# Method

## Data analysis

We used R version 4.3.0 (R Core Team, 2023) for all our analyses. A multivariate analysis was conducted using a binary logistic regression model to assess the personality factors associated with insomnia classification. Prior to the analyses all continuous variables were mean centered to ease interpretation of results. Odds ratio (OR) and 95% confidence interval (95% CI) were reported for the model. For each independent variable we estimated an adjusted OR (aOR), resulting from the multivariate logistic regression. The multivariate model included age, sex, educational level (university/ no university), HADS Anxeity and Depression scores as covariates and the personality traits Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism as predictors of insomnia classification (no insomnia/ insomnia).

The sleep diary measures were analyzed with the baseline scores of 163 participants randomly assigned to any of the intervention groups. The measures of sleep–wake patterns were sleep efficiency (%), sleep onset latency (SOL; min), wake time after sleep onset (WASO; min), and total sleep time (min). We fitted Generalized mixed models (GMM) using the package glmmTMB version 1.1.7 (Brooks et al., 2017) with Gaussian (total sleep time), zero-inflated Gamma (WASO and SOL), and beta (sleep efficiency) distributions. To decide on the most appropriate family, we first generated density plots of the raw dependent variables and then, after selecting a candidate family, examined the QQ plot of residuals and residuals vs. fitted plot to verify homoscedasticity, normality of residuals, and influential cases. Model diagnostics were assessed with the DHARMa package version 0.4.6 (Hartig, 2022).

## Results

**Table 1.** Sample characteristics

|  | Sem insônia  (n = 237) | Com insônia  (n = 371) | *p* | Total  (n = 608) |
| --- | --- | --- | --- | --- |
| Idade, média (dp) | 36,64 (8,98) | 40,07 (11,27) | <0,001 | 38,73 (10,56) |
| Número de filhos, média (dp) | 0,61 (0,95) | 0,73 (0,98) | 0,162 | 0,68 (0,97) |
| Sexo masculino, n (%) | 34 (14.3) | 81 (21.8) | .028 | 115 (18.9) |
| Superior completo, n (%) | 214 (90.3) | 279 (75.2) | <.001 | 493 (81.1) |
| Etnia, n (%) |  |  | .274 |  |
| Asiática | 10 (4.2) | 14 (3.8) |  | 24 (3.9) |
| Branca | 180 (75.9) | 266 (71.7) |  | 446 (73.4) |
| Indígena | 1 (0.4) | 0 (0.0) |  | 1 (0.2) |
| Outros/Não-informado | 0 (0.0) | 3 (0.8) |  | 3 (0.5) |
| Preto ou pardo | 46 (19.4) | 88 (23.7) |  | 134 (22.0) |
| Estado civil (%) |  |  | .856 |  |
| Casado | 116 (49.0) | 184 (49.6) |  | 300 |
| Solteiro | 121 (51.0) | 187 (50.4) |  | 308 |
| Ocupação (%) |  |  | <.001 |  |
| Trabalha | 192 (81.0) | 258 (69.5) |  | 450 (74.0) |
| Não trabalha | 45 (19.0) | 113 (30.5) |  | 158 (26.0) |
| Região (%) |  |  | .504 |  |
| Centro-Oeste | 5 (2.1) | 16 (4.3) |  | 21 (3.5) |
| Estrangeiro | 1 (0.4) | 0 (0.0) |  | 1 (0.2) |
| Nordeste | 18 (7.6) | 30 (8.1) |  | 48 (7.9) |
| Norte | 6 (2.5) | 11 (3.0) |  | 17 (2.8) |
| Sudeste | 187 (78.9) | 289 (77.9) |  | 476 (78.3) |
| Sul | 20 (8.4) | 25 (6.7) |  | 45 (7.4) |

**Table 2.** Descriptive analysis of personality traits and insomnia severity and HADS subscales.

|  | Sem insônia  (n = 237) | Com insônia  (n = 371) | *p* | Total  (n = 608) |
| --- | --- | --- | --- | --- |
| Neuroticismo, média (dp) | 48.65 (12.30) | 58.96 (12.11) | <.001 | 54.94 (13.18) |
| Extroversão, média (dp) | 44.38 (11.21) | 42.27 (11.85) | .027 | 43.09 (11.64) |
| Abertura, média (dp) | 50.84 (9.41) | 47.26 (10.91) | <.001 | 48.66 (10.49) |
| Amabilidade, média (dp) | 52.61 (10.13) | 49.97 (11.12) | .003 | 51.00 (10.81) |
| Conscienciosidade, média (dp) | 51.81 (10.25) | 47.50 (11.80) | <.001 | 49.18 (11.41) |
| IGI | 1.78 (1.71) | 19.01 (4.78) | <.001 | 12.30 (9.26) |
| HADS - Depressão | 3.77 (3.17) | 9.07 (4.33) | <.001 | 7.00 (4.69) |
| HADS - Ansiedade | 5.03 (3.41) | 11.24 (4.35) | <.001 | 8.81 (5.03) |

**Table 3.** Sample characteristics of personality trait levels

|  | Sem insônia | | | | | | Com insônia | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Baixo | | Médio | | Alto | | Baixo | | Médio | | Alto | |
|  | N | % | N | % | N | % | N | % | N | % | N | % |
| Abertura | 56 | 23.6 | 97 | 40.9 | 84 | 35.4 | 151 | 40.7 | 125 | 33.7 | 95 | 25.6 |
| Amabilidade | 55 | 23.2 | 90 | 38.0 | 92 | 38.8 | 117 | 31.5 | 142 | 38.3 | 112 | 30.2 |
| Conscienciosidade | 57 | 24.1 | 80 | 33.8 | 100 | 42.2 | 140 | 37.7 | 118 | 31.8 | 113 | 30.5 |
| Extroversão | 119 | 50.2 | 80 | 33.8 | 38 | 16.0 | 211 | 56.9 | 114 | 30.7 | 46 | 12.4 |
| Neuroticismo | 96 | 40.5 | 64 | 27.0 | 77 | 32.5 | 49 | 13.2 | 93 | 25.1 | 229 | 61.7 |

**Primary outcome**

The model to predict insomnia classification with age, educational level, sex, anxiety, depression, Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism was statistically significant [𝜒² (10) = 339, *p* < .001] and explained approximately 42.4% of the variance (McFadden’s R²). The model's intercept, corresponding to an observation of 38.7 years, without a university degree, female, and with self-report scale scores at the mean, is at 1.68 (95% CI [0.89, 1.57], OR = 5.36 [2.80, 10.71], *p* < .001). We found that, holding all other predictor variables constant, the odds for insomnia classification increased by: 131% for males; 200% for people without a university degree; 6% for each additional year of age; and 3% for each reduced point on the Openness scale.

**Table 4.** Associated sociodemographic, personality and psychological factors of severe insomnia.

|  | aOR [95% CI] | *p* |
| --- | --- | --- |
| University degree [yes] | 0.35 [0.17, 0.69] | 0.003 |
| Age | 1.06 [1.03, 1.09] | <0.001 |
| Sex [male] | 2.31 [1.28, 4.25] | 0.006 |
| Depression | 1.17 [1.08, 1.27] | <0.001 |
| Anxiety | 1.37 [1.26, 1.49] | <0.001 |
| Neuroticism | 1.00 [0.98, 1.03] | 0.923 |
| Extraversion | 1.01 [0.98, 1.03] | 0.650 |
| Agreeableness | 1.00 [0.97, 1.02] | 0.850 |
| Conscientiousness | 1.00 [0.98, 1.03] | 0.709 |
| Openness | 0.97 [0.95, 0.99] | 0.009 |

**Sleep diary**

The analysis of the covariates showed that age was a significant predictor of WASO and total sleep time. Holding all other predictors constant, a one-year age increase leads to an increase of 0.02 minutes in wake time after sleep onset and a decrease of 1.58 minutes in total sleep time. We also found that being male leads to a relative change of 32% in sleep efficiency and a decrease of 0.42 minutes in sleep onset latency. A university degree was associated with a relative change of 41% in sleep efficiency and a 36.7 increase in total sleep time.

Regarding the personality traits, we found that holding the other predictors constant, a one-point increase in the standardized Extraversion score led to a relative change of 1% in sleep efficiency and a decrease of 0.02 minutes in WASO.

**Table 5.** Results from the regression models for sleep diary variables.

|  |  |  |  |
| --- | --- | --- | --- |
| Sleep diary measures | Estimate [95% CI] | SE | p-value |
| *Sleep efficiency (%)* |  |  |  |
| Intercept | -0.47 [-1.56, 0.62] | 0.55 | 0.40 |
| Age | 0.00 [-0.01, 0.01] | 0.00 | 0.88 |
| Sex [male] | 0.27 [0.04, 0.51] | 0.12 | 0.02 |
| University degree [yes] | 0.34 [0.11, 0.58] | 0.12 | 0.00 |
| Neuroticism | 0.00 [-0.01, 0.01] | 0.00 | 0.55 |
| Extraversion | 0.01 [0, 0.02] | 0.00 | 0.04 |
| Agreeableness | 0.01 [0, 0.02] | 0.00 | 0.06 |
| Conscientiousness | 0.00 [-0.01, 0.01] | 0.00 | 0.54 |
| Openness | 0.00 [-0.01, 0.01] | 0.00 | 0.61 |
| *Sleep onset latency (min)a* |  |  |  |
| Intercept | 5.08 [3.54, 6.62] | 0.79 | <0.001 |
| Age | -0.01 [-0.02, 0] | 0.00 | 0.17 |
| Sex [male] | -0.42 [-0.74, -0.11] | 0.16 | 0.01 |
| University degree [yes] | -0.32 [-0.64, 0] | 0.16 | 0.05 |
| Neuroticism | -0.01 [-0.02, 0.01] | 0.01 | 0.31 |
| Extraversion | 0.00 [-0.01, 0.01] | 0.01 | 0.78 |
| Agreeableness | 0.00 [-0.01, 0.01] | 0.01 | 0.72 |
| Conscientiousness | -0.01 [-0.02, 0] | 0.01 | 0.09 |
| Openness | 0.01 [0, 0.02] | 0.01 | 0.08 |
| *Wake time after sleep onset (min)a* | |  |  |
| Intercept | 3.83 [1.96, 5.69] | 0.95 | <0.001 |
| Age | 0.02 [0.01, 0.03] | 0.01 | <0.001 |
| Sex [male] | -0.27 [-0.62, 0.08] | 0.18 | 0.13 |
| University degree [yes] | -0.14 [-0.5, 0.23] | 0.19 | 0.46 |
| Neuroticism | 0.00 [-0.02, 0.01] | 0.01 | 0.84 |
| Extraversion | -0.02 [-0.04, -0.01] | 0.01 | 0.00 |
| Agreeableness | 0.00 [-0.02, 0.01] | 0.01 | 0.60 |
| Conscientiousness | 0.00 [-0.01, 0.01] | 0.01 | 0.99 |
| Openness | 0.00 [-0.01, 0.02] | 0.01 | 0.52 |
| *Total sleep time (min)* |  |  |  |
| Intercept | 301.74 [166.41, 437.08] | 69.05 | <0.001 |
| Age | -1.58 [-2.55, -0.62] | 0.49 | <0.001 |
| Sex [male] | -8.13 [-35.79, 19.53] | 14.11 | 0.56 |
| University degree [yes] | 36.7 [7.35, 66.04] | 14.97 | 0.01 |
| Neuroticism | 0.77 [-0.32, 1.85] | 0.55 | 0.17 |
| Extraversion | 0.89 [-0.2, 1.97] | 0.55 | 0.11 |
| Agreeableness | 0.33 [-0.8, 1.45] | 0.57 | 0.57 |
| Conscientiousness | 0.04 [-1.14, 1.21] | 0.60 | 0.95 |
| Openness | 0.48 [-0.55, 1.51] | 0.53 | 0.36 |

Note: aResults for the conditional models. None of the coefficients from Zero-inflation models were statistically significant.

**References**

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