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Original Article

Personality differences in patients with delayed sleep–wake phase disorder and non-24-h sleep–wake rhythm disorder relative to healthy sleepers

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ABSTRACT

Objective/Background: Delayed sleep–wake phase disorder (DSWPD) is associated with a delayed timing of circadian rhythms, and this delay is suggested to be the basis of the disorder. However, this has been questioned due to frequent relapses following treatment based on this aetiology. Recent studies have emerged suggesting personality factors may contribute to sleep patterns in DSWPD. The aim of this study was to further investigate circadian and personality factors in DSWPD patients as well as patients with non-24-h sleep–wake rhythm disorder (N24SWD) relative to control sleepers.
Patients/Methods: This sample consisted of 16 DSWPD (age = 21.1 ± 2.8, 10 m, 7 f), and three N24SWD patients (age = 24.0 ± 4.4, 2 m, 1 f). Controls were seven males and seven females (age = 23.4 ± 5.9). Before starting an 80-h modified constant routine, eligible participants' sleep patterns were monitored for a week and they completed a personality questionnaire (NEO PI–R). An ultradian routine with alternating 20-min sleep opportunities and 40 min of enforced wakefulness was used to measure the timing of endogenous circadian temperature and melatonin rhythms.
Results: As compared with controls, DSWPD patients reported higher neuroticism, significantly lower extraversion, conscientiousness and agreeableness. Similarly, N24SWD patients' patterns of personality traits were similar to that of DSWPD. Conscientiousness, in particular, was associated with phase timings of circadian rhythms as well as sleep measures and lifestyle factors within the DSWPD group.
Conclusions: These findings suggest that circadian rhythm sleep–wake disorders (CRSWDs) may not only stem from circadian abnormalities but personality factors may also drive lifestyle choices, including sleep timing.

Delayed sleep–wake phase disorder (DSWPD) is defined as an abnormally late sleep period (eg, 3:00 am to 12:00 pm) compared with conventional or socially desirable times [1–3]. The delay in patients' major sleep period is presumably caused by a delay in patients' circadian rhythms [4,5] and typically associated with significant morbidity [1,2,6,7]. Non-24-h sleep–wake rhythm disorder (N24SWD) is characterized by successively delayed sleep patterns analogous to those observed in 'free-running' experiments where patients are isolated from time cues [8,9]. During phases when the circadian system is misaligned relative to the natural light/dark cycle, N24SWD patients experience night-time insomnia and daytime sleepiness. Although DSWPD and N24SWD are separate disorders, both are classified as circadian rhythm sleep–wake disorders (CRSWDs) and associated with difficulty in stabilizing sleep periods to socially conventional times; attempts to do so often fail [5–7,10–13]. Evidence suggests that lifestyle and psychosocial factors may cause, be a result of, or exacerbate the conditions, thus making them difficult to treat [10,11,14–16].

Incidence of personality disorders or other psychiatric ailments in CRSWDs patients could influence social cues in lifestyles [17]. The empirical literature suggests that personality aspects and psychosocial conditions are related to and can influence sleep timing [18], and be a cause of CRSWD, although the relationships are complex [19]. Personality traits underwrite attitudes, habits and emotive tendencies that affect individuals' lifestyles. They are likely to influence behaviours such as daytime activities, organizational ability and choice of sleep times. Much like light [20], social cues

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can contribute to either entraining or perpetuating circadian misalignment as secondary zeitgebers or entraining cues [21,22]. It is important to examine psychosocial and personality factors related to the aetiology of CRSWDs because the exact processes underlying circadian disruption and the interaction with personalities and psychiatric vulnerability are poorly understood.

The Revised NEO Personality Inventory (NEO PI-R) is one holistic approach to assess human psychosocial domains and entails the use of the five-factor model [23,24]. The first and only study to assess the five personality factors in DSWPD patients showed elevated scores on neuroticism, yet low on conscientiousness and extraversion compared with healthy controls [16]. Studies investigating diurnal preferences (chronotypes: eveningness/morningness) and personality similarly reveal positive associations among early bedtimes, conscientiousness and agreeableness, while later bedtimes relate to less extraversion and greater neuroticism [25–28]. These findings are consistent and seem applicable to DSWPD patients who typically exhibit evening-type preferences.

Personality data are not available for N24SWD patients, yet the empirical literature suggests that the prevalence rates of psychological disorders, such as depression and personality disorders [17], are elevated in these patients. Hayakawa et al. [8] suggest that 28% of sighted N24SWD patients report psychiatric complaints, thus highlighting the importance of assessing differences in psychosocial and personality dimensions in N24SWD patients.

The present paper has noteworthy a priori strengths to investigate the psychological profile of N24SWD patients. These patients tend to be rare in both literature and clinical settings. However, they do present clinically and practitioners could benefit from a better understanding of the aetiology. In addition, this is the first study to associate circadian phase and period length (ie, the time taken to complete one full circadian cycle or *tau*) with the big five personality factors in normal sleeping individuals as well as DSWPD and N24SWD patients. Outcomes of the investigation may support the use of supplementary therapies for better treatment outcomes in patients.

The objective of this study was to examine differences in personality factors among DSWPD, N24SWD patients and normal sleepers. Furthermore, we aimed to investigate whether personality traits are associated with lifestyles, psychosocial factors and sleep characteristics within the DSWPD group. This will help to inform CRSWD diagnosis and augment more effective long-term treatment programmes. In line with the findings of Wilhelmsen-Langeland et al. [16], it was hypothesized that DSWPD patients will indicate significantly higher scores on neuroticism, as well as significantly lower conscientiousness and extraversion compared with healthy control sleepers. As N24SWD stems from a circadian misalignment, it was predicted that N24SWD patients will also report similar personality differences.

1. Methods

Comprehensive details of the methodology applied in this study have been previously published (Micic et al., unpublished observation) and will be briefly summarized here.

1.1. Participants

Thirty-three patients and healthy sleepers participated in this study. They were selected from the community via advertisements placed on public noticeboards and from the three major universities of South Australia. There were 16 DSWPDs comprising 10 males (62.5%) and six females (37.5%) aged 18–29 years. Controls consisted of seven males (50%) and seven females (50%) aged 18–37 years. An additional third study group consisting of three full-sighted patients was diagnosed with N24SWD, two of whom were male and one female. The mean age in years was 21.1 ± 2.8 for DSWPD patients, 24.0 ± 4.4 for N24SWD patients and 23.4 ± 5.9 for controls. Neither age ($F(2,33) = 1.27$, $p = 0.30$) nor gender (X^2 (2, $N = 34$) = 0.11, $p = 0.820$) varied significantly across groups.

Thorough screening procedures and inclusion/exclusion criteria were implemented, based on the International Classification of Sleep Disorders (third edition), to ensure suitability of all participants to designated conditions. Table 3 presents lifestyle differences between DSWPD and control groups. This pattern of results confirms the validity of our selection procedure. Ethics approval was granted by the Southern Adelaide Clinical Human Research Ethics Committee, and informed consent was obtained from all participants. The protocol was designed to simulate 1-h 'days', alternating 20-min sleep opportunities with 40-min enforced wakefulness. After completion of the study, participants were compensated for their time with AUD$500.

1.2. Revised NEO personality inventory

The NEO PI-R [22] is one of the most commonly used assessments of 'the big five' personality factors and consists of 240 disposition statement items. Specifically, 'Form S' is designed for self-report with statements of each item rated on a five-point scale, from *strongly disagree* to *strongly agree*. Scores are totalled to generate the five factors of general personality functioning: Neuroticism/Emotional Instability, Extraversion, Openness to Experience, Agreeableness and Conscientiousness. Each dimension includes six subcomponents of the personality trait through eight items dedicated to each subcomponent. All 30 subcomponents can be seen in Table 1. The NEO PI-R has good concurrent/construct validity and test–retest reliability with high coefficient alphas for Neuroticism ($\alpha = 0.92$), Extraversion ($\alpha = 0.89$), Openness ($\alpha = 0.87$), Agreeableness ($\alpha = 0.86$) and Conscientiousness ($\alpha = 0.90$) [23].

1.3. Additional testing apparatus

Data collected from the screening measures and constant routine were also included in the subsequent analyses. During the screening phase, responses were reported to the General Health and Medical Questionnaire (GHMQ), Delayed Sleep Phase Disorder–Sleep Timing Questionnaire (DSPD–STQ), Pittsburgh Sleep Quality Index (PSQI) [29], Munich Chronotype Questionnaire (MCTQ) [30], Morningness–Eveningness Questionnaire (MEQ) [31], Sheehan Disability Scale (SDS) [32] and Depression Anxiety Stress Scale-21, short form ($DASS_{21}$) [33]. The seven-day sleep/wake diary plus actigraphy data were collected before starting the laboratory procedure. This information was analysed separately for days free of commitments (ie, enabling spontaneous sleep/wake times) as well as commitment days (ie, enforced sleep/wake schedules). Data from the constant routine were also incorporated in the present analyses including dim light melatonin onset (DLMO) time, melatonin rhythm length period or *tau* (Mτ), temperature minimum time (Tmin) and temperature rhythm *tau* (Tτ).

1.4. Protocol procedures

After initial screening, meetings with individual participants were arranged one week before starting the experiment. During the meeting, participants were familiarized with the protocol, testing apparatus and experimental procedures. All questions were answered in depth and participants were provided with information regarding parameters of living within the confines of the laboratory and the NEO PI-R. Participants were requested to complete the NEO PI-R before the next meeting (ie, the start of the