Eveningness relates to burnout and seasonal sleep and mood problems among young adults

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Aims: Diurnal preference towards eveningness among adults has been associated with unhealthy habits and a range of health hazards, such as sleeping problems and higher odds for depression. We wanted to analyse whether diurnal preference towards eveningness is associated with more severe symptoms regarding sleep problems and mental disorders among young adults.

Methods: Our sample consists of 469 young adults, aged 18–29 years, from the Mental Health in Early Adulthood Study in Finland (MEAF) conducted in 2003–2005. Chronotype was based on the assessment of one question that was asked first in 2000–2001 and the second time in 2003–2005. Those 73 participants who changed their chronotype were excluded from the main analysis, but separate analyses were performed with this group.

Results: Concerning sleep, E-types reported higher dependency on alarm clocks (p < 0.001), and E-types and I-types had more problems in feeling refreshed after waking up (p < 0.0001 and p < 0.05 respectively) than M-types. Regarding mental health, E-types and I-types had lower odds for any lifetime DSM-IV Axis I disorder (p < 0.05 and p < 0.01 respectively) than M-types.

Conclusions: Our results are in line with previous findings that those with the diurnal preference towards eveningness have more frequently three or more lifetime mental disorders, more sleeping problems, more seasonal variation in mood and behaviour, and more burnout compared with those with the diurnal preference towards morningness.

• Circadian, DSM-IV Axis I disorder, Mid-point sleep, population, SAD, Structured interview, Survey.

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Humans can be classified as morning types (M-types), intermediate types (I-types) or evening types (E-types) based on the diurnal timing of their physiological functions and daily activities. Diurnal peak in physiological functions occur earlier in M-types and later in E-types, I-types having their peak-time later than M-types but earlier than E-types (1, 2). Earlier studies have revealed that diurnal preference of eveningness predisposes to various health hazards, from sleep problems to depression and hypertension, type 2 diabetes, bronchial asthma and spinal diseases (3–10). E-types have also unhealthier life habits, such as smoking (9, 11, 12), greater alcohol consumption (9, 11) and unhealthy diet (13).

Aims
Considering the accumulation of health problems for E-types and the fact that depression and sleep problems are often intertwined (14–16), we wanted to analyse whether diurnal preference towards eveningness is associated with more severe symptoms regarding sleep problems, seasonal variation in mood and behaviour, as well as feelings of hopelessness, anhedonia and burnout among young adults. Our sample consists of young adults (aged 18–29 years) from the Mental Health in Early Adulthood Study in Finland.

Methods
Participants
The Mental Health in Early Adulthood in Finland (MEAF) study was conducted as a follow-up study in 2003–2005 for young adults (aged 18–29 years) who had previously participated in the Health 2000 study. The Health 2000 Study, a national health examination survey in Finland, consisted of 1863 participants (aged 18–29 years) and
was conducted in 2000–2001. A demographic and health pre-examination questionnaire (questionnaire 1) was sent in the MEAF to those Health 2000 study participants who had not refused further contact (n = 1863), response rate being 70.6%. Those who returned the pre-examination questionnaire were invited to participate in a clinical examination held in the most convenient place for the participant, in which the mental health interview was conducted by nurses or psychologists, who were trained and supervised for its implementation, using the Research Version of the Structured Clinical Interview for DSM-IV-TR (SCID-I) (17). A second (post-examination) questionnaire was sent to participants that had participated in the clinical examination (n = 546). Our data consists of the MEAF participants that had information available regarding chronotype in both questionnaires 1 and 2 (n = 469, the total MEAF sample size being 475). Of our sample, chronotype information was available from 332 young adults that reported mental symptoms in the first questionnaire (83.8%) and 64 young adults that were negative in the mental screening (16.2%) (18). Supplementary Figure 1 to be found online at http://informahealthcare.com/doi/abs/10.3109/08039488.2015.1053519 presents the flow chart of MEAF study participants.

Assessment
Chronotype was assessed in both questionnaires with a single question “Do you consider yourself as a morning person or an evening person?” On a scale of 1–4, 1 = definitely a morning person (M-type); 2 = more a morning person than an evening person; 3 = more an evening person than a morning person; 4 = definitely an evening person (E-type). Answers two and three together referred to intermediate chronotype (I-type). After removing those that had changed chronotype between questionnaires, the chronotype assessment yielded 35 M-types, 258 I-types and 103 E-types. Cross-tabulation between questionnaires 1 and 2 is presented in Table 1. Altogether, 73 participants changed their chronotype in between questionnaires (37 towards eveningness and 36 towards morningness, see Table 1). None changed their chronotype drastically from E-type to M-type or vice versa.

Table 1. Crosstabulation of chronotype between questionnaires.

| Chronotype in questionnaire 1 | Chronotype in questionnaire 2 | M-types | I-types | E-types | Total |
|-------------------------------|-------------------------------|---------|---------|---------|-------|
| M-types                       |                               | 35      | 15      | 0       | 50    |
| %                             |                               | 70.0%   | 30.0%   | 0.0%    | 100.0%|
| I-types                       |                               | 13      | 258     | 22      | 293   |
| %                             |                               | 4.4%    | 88.1%   | 7.5%    | 100.0%|
| E-types                       |                               | 0       | 23      | 103     | 126   |
| %                             |                               | 0.0%    | 18.3%   | 81.7%   | 100.0%|
| Total                         |                               | 48      | 296     | 125     | 469   |
| %                             |                               | 10.2%   | 63.1%   | 26.7%   | 100.0%|

Sleeping problems were assessed in the second questionnaire by the following questions: 1) How fast do you generally fall asleep? (1 = less than 10 min; 2 = 10–20 min; 3 = 21–30 min; 4 = 31–40 min; 5 = over 40 min); 2) How fast do you feel refreshed after waking up? (1 = less than 10 min; 2 = 10–20 min; 3 = 21–30 min; 4 = 31–40 min; 5 = over 40 min); 3) How dependent are you on an alarm clock? (1 = not at all; 2 = have been during the last half a year; 3 = have been during the last year; 4 = totally dependent); 4) Do you feel that you are more tired compared to your friends or colleagues? (1 = no, I’m clearly more alert; 2 = no, I’m somewhat more alert, 3 = no, there is no difference; 4 = yes, I’m somewhat more tired; 5 = yes, I’m clearly more tired). The mid-point of sleep on non-working days was assessed as the clock time between going to sleep and awakening, corrected for sleep durations on working days and non-working days (19) to validate the chronotype assessment (Table 2).

Seasonal variation in mood and behaviour was assessed in questionnaire 1 by six items measuring changes in sleep duration, social activity, mood, weight, appetite and energy level. Each item was scored from 0–3 (none, slight, moderate or marked change), the sum score of 0–8 indicating no symptoms or mild symptoms, and the sum score of 9–18 indicating a seasonal variation in mood and behaviour (20).

The second questionnaire included the Hopelessness Scale (21), the Perceived Social Support Scale (22, 23), the Maslach Burnout Inventory (24) the Social Anhedonia Scale and the Physical Anhedonia Scale (25, 26).

The information on lifetime prevalence of any DSM-IV Axis I disorder was based on information from SCID-I interviews conducted by nurses and psychologists, and medical records from all outpatient and inpatient records.

Table 2. Difference in the mid-point of sleep on non-working days by chronotype.*

| Chronotype | B | Lower | Upper |
|------------|---|-------|-------|
| Model 1 (N = 380) |   |       |       |
| E-types     | 1.0 | 0.7   | 1.4*  |
| I-types     | 0.8 | 0.5   | 1.1*  |
| Model 2 (N = 380) |   |       |       |
| E-types     | 1.0 | 0.7   | 1.4*  |
| I-types     | 0.8 | 0.5   | 1.1*  |
| Model 3 (N = 279) |   |       |       |
| E-types     | 0.9 | 0.6   | 1.2*  |
| I-types     | 0.8 | 0.5   | 1.1*  |

*Model 1 crude (univariate); model 2 controlled for gender, age, mental health interview; model 3 controlled for gender, age, mental health interview, basic education level, professional education, marital status, employment, alcohol consumption, smoking, drugs, M-types as the reference category.

*p < 0.0001.
inpatient treatment contacts; diagnostic assessment was based on all available systematically evaluated information as described in more detail elsewhere (18). The most common DSM-IV Axis I disorder in 25–29-year-old participants was substance use or dependence, the second most common was anxiety disorder, and the third most common was a depressive disorder (18).

Statistics
Chi-square tests were used to judge the statistical significance of the differences in the distribution of sociodemographic, socio-economic and health-related characteristics between chronotypes (Table 3). Poisson regression analysis was used to estimate the beta values for tiredness and sleep problems (Table 4). Binary logistic regression analysis was used to estimate the odds ratios with 95% confidence limits (CLs) for seasonal variation in mood and behaviour between chronotypes as well as DSM-IV Axis I disorder (Table 5). Linear regression analysis was performed to estimate the association between chronotype and burnout, anhedonia, perceived social support, and feeling of hopelessness (Table 5). For all regression models the crude (univariate) association with chronotype was analysed, and second, the model was controlled for gender, age, and participation in the mental health interview. Finally, the models were controlled for gender, age, mental health interview, basic education level, professional education level, marital status, employment, alcohol consumption, smoking, and illicit drugs. In these analyses, M-type was a reference category. For a more specific description of the explanatory variables, see Table 3. Similar analyses were also performed for participants who had changed chronotype between questionnaires. Chronotype change towards morningness was a reference category. Furthermore, repeated measures analysis of variance was performed both for those who had changed chronotype from morningness towards mild eveningness and eveningness towards mild morningness regarding sleep length.

Ethics
The Health 2000 survey and the MEAF reassessment were approved by the Ethics Committee (Institutional Review Board) of the Hospital District of Helsinki and Uusimaa, Finland and conducted according to accepted international ethical standards. All the participants gave written informed consent.

Results
Sociodemographic, socioeconomic and health-related characteristics
The mid-point of sleep on non-working days was significantly later in E-types (on average at 03:54 h) compared with M-types (on average at 02:48 h) but similar to I-types (on average at 03:36 h) in all the models, indicating that the single question for chronotype assessment reflected the true diurnal preference of the participants and demarcated the extreme ends of the trait (Table 2). E-types slept either longer than 10 hours or less than 7 hours on working days significantly more often compared to other chronotypes. Similarly, E-types felt that they had a poorer quality of life compared to other chronotypes. E-types also felt that they had a poorer health status than other chronotypes. E-types also reported a higher usage of drugs than M-types, although this did not yield statistical significance between chronotypes. E-types also reported a need for longer sleep, and sleeping longer on weekends than other chronotypes, but these did not differ statistically between chronotypes (Table 3).

Those who had changed their chronotype towards eveningness were more professionally educated (97%) than those who had changed their chronotype towards morningness (65%, \( p < 0.001 \)). Those who had changed their chronotype towards eveningness also smoked less (58% never daily and 30% smoked daily more than a year) than those who had changed their chronotype towards morningness (29% never daily and 68% smoked daily more than a year, \( p < 0.01 \)). There were no significant differences between the groups regarding other sociodemographic, socio-economic or health-related characteristics.

Sleeping problems
E-types reported in all the models being significantly more dependent on the alarm clock compared to other chronotypes. In crude analysis, E-types reported significantly more problems in falling asleep and in feeling refreshed after waking up than other chronotypes. Interestingly, when gender, age and the mental health interview were added to the explanatory variables, E-types reported significantly less problems in feeling refreshed as compared with M-types. E-types also reported more daily tiredness than other chronotypes in the crude analysis and when the model was controlled for gender, age and the mental health interview (Table 4). Concerning other sleeping problems, there were no significant differences between those who had changed their chronotype from the first-wave survey to the second-wave survey. There were also no significant differences the questionnaires regarding sleep length between different questionnaires among those who had changed their chronotype towards morningness and neither among those who had changed their chronotype towards eveningness.

Mood
E-types reported more seasonal variation in mood and behaviour than other chronotypes in model 2 (controlled for gender and age), but no differences between
Table 3. Sociodemographic, socioeconomic and health characteristics by chronotype.

|                        | M-types (N = 35) | I-types (N = 258) | E-types (N = 103) |
|------------------------|------------------|-------------------|-------------------|
| Gender (%)             |                  |                   |                   |
| Men                    | 37.1             | 34.9              | 40.8              |
| Women                  | 62.9             | 65.1              | 59.2              |
| Age (years, mean ± SD) | 28.2 ± 3.5       | 27.6 ± 3.8        | 27.8 ± 3.6        |
| Marital status (%)     |                  |                   |                   |
| Married or co-habiting | 71.4             | 58.9              | 49.5              |
| Separated or unmarried | 28.6             | 41.1              | 50.5              |
| Basic education level (%) |              |                   |                   |
| Basic                  | 28.6             | 34.1              | 33.0              |
| Secondary              | 71.4             | 65.9              | 67.0              |
| Professional education (%) |            |                   |                   |
| Professional education | 84.8             | 77.8              | 70.7              |
| No professional education | 15.2         | 22.2              | 29.3              |
| Employment (%)         |                  |                   |                   |
| Working or studying    | 88.6             | 83.4              | 83.3              |
| Civilian service or managing household | 5.7 | 9.5 | 4.9 |
| Unemployed or disability pension | 5.7 | 7.1 | 11.8 |
| Smoking (%)            |                  |                   |                   |
| Smoked daily more than a year | 57.1 & 56.8 & 66.7 |                  |                   |
| Smoked daily less than a year | 10.7 & 10.7 & 4.3  |                  |                   |
| Never daily            | 32.1             | 32.5              | 29.0              |
| Alcohol consumption (%)|                  |                   |                   |
| Never used alcohol     | 5.7              | 5.4               | 2.9               |
| About once in two months or less | 22.9 & 23.6 & 15.5  |                  |                   |
| About once or twice a month | 31.4 & 34.1 & 33.0 |                  |                   |
| 1–3 times a week       | 34.3             | 34.9              | 45.6              |
| 4–7 times a week       | 5.7              | 1.9               | 2.9               |
| Illicit drugs (%)      |                  |                   |                   |
| Never used             | 80.0             | 72.3              | 62.5              |
| Used once or more      | 20.0             | 27.7              | 37.5              |
| Health status (%)*     |                  |                   |                   |
| Good                   | 57.1             | 37.2              | 36.9              |
| Quite good             | 34.3             | 43.0              | 35.0              |
| Average                | 5.7              | 17.1              | 20.4              |
| Quite bad or bad       | 2.9              | 2.7               | 7.8               |
| Bad                    | 0                | 0                 | 0                 |
| Quality of life (%)**  |                  |                   |                   |
| Very good              | 31.4             | 17.4              | 16.5              |
| Good                   | 62.9             | 63.2              | 55.3              |
| Average                | 5.7              | 19.0              | 21.4              |
| Bad                    | 0                | 0.4               | 5.8               |
| Very bad               | 0                | 0                 | 1.0               |
| Habitual sleep duration (%) |         |                   |                   |
| 3–4 h                  | 0                | 0                 | 0                 |
| 5–6.5 h                | 10.8             | 9.3               | 20.6              |
| 7–8 h                  | 67.6             | 69.3              | 47.1              |
| 8.5–9 h                | 16.7             | 18.3              | 26.5              |
| 10–12 h                | 4.9              | 3.1               | 5.9               |
| Sleep duration on weekends (%) |     |                   |                   |
| 6–< 7 h                | 2.9              | 0.8               | 1.0               |
| 7–8 h                  | 34.3             | 17.5              | 21.6              |
| > 8–9.5 h              | 45.7             | 51.4              | 45.1              |
| 10–11 h                | 17.1             | 25.7              | 23.5              |
| >11 h                  | 0                | 4.7               | 8.8               |

(Continued)
chronotypes were seen in crude analysis or in full model. However, E-types had lower odds than M-types for any lifetime DSM-IV Axis I disorder in the full model, but not in crude analysis or in model 2 (Table 5). One or two lifetime DSM-IV Axis I disorders were significantly more frequent among M-types than I-types and similar to E-types, while three or more lifetime DSM-IV Axis I disorders were more (but not significantly more) frequent among E-types than M-types (Table 3). E-types had also burnout more frequently than other chronotypes in both crude analysis and model 2 (Table 5). No significant differences between chronotypes were found regarding the Hopelessness scores, the Perceived Social Support scores, or the Social and Physical anhedonia scores (Table 5).

Those who had changed their chronotype towards evenness had higher odds in the Perceived Social Support scale in model 3 than those who had changed their chronotype towards morningness (B = 5.0, p < 0.05). Those who had changed their chronotype towards eveningness also reported less burnout than those who had changed their chronotype towards morningness in model 3, but this was in the border of a significant difference (B = −0.5, p = 0.05).

**Conclusion**
Our key findings were that E-types had more sleeping problems, seasonal variation in mood and behaviour, and burnout as compared with M-types. Even though E-types had lower odds for any lifetime DSM-IV Axis I disorder than M-types, three or more lifetime DSM-IV Axis I disorders were the most frequent among E-types.

E-types complained of daily tiredness more than M-types, which could reflect E-types not getting enough sleep to feel refreshed. This is supported by our finding of E-types sleeping less during working days and having problems of falling asleep or of feeling refreshed after waking up. Earlier studies suggest that E-types have shorter sleep durations during working days (19, 27) and are generally more unsatisfied with their sleep duration than the other chronotypes (6). E-types also reported being more dependent on the alarm clock than M-types, which indicates that E-types need to wake up earlier than their natural circadian sleep–wakefulness cycle would dictate. Both sleeping less and sleeping more than 7 to 8 h per night have been associated with the increased morbidity and mortality (7, 28, 29). It is thus not surprising that in our study E-types complained more often of poorer health status and a poorer quality of life as compared with M-types.

Concerning mental disorders, E-types had more seasonal variation in mood and behaviour as well as burnout than M-types. This result is in line with a previous study reporting that evening chronotype is associated with psychological distress among young adults (30), but contradicts another study concerning young adults regarding
**Table 4. Poisson regression, beta-values (95% confidence limits) by chronotype.**

| Chronotype                        | B     | Lower  | Upper  |
|-----------------------------------|-------|--------|--------|
| Daily tiredness                   |       |        |        |
| Model 1 (N = 395)                 |       |        |        |
| Evening types                     | 0.3   | 0.03   | 0.5    |
| Intermediate types                | 0.2   | −0.07  | 0.4    |
| Model 2 (N = 395)                 |       |        |        |
| Evening types                     | 0.3   | 0.03   | 0.5    |
| Intermediate types                | 0.2   | −0.07  | 0.4    |
| Model 3 (N = 288)                 |       |        |        |
| Evening types                     | 0.2   | −0.03  | 0.5    |
| Intermediate types                | 0.1   | −0.1   | 0.3    |
| How fast do you fall asleep?      |       |        |        |
| Model 1 (N = 395)                 |       |        |        |
| Evening types                     | 0.4   | 0.1    | 0.7    |
| Intermediate types                | 0.2   | −0.1   | 0.5    |
| Model 2 (N = 395)                 |       |        |        |
| Evening types                     | −0.02 | −0.4   | 0.01   |
| Intermediate types                | −0.06 | −0.2   | 0.1    |
| Model 3 (N = 289)                 |       |        |        |
| Evening types                     | −0.04 | −0.4   | 0.04   |
| Intermediate types                | −0.2  | −0.3   | 0.2    |
| How fast do feel refreshed        |       |        |        |
| after waking up                   |       |        |        |
| Model 1 (N = 396)                 |       |        |        |
| Evening types                     | 0.4   | 0.2    | 0.7    |
| Intermediate types                | 0.4   | 0.2    | 0.7    |
| Model 2 (N = 396)                 |       |        |        |
| Evening types                     | −0.5  | −0.7   | −0.3   |
| Intermediate types                | −0.3  | −0.4   | −0.06  |
| Model 3 (N = 289)                 |       |        |        |
| Evening types                     | −0.5  | −0.7   | −0.3   |
| Intermediate types                | −0.2  | −0.4   | −0.04  |
| Dependent on alarm clock          |       |        |        |
| Model 1 (N = 396)                 |       |        |        |
| Evening types                     | 0.4   | 0.2    | 0.7    |
| Intermediate types                | 0.3   | 0.05   | 0.5    |
| Model 2 (N = 396)                 |       |        |        |
| Evening types                     | 0.4   | 0.2    | 0.7    |
| Intermediate types                | 0.3   | 0.05   | 0.5    |
| Model 3 (N = 289)                 |       |        |        |
| Evening types                     | 0.4   | 0.1    | 0.6    |
| Intermediate types                | 0.2   | −0.05  | 0.5    |

*Model 1 crude (univariate); model 2 controlled for gender, age, mental screening; model 3 controlled for gender, age, mental health interview, basic education level, professional education, marital status, employment, alcohol consumption, smoking, drugs. M-types as the reference category.

\[ p<0.05; \quad **p<0.01; \quad ***p<0.001; \quad ****p<0.0001 \]

association between eveningness and SAD (31). Earlier, in a population-based health examination study of adults aged 25 to 79 years, we also found that depressive symptoms were more common among E-types than among other chronotypes (8). Both eveningness and SAD have also been found to be more common among women than among men (6, 32). Higher odds for burnout and seasonal variation in mood and behaviour in E-types could also reflect that eveningness is related to a higher risk for depression than morningness. Earlier, in another population-based health examination study of adults aged 30 years or over, both burnout and seasonal variation in mood and behaviour have been associated with depressive disorders and depressive symptoms (33, 34).

Those who had changed their chronotype towards eveningness reported higher social support and less burnout than those who had changed their chronotype towards morningness. It is possible that the previous tendency towards morningness protects from mental issues. Alternatively, a switch from M-type to mild tendency towards eveningness could have a positive effect on social performance. As most of those who had changed their chronotype towards eveningness had switched from M-type to I-type, this group shows more of a milder form of eveningness than those that have changed from I-type to E-type or E-type to I-type. Milder tendency towards eveningness has been associated with better social life and less depressive symptoms among adolescents (35).

A limitation of our study is that the assessment of chronotype was based on a single question. However, the assessment of the mid-point of sleep on non-working days supported that the assessment reflected the individual diurnal preference, so that those who had been assessed as E-types with the single question had significantly later clock times for the mid-point of sleep as compared with M-types. Using the sleep mid-point as a chronotype assessment is still a relatively new method and the correlation with the morningness-eveningness questionnaire (MEQ) is weakened when sleep deprivation, gender and age are considered. Thus the sleep mid-point might not be as sensitive in detecting E-types as the 6- or 19-item MEQ (36). There are also no corrections for multiple testing in our analysis.

In conclusion, our findings support earlier results considering E-types, as we found that those with a diurnal preference towards eveningness reported more sleeping problems, seasonal variation in mood and behaviour, and burnout as compared with those with the diurnal preference towards morningness. There is still no clear answer whether the association between eveningness and sleep problems and depression is purely biological or if it is related to a problem of synchronization between biological and social rhythms. Yet, most likely those E-types that are restricted to functioning in a circadian rhythm more suitable for M-types for extended periods will eventually face disruption of circadian system that predisposes to health issues. Assessment of chronotype is beneficial for early detection and prevention of mental and sleep problems as the preference towards eveningness is related to higher risk for these health problems.
**Table 5. Mental health by chronotype.**

**Binary logistic regression analysis**

| Chronotype                        | Odds ratio | 95% confidence limit |
|-----------------------------------|------------|----------------------|
| **Seasonal variation in mood and behaviour** |            |                      |
| Model 1 (N = 391, No N = 290, Yes N = 101) |            |                      |
| Evening-types                     | 2.7        | 1.0                  | 7.7 |
| Intermediate-types                | 2.0        | 0.8                  | 5.4 |
| Model 2 (N = 391, No N = 290, Yes N = 101) |            |                      |
| Evening-types                     | 3.2        | 1.1                  | 9.4*|
| Intermediate-types                | 2.1        | 0.8                  | 5.9 |
| Model 3 (N = 287, No N = 209, Yes N = 78) |            |                      |
| Evening-types                     | 2.2        | 0.6                  | 7.8 |
| Intermediate-types                | 2.1        | 0.6                  | 7.0 |
| **DSM-IV Axis I disorder**        |            |                      |
| Model 1 (N = 396, No N = 219, Yes N = 177) |            |                      |
| Evening-types                     | 0.5        | 0.2                  | 1.1 |
| Intermediate-types                | 0.4        | 0.2                  | 0.9*|
| Model 2 (N = 396, No N = 219, Yes N = 177) |            |                      |
| Evening-types                     | 0.5        | 0.2                  | 1.3 |
| Intermediate-types                | 0.4        | 0.2                  | 1.0*|
| Model 3 (N = 350, No N = 202, Yes N = 148) |            |                      |
| Evening-types                     | 0.4        | 0.2                  | 1.0*|
| Intermediate-types                | 0.3        | 0.1                  | 0.7**|

**Linear regression**

| Chronotype                        | B          | 95% confidence limit |
|-----------------------------------|------------|----------------------|
| **Burnout**                       |            |                      |
| Model 1 (N = 380)                 |            |                      |
| Evening-types                     | 0.4        | 0.07                 | 0.8* |
| Intermediate-types                | 0.4        | 0.01                 | 0.7* |
| Model 2 (N = 380)                 |            |                      |
| Evening-types                     | 0.4        | 0.07                 | 0.8* |
| Intermediate-types                | 0.4        | 0.01                 | 0.7* |
| Model 3 (N = 279)                 |            |                      |
| Evening-types                     | 0.2        | −0.2                 | 0.6  |
| Intermediate-types                | 0.2        | −0.2                 | 0.6  |
| **Social anhedonia**              |            |                      |
| Model 1 (N = 396)                 |            |                      |
| Evening-types                     | 0.1        | −2.0                 | 2.3  |
| Intermediate-types                | −0.7       | −2.6                 | 1.3  |
| Model 2 (N = 396)                 |            |                      |
| Evening-types                     | 0.1        | −2.0                 | 2.3  |
| Intermediate-types                | −0.7       | −2.6                 | 1.3  |
| Model 3 (N = 289)                 |            |                      |
| Evening-types                     | −0.4       | −2.6                 | 1.7  |
| Intermediate-types                | −1.3       | −3.3                 | 0.7  |
| **Physical anhedonia**            |            |                      |
| Model 1 (N = 396)                 |            |                      |
| Evening-types                     | 0.06       | −2.5                 | 2.6  |
| Intermediate-types                | −1.1       | −3.5                 | 1.2  |
| Model 2 (N = 396)                 |            |                      |
| Evening-types                     | 0.06       | −2.5                 | 2.6  |
| Intermediate-types                | −1.1       | −3.5                 | 1.2  |

*(Continued)*
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Table 5. (Continued)

| Chronotype            | Model 1 (N = 396) | Model 2 (N = 395) | Model 3 (N = 288) |
|-----------------------|-------------------|-------------------|-------------------|
|                       | Odds ratio        | Lower             | Upper             |
| Evening-types         | −0.4              | −3.9              | 3.0               |
| Intermediate-types    | −1.6              | −4.7              | 1.6               |
| Evening-types         | −0.6              | −2.7              | 0.5               |
| Intermediate-types    | −0.8              | −1.8              | 0.2               |

*Model 1 crude (univariate); model 2 controlled for gender, age, mental screening; model 3 controlled for gender, age, mental health interview, basic education level, professional education, marital status, living arrangement, employment, alcohol consumption, smoking, drugs. M-types as the reference category.

*p < 0.05; **p < 0.01; ***p < 0.001; ****p < 0.0001.

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Supplementary material available online
Supplementary Figure 1.