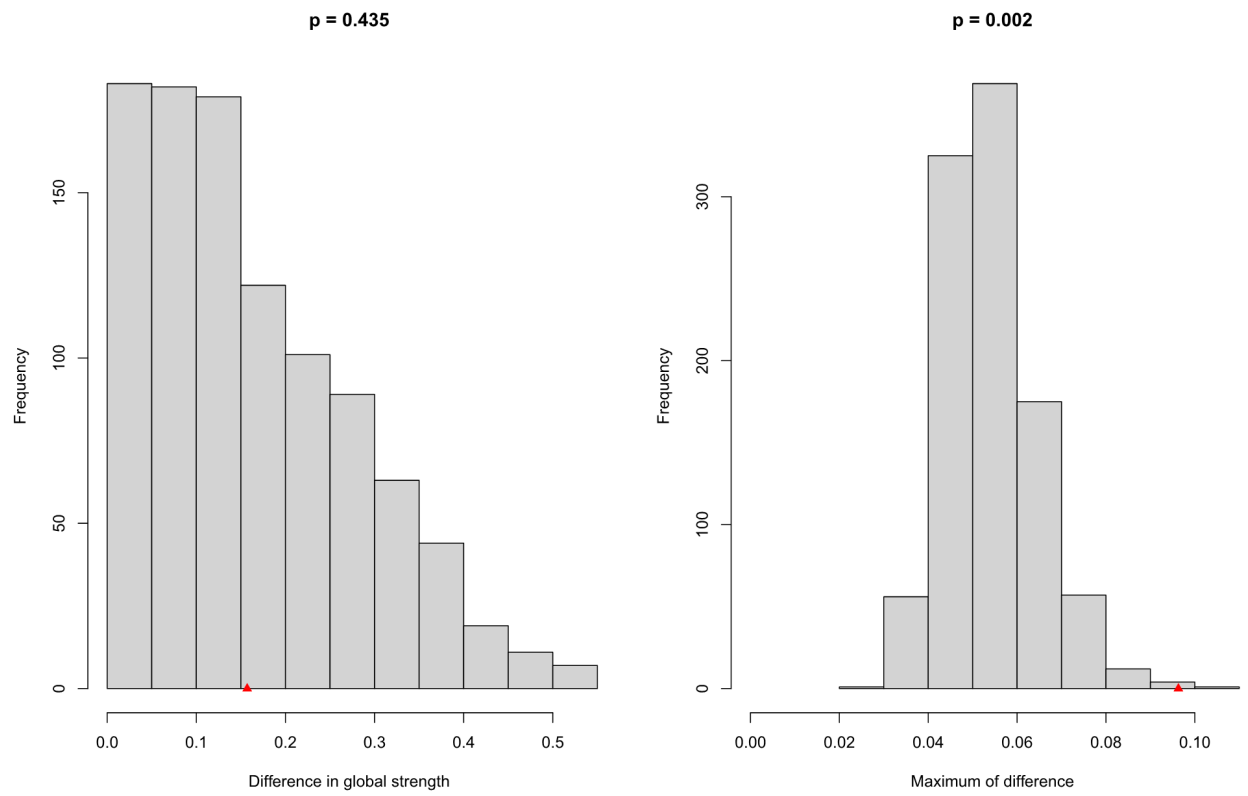
Figure S7. Network comparison of younger adults (N=7,385) and older adults (N=3,809).
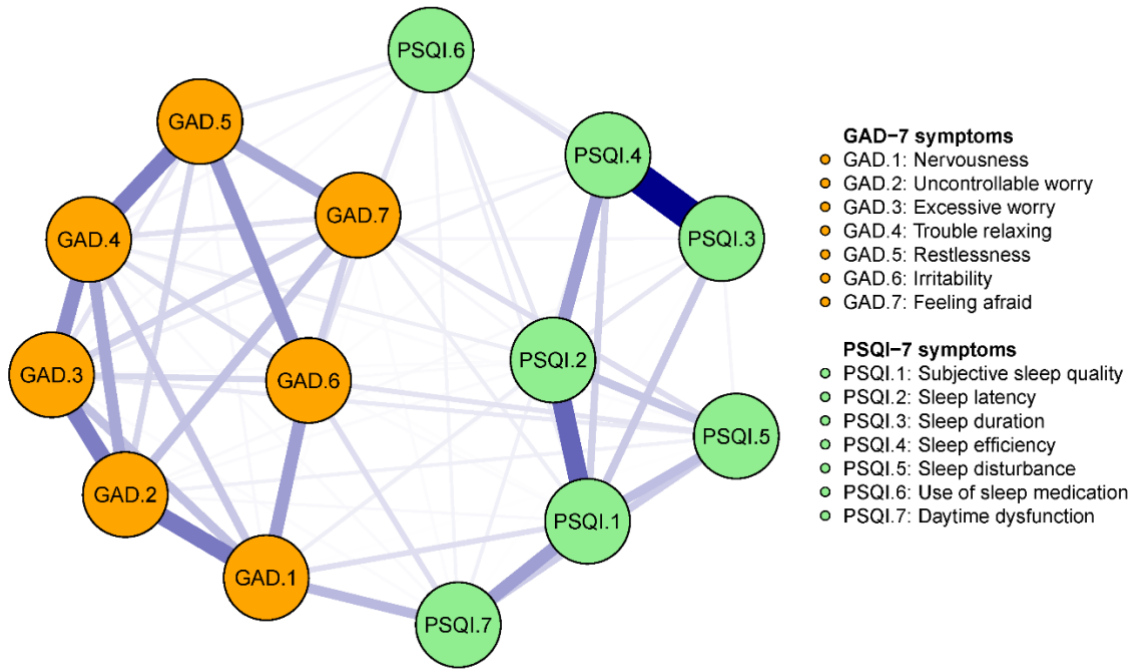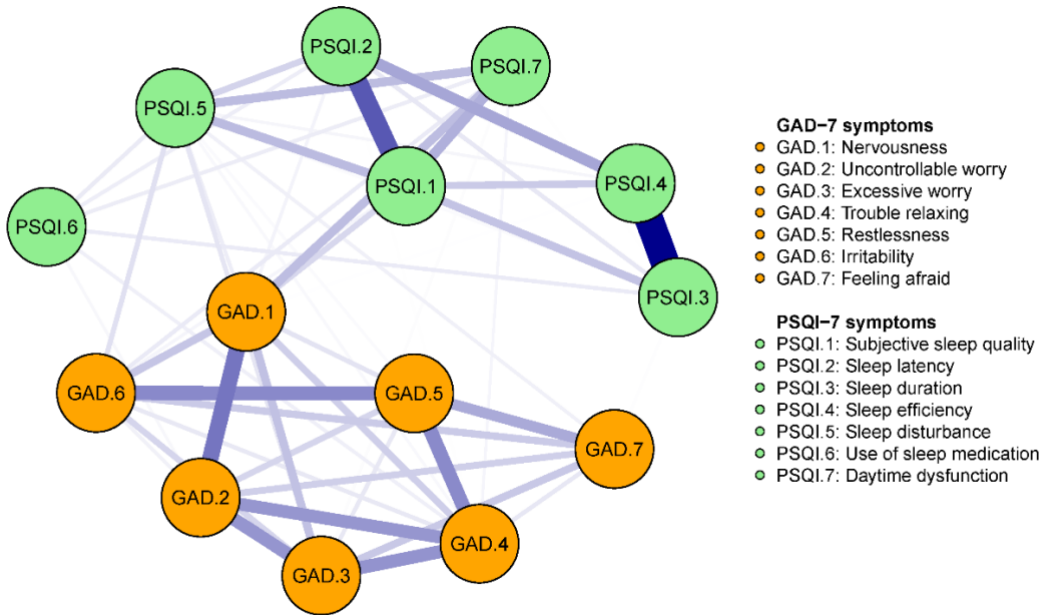


Note: GAD: The seven-item Generalized Anxiety Disorder Scale; PSQI: The Pittsburgh Sleep Quality Index

Figure S8. Comparison of network properties between younger adults (N=7,385) and older adults (N=3,809) groups.
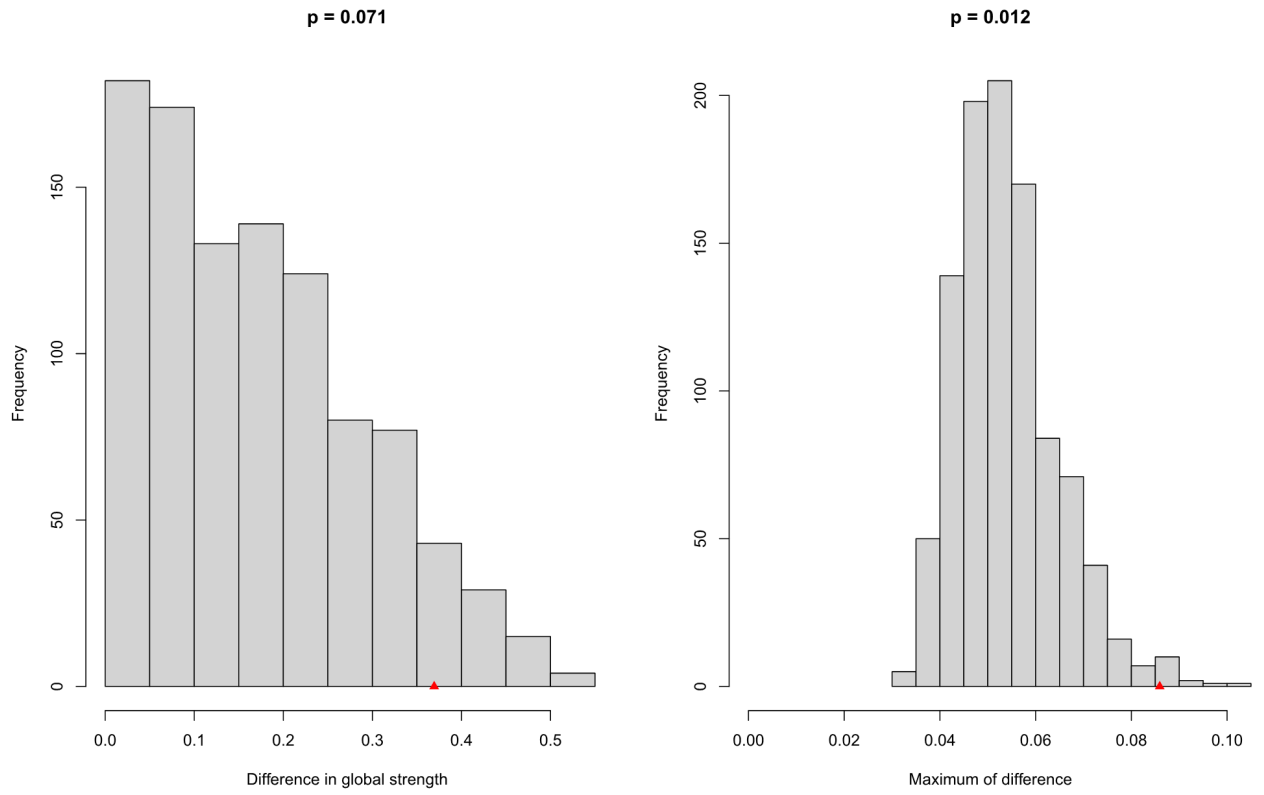
Figure S9. Comparison of network properties between above bachelor's level (N=3,620) and below bachelor's level (N=7,283) groups.
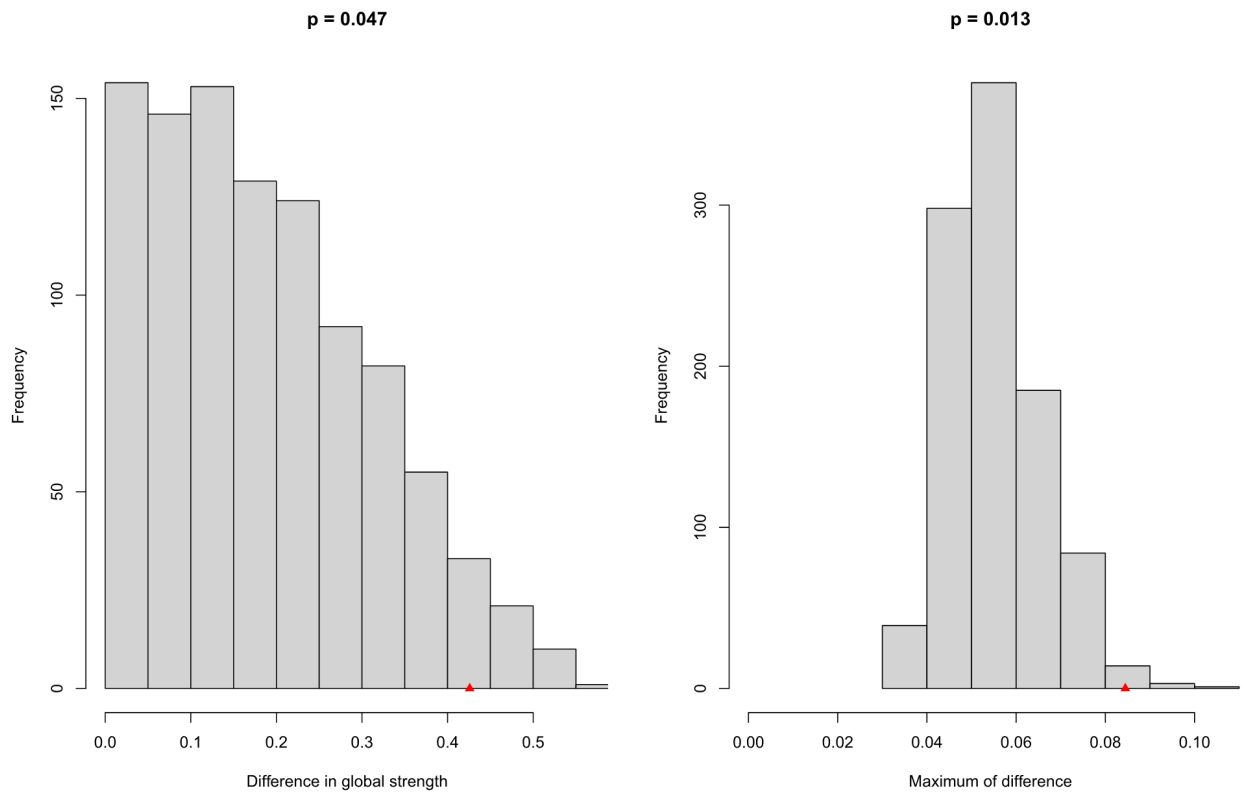
Table S1. Comparison of the expected influence index values of nodes in the network of anxiety and sleep problem (Unadjusted vs. Adjusted).

| Node | EI (Unadjusted) | EI (Adjusted) | Pearson correlation | T Value | 95% CIs | P Value |
|---|---|---|---|---|---|---|
| GAD.1 | 1.11 | 1.10 | | | | |
| GAD.2 | 1.10 | 0.98 | | | | |
| GAD.3 | 0.98 | 1.10 | | | | |
| GAD.4 | 1.11 | 0.94 | | | | |
| GAD.5 | 0.99 | 0.62 | | | | |
| GAD.6 | 0.81 | 0.57 | | | | |
| GAD.7 | 0.63 | 0.03 | 0.75 | 0.76 | (−0.15, 0.32) | 0.46 |
| PSQI.1 | 1.02 | 1.11 | | | | |
| PSQI.2 | 0.88 | 0.68 | | | | |
| PSQI.3 | 0.91 | 1.01 | | | | |
| PSQI.4 | 0.89 | 0.90 | | | | |
| PSQI.5 | 0.67 | 0.69 | | | | |
| PSQI.6 | 0.14 | 0.25 | | | | |
| PSQI.7 | 0.58 | 0.65 | | | | |

Note: GAD: The seven-item Generalized Anxiety Disorder Scale; PSQI: The Pittsburgh Sleep Quality Index; EI, expected influence index; CIs, confidence intervals.

Table S2. The partial correlation coefficient between nodes of the network structure of anxiety and sleep problems.

| | GAD.1 | GAD.2 | GAD.3 | GAD.4 | GAD.5 | GAD.6 | GAD.7 | PSQI.1 | PSQI.2 | PSQI.3 | PSQI.4 | PSQI.5 | PSQI.6 | PSQI.7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GAD.1 | 0.00 | 0.32 | 0.14 | 0.12 | 0.03 | 0.20 | 0.00 | 0.08 | 0.04 | 0.00 | 0.00 | 0.02 | 0.00 | 0.16 |
| GAD.2 | 0.32 | 0.00 | 0.28 | 0.22 | 0.10 | 0.01 | 0.14 | 0.01 | 0.00 | 0.00 | 0.00 | 0.02 | 0.01 | 0.00 |
| GAD.3 | 0.14 | 0.28 | 0.00 | 0.25 | 0.06 | 0.09 | 0.11 | 0.00 | 0.00 | 0.00 | -0.02 | 0.06 | -0.01 | 0.01 |
| GAD.4 | 0.12 | 0.22 | 0.25 | 0.00 | 0.29 | 0.08 | 0.07 | 0.00 | 0.03 | 0.01 | 0.00 | 0.01 | 0.02 | 0.02 |
| GAD.5 | 0.03 | 0.10 | 0.06 | 0.29 | 0.00 | 0.25 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.04 | 0.00 |
| GAD.6 | 0.20 | 0.01 | 0.09 | 0.08 | 0.25 | 0.00 | 0.12 | 0.01 | 0.01 | 0.00 | -0.01 | 0.06 | -0.07 | 0.07 |
| GAD.7 | 0.00 | 0.14 | 0.11 | 0.07 | 0.20 | 0.12 | 0.00 | -0.03 | -0.01 | 0.00 | -0.01 | 0.07 | -0.01 | 0.00 |
| PSQI.1 | 0.08 | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 | -0.03 | 0.00 | 0.37 | 0.12 | 0.12 | 0.15 | -0.04 | 0.21 |
| PSQI.2 | 0.04 | 0.00 | 0.00 | 0.03 | 0.00 | 0.01 | -0.01 | 0.37 | 0.00 | 0.05 | 0.21 | 0.12 | 0.05 | 0.00 |
| PSQI.3 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.12 | 0.05 | 0.00 | 0.60 | 0.03 | 0.10 | 0.00 |
| PSQI.4 | 0.00 | 0.00 | -0.02 | 0.00 | 0.00 | -0.01 | -0.01 | 0.12 | 0.21 | 0.60 | 0.00 | 0.00 | 0.03 | -0.03 |
| PSQI.5 | 0.02 | 0.02 | 0.06 | 0.01 | 0.02 | 0.06 | 0.07 | 0.15 | 0.12 | 0.03 | 0.00 | 0.00 | -0.01 | 0.13 |
| PSQI.6 | 0.00 | 0.01 | -0.01 | 0.02 | 0.04 | -0.07 | -0.01 | -0.04 | 0.05 | 0.10 | 0.03 | -0.01 | 0.00 | 0.02 |
| PSQI.7 | 0.16 | 0.00 | 0.01 | 0.02 | 0.00 | 0.07 | 0.00 | 0.21 | 0.00 | 0.00 | -0.03 | 0.13 | 0.02 | 0.00 |

Note: GAD: The seven-item Generalized Anxiety Disorder Scale; PSQI: The Pittsburgh Sleep Quality Index.

Table S3. The partial correlation coefficient between nodes of the adjusted network structure of anxiety and sleep problems.

| | GAD.1 | GAD.2 | GAD.3 | GAD.4 | GAD.5 | GAD.6 | GAD.7 | PSQI.1 | PSQI.2 | PSQI.3 | PSQI.4 | PSQI.5 | PSQI.6 | PSQI.7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GAD.1 | 0.00 | 0.32 | 0.15 | 0.11 | 0.03 | 0.19 | 0.00 | 0.07 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.17 |
| GAD.2 | 0.32 | 0.00 | 0.27 | 0.22 | 0.09 | 0.00 | 0.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| GAD.3 | 0.15 | 0.27 | 0.00 | 0.25 | 0.05 | 0.09 | 0.12 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 |
| GAD.4 | 0.11 | 0.22 | 0.25 | 0.00 | 0.30 | 0.07 | 0.07 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 |
| GAD.5 | 0.03 | 0.09 | 0.05 | 0.30 | 0.00 | 0.25 | 0.19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 |
| GAD.6 | 0.19 | 0.00 | 0.09 | 0.07 | 0.25 | 0.00 | 0.10 | 0.02 | 0.00 | 0.00 | 0.00 | 0.05 | 0.06 | 0.07 |
| GAD.7 | 0.00 | 0.13 | 0.12 | 0.07 | 0.19 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.07 | 0.00 | 0.00 |
| PSQI.1 | 0.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.38 | 0.11 | 0.11 | 0.15 | 0.03 | 0.20 |
| PSQI.2 | 0.02 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.38 | 0.00 | 0.05 | 0.20 | 0.13 | 0.03 | 0.00 |
| PSQI.3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.11 | 0.05 | 0.00 | 0.58 | 0.02 | 0.06 | 0.00 |
| PSQI.4 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.11 | 0.20 | 0.58 | 0.00 | 0.00 | 0.00 | 0.00 |
| PSQI.5 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 | 0.05 | 0.07 | 0.15 | 0.13 | 0.02 | 0.00 | 0.00 | 0.00 | 0.13 |
| PSQI.6 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.06 | 0.00 | 0.03 | 0.03 | 0.06 | 0.00 | 0.00 | 0.00 | 0.06 |
| PSQI.7 | 0.17 | 0.00 | 0.00 | 0.02 | 0.00 | 0.07 | 0.00 | 0.20 | 0.00 | 0.00 | 0.00 | 0.13 | 0.06 | 0.00 |

Note: GAD: The seven-item Generalized Anxiety Disorder Scale; PSQI: The Pittsburgh Sleep Quality Index.

Table S4. Significant difference tests for global strength and edge weights of network groups among sex, age, educational levels, and occupation.

| | | Global Strength | | Edge Weight | |
|---|---|---|---|---|---|
| | M Statistics | Test statistics | P value | Test statistics | P value |
| Sex | | | | | |
|   Male group | 6.31 | 0.16 | 0.435 | 0.10 | **< 0.01** |
|   Female group | 6.46 | | | | |
| Age | | | | | |
|   Older adult | 6.07 | 0.37 | 0.071 | 0.09 | **< 0.05** |
|   Younger adult | 6.44 | | | | |
| Educational levels | | | | | |
|   Above bachelor | 6.09 | 0.43 | 0.047 | 0.08 | **0.013** |
|   Below bachelor | 6.52 | | | | |
| Occupation | | | | | |
|   Employed | 6.58 | 0.10 | 0.902 | 0.09 | 0.135 |
|   Unemployed | 6.48 | | | | |

Table S5. The value of significant difference on partial correlation coefficient of edges weights in network structures of sex, age, educational level.

| | Sex | Age | Educational Levels |
|---|---|---|---|
| PSQI.1-PSQI.2 | -0.10*** | | |
| PSQI.2-PSQI.6 | 0.09*** | | |
| GAD.1-GAD.6 | | -0.09*** | |
| PSQI.5-PSQI.6 | | -0.05*** | |
| GAD.5-GAD.7 | | | 0.08*** |

Note: ***, P<0.001; GAD, Generalized Anxiety Disorders; PSQI, Pittsburgh Sleep Quality Index; Other associations between symptoms were not reported because of P value large than 0.001.