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Incidence rate and clinical characteristics of seasonal affective disorders in senior medical students

Ukraintsev I.I.[1], Schastnyy E.D.[2], Bokhan N.A.[1, 2]

[1] *Siberian State Medical University (SSMU)*
2, Moscow Trakt, Tomsk, 634055, Russian Federation

[2] *Mental Health Research Institute, Tomsk National Research Medical Center of the Russian Academy of Sciences (Tomsk NRMC RAS)*
4, Aleutskaya Str., Tomsk, 634014, Russian Federation

ABSTRACT

Aim. To study the incidence rate, clinical features, and prognosis of seasonal affective disorder (SAD) in senior (6^{th}-year) medical students.

Materials and methods. SAD screening using the Seasonal Pattern Assessment Questionnaire (SPAQ, 1987) included 119 undergraduate medical students. 78 students were females (65.5%) and 41 – males (34.5%) (p = 0.001). The average age of women was 23 (22; 23) years, the average age of men – 23 (22; 24) years. Statistical processing was performed using the Mann – Whitney U-test, Pearson's χ^2 test, and Spearman's rank correlation coefficient (r_s).

Results. The data on the prevalence of affective disorders with a seasonal pattern in medical students were obtained: SAD – 9.2%, sub-SAD – 13.5%, psychological undulation of season perception (PUSP) – 16.8%. The number of students who did not exhibit seasonal undulation of the six main characteristics recorded by the SPAQ was 72 (60.5%) (p = 0.001). There were statistically significant differences in the higher median Global Seasonality Score of the SPAQ for SAD compared with PUSP, both with and without account of the gender factor (p = 0.001). The use of a binary logistic regression model made it possible to identify groups of students with or without SAD according to the SPAQ. The data obtained determined the contribution of the following factors: gender, seasonality, body weight, and the number of sleep hours per day in spring.

Conclusion. The study made it possible to obtain a logistic regression model that allowed to predict the greatest likelihood of developing SAD.

Key words: seasonal affective disorder, medical students, Seasonal Pattern Assessment Questionnaire (SPAQ).

Conflict of interest. The authors declare the absence of obvious and potential conflicts of interest related to the publication of this article.

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Conformity with the principles of ethics. All participants of the study signed an informed consent. The study was approved by the local Ethics Committee at Mental Health Research Institute, Tomsk NRMC RAS (Protocol No. 115 of 26.11.2018).

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✉ *Schastnyy Evgeny D.,* e-mail: evgeny.schastnyy@gmail.com

Частота встречаемости и клинические характеристики сезонного аффективного расстройства у студентов-медиков старшего курса обучения

Украинцев И.И.[1], Счастный Е.Д.[2], Бохан Н.А.[1, 2]

[1] Сибирский государственный медицинский университет (СибГМУ)
Россия, 634055, г. Томск, Московский тракт, 2

[2] Научно-исследовательский институт (НИИ) психического здоровья, Томский национальный исследовательский медицинский центр (ТНИМЦ) Российской академии наук
Россия, 634014, г. Томск, ул. Алеутская, 4

РЕЗЮМЕ

Цель – изучение частоты встречаемости, клинических особенностей и прогнозирования развития сезонного аффективного расстройства (САР) у студентов-медиков 6-го курса обучения.

Материалы и методы. В скрининге на обнаружение САР с применением опросника для оценки сезонного паттерна (SPAQ, 1987) участвовали 119 студентов последнего курса медицинского университета, в том числе 78 представителей женского пола (65,5%) и 41 – мужского (34,5%) (p = 0,001). У женщин возраст составил 23 (22; 23) года, у мужчин – 23 (22; 24). Статистическую обработку проводили с использованием критерия χ^2 Пирсона и метода ранговой корреляции Спирмена (r_s).

Результаты. Получены данные о распространенности аффективных расстройств с сезонным паттерном у студентов-медиков: САР – 9,2%, суб-САР – 13,5%, психологическая ундуляция восприятия времен года (ПУВВГ) – 16,8%. Количество студентов, не проявляющих сезонной ундуляции шести основных характеристик, фиксируемых опросником SPAQ, составляло 72 (60,5%) (p = 0,001). Выявлены статистически значимые различия более высокого уровня медианы балла по общей сезонной шкале опросника SPAQ в случае САР по сравнению с ПУВВГ обследуемых как с учетом фактора пола, так и с его отсутствием (p = 0,001). Применение бинарной логистической регрессии позволило определить группы студентов с наличием или отсутствием САР по шкале SPAQ. Полученные данные определили величину вклада следующих факторов: пол, сезонность, масса тела и количества часов сна в сутки весной.

Заключение. Проведенное исследование позволило получить логистическую регрессионную модель, позволяющую прогнозировать наибольшую вероятность развития САР.

Ключевые слова: сезонное аффективное расстройство, студенты медицинского университета, опросник SPAQ.

Конфликт интересов. Авторы декларируют отсутствие явных и потенциальных конфликтов интересов, связанных с публикацией настоящей статьи.

Источник финансирования. Исследование выполнено в рамках государственного задания (бюджетное финансирование в рамках комплексной темы НИР АААА-А19-119020690013-2 «Комплексное исследование клинико-психопатологических закономерностей и патобиологических механизмов формирования и прогредиентности социально значимых психических и поведенческих расстройств с разработкой инновационных методов ранней диагностики, персонализированных стратегий терапии и профилактики»).

Соответствие принципам этики. Все участники исследования подписали информированное согласие. Исследование одобрено локальным этическим комитетом НИИ психического здоровья, Томский НИМЦ (протокол № 115 от 26.11.2018).

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INTRODUCTION

The etiology and pathophysiology of seasonal affective disorder (SAD) are associated with a particular season and light intensity. Long-term clinical and biological studies of SAD make it possible to identify its typical features, including recurrent affective episodes, a rapid response to non-pharmacological treatment, specific neurovegetative symptoms, and nutritional patterns [1]. Recent years have witnessed new results explaining the main biological hypotheses of SAD, with an emphasis on circadian rhythms, neurotransmitters, and molecular genetics. Integrative issues in the study of SAD are being discussed, including the research value of a dual vulnerability hypothesis, which conceptualizes seasonality as a dimensional spatial construct and the importance of studying endophenotypes. Chronotypes are defined as individual preferences for activity and sleep during the day. Morning and evening individuals differ in sleep-wake cycle time, peak performance times, and sensation upon awakening.

Circadian rhythm dysregulation is important in the development of affective disorders and widespread among people with mood disorders [2]. Sleep changes are the most significant diagnostic criterion for these disorders. Patients with bipolar disorder (BD) usually have more irregular sleep and corresponding social patterns, as well as abnormal secretion of melatonin and cortisol. Numerous studies on the effect of a chronotype on mood symptoms have conflicting results. The evening chronotype is often associated with an affective pathology. A large cohort study showed that depressive and anxiety disorders are associated with evening circadian rhythms, taking into account relevant socio-demographic, clinical, physical health, and sleep-related factors [3]. Evening activity is more common in adults with bipolar disorder. Research by M.C. Melo et al. (2020) showed that the evening chronotype has a poor prognosis for BD, which confirms the need for treatment of circadian rhythm disorders even in euthymia to improve the patient's quality of life and prevent the development of affective episodes [2].

In young respondents, seasonal variability in mild depression symptoms was shown in the Canadian population [4]. Higher levels of depressive symptoms were reported during the winter months compared to the summer months.

A study by A.V. Zhedik et al. [5] that included 81 medical university students of all years of study (average age 18.8 ± 0.8 years) revealed SAD signs in 40 individuals (37 women, 3 men). The authors associated this disorder with high mental and psychological strain. Another study showed higher prevalence of SAD in female students, and an important role in the development of the disorder in question was attributed to students' character and temperament characteristics [6]. The gender factor influence was also revealed in the study that showed the predominance of anxiety disorders in female students [7].

The aim of this study was to investigate the incidence rate, clinical features, and prognosis of seasonal affective disorder in senior (6^{th}-year) medical students.

MATERIALS AND METHODS

The study included senior medical students. The inclusion criteria for the study encompassed age of 18–30 years and the ability to give a written informed consent. The exclusion criteria were the presence of organic, neurological, and severe somatic disorders leading to organ failure and refusal to participate in the study. The study was carried out in compliance with the ethical standards developed in accordance with the Declaration of Helsinki of the World Medical Association, "Ethical Principles for Medical Research Involving Human Subjects" as amended in 2000 and "Rules of Clinical Practice in the Russian Federation" approved by the Order of the Ministry of Health of the Russian Federation No. 266 of 19.06.2003.

SAD screening using the Seasonal Pattern Assessment Questionnaire (SPAQ, 1987) involved 119 undergraduate medical students. 78 students were females (65.5%) and 41 – males (34.5%) ($p = 0.001$). The average age of females was 23 (22; 23) years, and the average age of males was 23 (22; 24) years.

When studying the prevalence of sub-SAD and SAD, the SPAQ [8] was used. This study used the modified version of the questionnaire, which was developed in our country [9]. The diagnosis of SAD required a Global Seasonality Score (GSS) greater than 11, with a problem being marked or severe. Subsyndromal forms of SAD were diagnosed by GSS of 11 or more in the absence of the problem or by GSS 9–10 in case the problem was marked or severe. The absence of SAD was determined in the following cases: the absence of a problem; the problem was assessed as moderate and had GSS less than 9. The entire surveyed group was assessed in terms of values in 4 main categories: 1 – the presence of SAD; 2 – the absence of SAD; 3 – psychological undulation

of the season perception (PUSP); 4 – subsyndromal SAD.

Assignment of the surveyed to any category due to the screening findings was based on the cumulative scoring and categorical assessment. As presented in the SPAQ text, the questionnaire includes six questions about seasonal changes in sleep, activity, mood, body weight, appetite, and energy, which makes up a Global Seasonality Score (GSS), where each question corresponds to the answer, estimated in the range from 0 to 4 points. Thus, the maximum possible result may be 24 points. The SPAQ also includes a question about the difficulties arising from these changes (seasonality as a problem), implying one of the following answers: absence of the problem, moderate, marked or severe problem.

Statistical data processing was carried out using the standard software package IBM SPSS Statistics 26. Quantitative data were presented as the median and the interquartile range Me [Q_1; Q_3]. Qualitative data were presented by frequency parameters (n (%)). Statistical processing was performed using the Spearman's rank correlation coefficient (r_s). Qualitative variables were analyzed through the study of their frequencies by means of contingency tables using the Pearson's χ^2 test.

To construct a binary logistic model, a step-by-step inclusion method was used. The value of the weighting factors (W), standard error (SE), and the level of significance (p) were calculated. To assess the quality of the predictive model built on the basis of the logistic regression algorithm, ROC analysis was used, with calculation of the sensitivity (Se), specificity (Sp), and the area under the curve (AUC). Assessment of the specificity and sensitivity values made it possible to test the adequacy of the model.

RESULTS

Students often underestimate the problem that is caused by seasonal mood changes. A prerequisite for diagnosing SAD was assessment of seasonal fluctuations as at least a marked problem and GSS of 11 or more. Considering this categorization, the prevalence of SAD among senior medical students was studied and the following results were obtained (Fig. 1).

Figure1 shows that the prevalence of SAD was 9.2% (11 persons), sub-SAD – 13.5% (16 persons), and PUSP – 16.8% (20 persons). The number of students who did not show seasonal undulation of the six main characteristics recorded by the SPAQ questionnaire was 60.5% (72 persons).

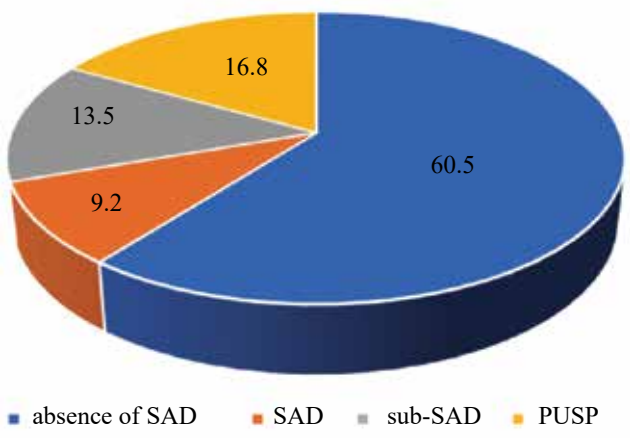

Fig. 1. Incidence rate of SAD, sub-SAD, and PUSP

Figure 2 shows that when assessing the gender-related differences in the selected groups of the disorder in women, the values of SAD (11.5%), sub-SAD (18.0%), and PUSP (18.0%) differed from the corresponding parameters (4.9; 4.9, and 14.6%) in men ($p = 0.034$, Pearson's χ^2 test).

Figure 2 illustrates the gender-related incidence rate of SAD, sub-SAD, and PUSP.

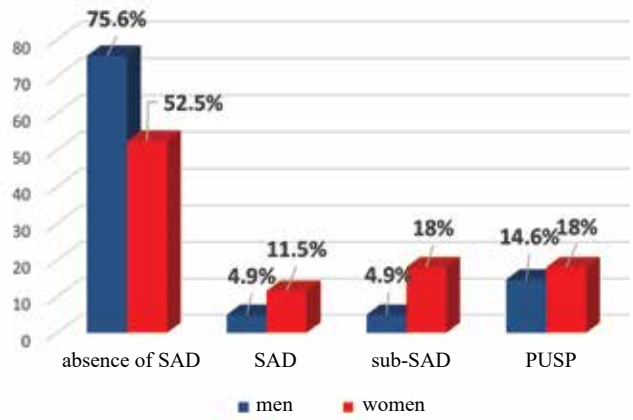

Fig. 2. The gender-related incidence rate of SAD, sub-SAD, and PUSP

A statistical analysis of the correlations between different variables was carried out to determine their most significant interrelations. When considering the ratios of seasonal undulation of the six main characteristics in the patients with SAD, determined by the SPAQ, the closest significant positive correlation ($p = 0.03$) was found between the energy level and social activity ($r_s = 0.74$). In the patients with SAD and sub-SAD, a correlation was found between increased appetite and sleep length ($r_s = 0.52$), as well as between increased appetite ($r_s = 0.52$) (preference for

carbohydrate foods) and weight in the fall and winter months (September and January). The obtained data show the practical significance of the seasonal undulation of the above-mentioned six main characteristics on the Global Seasonality Score for the diagnosis of SAD and sub-SAD at the screening stage.

Statistically significant relationships ($p < 0.05$) were revealed between the final GSS and the two parameters assessed on this scale: sleep length ($r_s = 0.74$) and body weight ($r_s = 0.82$).

Additionally, an association between seasonal variations in the six main characteristics (sleep length, social activity, mood (overall wellbeing), body weight, appetite, and energy level), the severity of the problem (absence of the problem, moderate, marked or severe problem), and gender was analyzed (Fig. 3). The differences in the selected groups were assessed. A moderate problem in women was statistically significantly more common than in men (37.2% and 22.0%, respectively; $p = 0.046$, Pearson's χ^2 test). In contrast, men showed the absence of the problem statistically significantly more often than women (73.2 and 48.7%, respectively; $p = 0.01$, Pearson's χ^2 test).

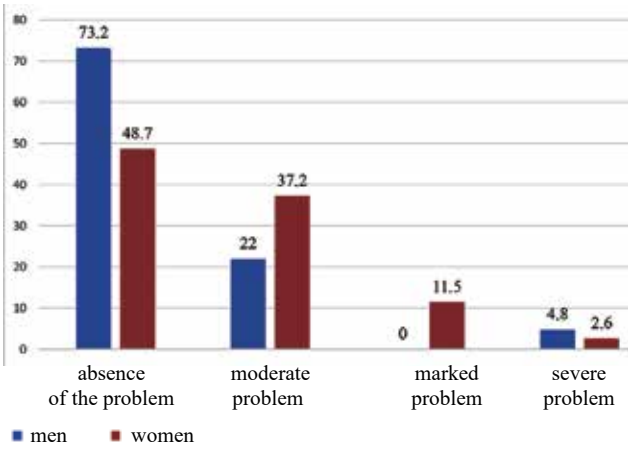

Fig. 3. Influence of the gender factor on the assessment of mood and behavior seasonality

When assigning the individuals to sub-SAD without considering the gender factor and assessing seasonality as a problem, a correlation with the mood parameter measured on the SPAQ Global Seasonality Score was revealed ($r_s = –0.51$). When assigning the individuals to the PUSP category without considering the gender factor and assessing seasonality as a problem, a correlation with sleep length ($r_s = 0.60$) and decreased appetite ($r_s = 0.46$) was identified.

A binary logistic regression analysis was used to select a group of factors that determine the possibility of assigning students to a group with or without SAD according to the SPAQ score. A logistic regression model was constructed to predict the highest likelihood of developing SAD. Interpretation of the results was determined by the values of the regression coefficients and their levels of significance. From the data obtained using logistic regression, the contribution of the following factors was determined. Gender parameters: W = 1.615, *SE* = 0.760, *Wald* = 4.511 (Wald statistics), *Sig* = 0.034 (significance level), *Exp* (B) = 5.029. Parameters of seasonality as a problem: W = 2.345, *SE* = 0.625, *Wald* = 14.070, *Sig* = 0.001, *Exp* (B) = 10.434. Parameters of body weight: W = 0.622, *SE* = 0.316, *Wald* = 3.879, *Sig* = 0.049, *Exp* (B) = 1.863. Parameters of sleep length per day in spring: W = 0.542, *SE* = 0.195, *Wald* = 7.686, *Sig* = 0.006, *Exp* (B) = 1.719.

At the first stage, the value of the function *Z* (x) was determined using the formula:

$$Z = –10{,}378 + 1{,}615 \cdot X_1 + 2{,}345 \cdot X_2 + 0{,}622 \cdot X_3 + 0{,}542 \cdot X_4,$$

where Z – SAD; W = –10.378; X_1, X_2, X_3, X_4 – values of the factors. X_1 – gender; X_2 – seasonality assessment scale as a problem according to the SPAQ; X_3 – parameters of sleep length per day in spring.

The main results of binary logistic regression among medical students were characterized by the following parameters: W = –10.378; *SE* = 2.496; *Wald* = 17.295; *Sig* = 0.001; *Exp* (B) = 0.001.

Then the likelihood of developing a seasonal affective disorder in students was assessed using the formula: $P = e^z/(1+e^z)$, where *P* is the likelihood of students' belonging to a group with / without SAD; *e* is the base of the natural logarithm ($e = 2.7183$).

According to the analysis carried out with the use of the logistic regression algorithm, parameters and weighting factors were identified that made it possible to construct a separating function with sufficient operational characteristics. When the number of input parameters decreased, the recognition quality of this model deteriorated.

ROC analysis was used to assess the quality of the model. For the variable *"Scale for assessing seasonality as a problem"* in the SPAQ, *AUC* = 0.792; *SE* = 0.050; asymptotic significance was 0.001; the lower limit was 0.693 and the upper limit was 0.891 of the asymptotic 95% confidence interval; *Se* = 89.0%; *Sp* = 63.0%. If this model is used, then in 83.1% of cases it will give a correct result, which is a fairly good indicator for biomedical systems.

DISCUSSION

This study contributes to the field of circadian and chronobiological research, showing a close relationship between SAD development and young age [10, 11]. From a diagnostic and preventive viewpoint, it is important to distinguish the three main categories of SAD according to cumulative scoring and categorical assessment. The PUSP category is close to sub-SAD in its clinical characteristics, which made it possible to create a continuous series of seasonal patterns of mood and behavior changes from normal values to a clinically most marked seasonal affective disorder. In terms of chronobiological parameters, subsyndromal SAD forms, respectively, are closer to SAD than to healthy individuals.

Analysis and systematization of epidemiological studies by searching in the electronic databases Medline, Excerpta Medica, and PsychLIT made it possible to estimate the prevalence of SAD using 20 retrospective studies [12]. SAD prevalence varied from 0% to 9.7%, which was confirmed by our study (9.2%).

In adolescence, depression is mostly characterized by atypical symptoms, including social withdrawal, increased sleepiness, overeating, and a desire for carbohydrates. The presence of atypical depressive symptoms in the structure of an episode of depression in progress often correlates with bipolar mood disorder. Sleep disorders are associated with a decreased quality of life and a risk of relapse in BD. At the same time, sleep disorders very frequently persist in BD, despite adequate pharmacological treatment [13]. In the modern literature, there is a small amount of studies devoted to sleep disorders in SAD. The issue of sleep disorders, in which circadian or behavioral abnormalities play a leading role in SAD patients, remains unclear. This is supported by the discrepancy between self-reported and actigraphic (polysomnographic) sleep length in SAD. Some studies largely ignore the period of summer remission in SAD, which could provide valuable information on the role of sleep disorders in the onset and recurrence of winter depressive episodes. Therefore, further studies should comprise a comprehensive assessment of sleep and circadian rhythms, including all seasons of the year, to fully characterize the corresponding phenotypes [14].

The obtained data on SAD predominance in women were consistent with the data of other researchers, who showed a positive correlation between age and the frequency of seasonal affective disorders. For instance, this parameter was higher in post-pubertal girls, which was probably associated with sexual neurohormonal characteristics [15, 16].

A study of a large sample of young people with depression demonstrated high incidence of anhedonia and anergy [17]. At the same time, the study by N.A. Majrashi et al. [18] found a negative correlation between the length of the light period and bad mood and anhedonia in women. No mediated effects were observed in men. This study expands the understanding of the neurobiological factors that influence the pathophysiology of SAD.

The use of methods for prompt diagnosis of mood disorders in practical healthcare (intelligent systems for express diagnosis) is of practical importance. It allows for timely identification of persons belonging to an increased risk group to carry out interventions aimed at improving their quality of life in the future [19]. Timely diagnosis of all SAD categories in students will make it possible to effectively use the existing preventive and therapeutic potential [20–22].

CONCLUSION

The data obtained show that in seasonal affective disorders, vegetative symptoms, such as seasonal fluctuations in sleep length (r_s = 0.74) and body weight (r_s = 0.82), were most significant for the subjective assessment of seasonal fluctuations as a problem of varying severity. The revealed patterns confirmed the previously obtained data on the relationship between the typical rhythms of seasonal mood fluctuations (vegetative and behavioral characteristics, school performance) and SAD [23]. Additionally, the results obtained in this study were comparable with the research confirming fairly high prevalence of SAD and sub-SAD in different age groups [24].

These data were of practical importance for the timeliest primary detection of sub-SAD and SAD with a focus on the diagnosis of seasonal fluctuations in vegetative manifestations of subdepressive or depressive disorders, not only circadian changes in mood.

Timely diagnosis and further use of therapeutic and preventive approaches determine a set of actions aimed at regulating biopsychosocial functioning of medical students [19]. To achieve this, relevant treatment methods are used along with rhythm-stabilizing measures (correct daily regimen, planning the rhythm of study load in student curricula, light regime).

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Authors information

Ukraintsev Igor I., Cand. Sci. (Med.), Assistant of the Psychiatry, Narcology, and Psychotherapy Division, SibMed, SSMU, Tomsk, Russian Federation. ORCID 0000-0001-5112-2188.

Schastnyy Evgeny D., Dr. Sci. (Med.), Professor, Head of the Affective States Department, Mental Health Research Institute, Tomsk NRMC RAS, Tomsk, Russian Federation. ORCID 0000-0003-2148-297X.

Bokhan Nikolay A., Dr. Sci. (Med.), Professor, Academician of RAS, Director of Mental Health Research Institute, Tomsk NRMC RAS; Head of the Psychiatry, Narcology, and Psychotherapy Division, SibMed, SSMU, Tomsk, Russian Federation. ORCID 0000-0002-1052-855X.

(✉) **Schastnyy Evgeny D.,** e-mail: evgeny.schastnyy@gmail.com

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