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Delayed sleep phase disorder risk is associated with absenteeism and impaired functioning

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ABSTRACT

Study objectives: The absence of a screening questionnaire for delayed sleep phase disorder (DSPD) remains a barrier to its detection and subsequent clinical evaluation. We developed a questionnaire to screen for DSPD risk and assessed its impact on self-reported absenteeism and functioning in work/school, social, and family life.

Design: Cross-sectional, with 13,844 individuals responding to a survey through an Internet survey provider, from which 1315 completed surveys were obtained from eligible participants.

Participants: A total of 1315 individuals who self-identified as evening type (n = 979) or as non-evening type (n = 356).

Measurements and results: A total of 295 participants were at high risk for DSPD, which is 5.1% of the total eligible survey respondents and 22.4% of our final sample with completed surveys. Compared to those who were not at high risk for DSPD, those who were at high risk were more likely to report frequent absenteeism, frequent loss of productivity, disruption to work or school activities, disruption to social life or leisure activities, and disruption to family life or home responsibilities. Difficulty with daytime sleepiness was more common in those at high risk for DSPD than those who were not. Increased sleep deficit on nights before school or work was also associated with more frequent difficulties with daytime sleepiness; 15.4% of those with no sleep deficit reported always or usually having difficulties with daytime sleepiness compared to 55.7% of those with a sleep deficit of 3 hours or more.

Conclusions: DSPD risk is associated with increased absenteeism and impaired functioning in work/school, social, and family life.

Introduction

Delayed sleep phase disorder (DSPD) is a primary sleep disorder characterized by a delayed sleep episode relative to desired sleep and wake times and is evidenced by chronic or recurrent sleep initiation insomnia when attempting to sleep at the desired conventional time, with difficulty awakening at the socially acceptable time.[1] In contrast, when not on a strict schedule that conflicts with the endogenous sleep-wake cycle, DSPD patients appear to have a normal sleep pattern and awaken spontaneously feeling refreshed.[2,3]

Although exact prevalence is not known, estimates in the general population range from 0.13%[4] to 0.17%,[5] with an increased rate in adolescents.[6-8] DSPD is associated with delayed endogenous circadian (~24-hour) rhythms, such as rhythms of melatonin and core body temperature,[9-11] as well as the rhythm of sleep propensity.[12] Other potential mechanisms for DSPD have been described, including reduced homeostatic sleep pressure leading to increased evening alertness, altered sensitivity to the circadian phase-resetting effects of light, and heightened cognitive activity due to comorbid sleep initiation insomnia.[13]

DSPD and, more generally, delayed sleep pattern are associated with adverse academic/work, health, and social outcomes. Impaired academic performance in DSPD[14] may be due to daytime sleepiness, in particular during the morning hours,[3] resulting from chronic sleep deficiency[15,16] imposed by school/work schedules. Adolescents with delayed bedtimes show poorer school performance, more disciplinary issues, and increased irritability and depression.[3,17] Adults with delayed sleep report impaired job performance, financial difficulties, marital problems,[14] and the ongoing use of sedatives and hypnotic drugs, behavioral interventions, or psychotherapy.[18] The comorbidity of DSPD and mood disorders has been described,[14,19] with depression being the most common.[19] DSPD patients show higher current depression ratings, antidepressant use, and greater lifetime history of unipolar depression compared to controls.[17,20] For example, 41% of DSPD sleep clinic patients showed evidence of depression; 7.2% showed moderate to severe depression.[21]

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The absence of a questionnaire screening tool for DSPD remains a barrier to the detection of those with DSPD symptoms and to the investigation of its prevalence, etiology, pathophysiology, and clinical significance. The daytime functional consequences of DSPD have not been systematically examined in large, non-clinic samples. We developed a survey to identify those at risk for DSPD and examined the relationship between DSPD risk and measures of daytime functioning.

Participants and methods

Participants

A total of 13,844 individuals registered to take an online survey, administered through a nationally representative opt-in survey panel (Greenfield Online, Wilton, CT). The survey was concurrently advertised by the survey company resulting in a mix of self-recruited online samples in addition to the opt-in survey panel. Of 13,844 individuals registering interest in and initiating the survey, 189 did not provide complete data, resulting in a participation rate of 98.2%.[22] Inclusion criteria were as follows: aged 18-65 years; currently employed (with all work hours falling between 7 AM and 10 PM, including paid, unpaid, volunteer work, or training) or a student; not working shifts (night, rotating, or early morning); and not employed in advertising, market research, or pharmaceutical industries. The survey was conducted between May and July 2009. The study protocol was approved by the Monash University Human Research Ethics Committee.

Survey instruments

DSPD symptom screening survey

We compiled a questionnaire to assess DSPD symptoms based on diagnostic criteria[1] (see Supplemental materials for full questionnaire) to identify those at high risk for the disorder who would likely warrant follow-up clinical assessment. Questions from the Composite Morningness-Eveningness Scale[23] were used to assess bed time and wake time according to each participant's reported "feeling best rhythm." In addition to this question related to the morningness-eveningness trait, we developed questions specifically assessing frequency of difficulty with getting out of bed in the morning, difference between the time the participant reports needing to go to bed on the night before school or work to feel fully rested in the morning ('needed' bedtime) and the actual time of going to bed before work or school, and latency to sleep onset when attempting to go to bed at the "needed" bedtime. Although the diagnostic criteria refer to "desired" clock time[1] and the more recent criteria refer to "desired or required sleep time and wake-up time,"[24] we asked the participant about their needed or required bedtime and wake-up time because this variable takes into account the need to schedule adequate amount of sleep considering study and work commitments. Initiating sleep at the desired bedtime would not necessarily result in adequate sleep duration.

To screen out individuals with low probability of DSPD, we terminated questionnaire participation from those who responded in the following way: (i) wake time according to feeling best rhythm earlier than 6:30 AM and (ii) bed time according to feeling best rhythm earlier than 10:15 PM.

To be classified as high risk for DSPD, in addition to questionnaire participation not being terminated based on responses to the above questions, the following criteria were met:

1. Difference between needed bed time before school/work and actual sleep onset time ≥30 minutes, to address the DSPD diagnostic criterion requiring "a delay in the phase of the major sleep period in relation to the desired sleep time"[1];
2. Sleep onset latency when attempting to sleep at needed bed time before school/work ≥30 minutes, based on established quantitative criteria for sleep onset latency in insomnia,[25] to address the diagnostic criterion requiring "inability to fall asleep at a desired conventional clock time"[1]; and
3. Frequent difficulty getting out of bed on school/work days—always (almost every school or work day), usually (several times per school or work week), or often (once per school or work week), which aims to address the diagnostic criterion requiring "inability to awaken at a desired and socially acceptable time."[1]

The remaining 2 diagnostic criteria for DSPD[1] were not specifically assessed by the questionnaire. Demonstration of a stable delay using sleep log or actigraphy cannot be achieved by a self-report questionnaire, and exclusion of comorbid sleep disorders would require a more comprehensive assessment of sleep, which we argue would be more appropriately undertaken during follow-up clinical assessment of those found to be at high risk for DSPD on the questionnaire.

Where participants reported that sleep disturbances persisted during their vacation or days off from work or school, we classified these individuals as high risk for both DSPD and sleep initiation insomnia. Specifically, to be classified as high risk for DSPD and/or sleep initiation insomnia, in addition to the above criteria for DSPD risk, participants reported always (almost every night) or usually (several times per week) experiencing difficulties with getting to sleep when on vacation or day off, when bed time occurs on, or after bed time according to feeling best rhythm.

Composite morningness-eveningness scale

We used a single question from the Composite Morningness-Eveningness Scale,[23] which has previously been shown through principal component analysis to be the most contributive item in the original questionnaire (13.2% of the variance explained).[26] In this question, participants select which of the following types that they consider themselves to be: definitely a morning type, more a morning than an evening type, more an evening than a morning type, and definitely an evening type.

To increase the probability that respondents were at risk for DSPD[17] and based on the age-related increase in morningness tendency,[27] all those aged 18-55 years who selected that they were "definitely an evening type" and all those aged 56-65 years who selected that they were either "more an evening than a morning type" or definitely an evening type were classified as evening type and were invited to complete the survey.

Before any analysis of outcome measures being undertaken, a random selection of participants who self-identified as nonevening type (and, therefore, had a lower probability of DSPD) according to the preceding definitions was also invited to complete the survey, to ensure that sufficient sample size of both high- and low-risk DSPD participants were available to test associations between DSPD risk and daytime functional impairments. We aimed to have approximately 25% of the final sample as nonevening type individuals.

Sheehan disability scale

The Sheehan Disability Scale[28] is a self-report instrument consisting of 5 items that evaluate functional impairment in 3 domains: work/school, family, and social life. In the first 3 items of the original scale, which are used to calculate the composite score, participants rate the extent to which their responsibilities in each of the 3 domains is impaired by his or her symptoms using a 10-point visual analog scale, anchored by the following descriptors: not at all (0), mildly (1-3), moderately (4-6), markedly (7-9), and extremely (10). To facilitate administration of the scale online, we modified the format of these response choices such that for each question that participants were asked to select from not at all, mildly, moderately, markedly, and