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Summary

Aim: The aim of the study was to verify the suitability of the Narcolepsy Severity Scale (NSS) as a basic clinical tool for determining the subjective severity of the disease in patients with narcolepsy type 1 (NT1) in the Czech Republic. *Set and Methods:* A total of 78 patients from 2 sleep centers with a diagnosis of NT1 (29 men, 49 women, mean age 36.1 ± 11.7 years, range 18-71 years, of whom 51 were treated $n=$) completed the NSS scale consisting of 15 questions focusing on the occurrence, frequency, and impact on daily of all major narcoleptic symptoms. At the same time, they were instructed to complete the Epworth Sleepiness Scale (ESS), the Fatigue Severity Scale (FSS), the Hospital Anxiety and Depression Rating Scale (HADS) and a short version of the Quality of Life Questionnaire (SF-36). *RESULTS:* The NSS scale shows good internal consistency of the questionnaire using Cronbach's α , which is 0.80 for the whole cohort of NT1 patients, 0.79 for the treated group and 0.82 for the untreated . The Keiser-Meyer-Olkin index for the entire cohort is 0.73, confirming sufficient structural validity of the questionnaire. There was no significant difference in the NSS scores of treated and untreated patients, however, the correlation of the total NSS score with ESS ($\rho= 0.61$; $p < 0.0001$) and FSS ($\rho= 0.4438$; $p < 0.0001$) was confirmed. *Conclusion:* the NSS is a convenient and easily applicable clinical tool to determine the subjective severity of the disease, it well captures the main narcoleptic symptoms and assesses their impact on daily activities.

Abstract

Aim: The aim of the study was to verify the applicability of the Narcolepsy Severity Scale (NSS) as a basic clinical tool for determining the subjective severity of the disease in patients with narcolepsy type 1 (NT1) in the Czech Republic. *Patients and methods:* A total of 78 patients from 2 sleep centers with a diagnosis of NT1 (29 men, 49 women, mean age 36.1 ± 11.7 years, range 18-71 years, $N= 51$ were treated) completed the NSS scale consisting of 15 questions focusing on the occurrence, frequency, and impact on daily activities of all major narcoleptic symptoms. At the same , they were instructed to complete the Epworth Sleepiness Scale (ESS), the Fatigue Severity Scale (FSS), the Hospital Anxiety and Depression Rating Scale (HADS) and a short version of the Quality of Life Questionnaire (SF-36). *Results:* The NSS scale shows good internal consistency of the questionnaire using Cronbach's α , which is 0.80 for the whole cohort of NT1 patients, 0.79 for the treated group and 0.82 for the untreated group. The Keiser-Meyer-Olkin index for the entire cohort is 0.73, confirming sufficient structural validity of the questionnaire. There was no significant difference in the NSS scores of treated and untreated patients; however, the correlation of the total NSS score with ESS ($\rho = 0.61$; $P < 0.0001$) and FSS ($\rho = 0.4438$; $P < 0.0001$) was confirmed. *Conclusions:* The NSS is a convenient and practical clinical tool for determining the subjective severity of the disease, well capturing the main narcoleptic symptoms and assessing their impact on daily activities.

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J. Bušková^{1,2}, T. Dvořáková^{1,2},
R. Králová^{1,2}, S. Nevšímalová³,
M. Milata³, K. Galušková³,
S. Dostálová³, K. Šonka³

¹ Department of Sleep Medicine, National Institute of Mental Health, Klecany

² 3rd Faculty of Medicine, Prague

³ Department of Neurology and Centre for Clinical Neurosciences, 1st Faculty of Medicine, Charles University in Prague



MUDr. Jitka Bušková, Ph.D.
Department of Sleep Medicine
National Institute of Mental
Health Topolová 748
250 67 Klecany
e-mail: jitka.buskova@nudz.cz

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Home

Narcolepsy type 1 (NT1), formerly known as narcolepsy with cataplexy, is a rare neurological disorder

with an estimated prevalence in the general population between 0.03-0.05% [1,2]. Its pathophysiological basis is immune-mediated loss/dysfunction

hypocretin neurons in the post-sterolateral hypothalamus in individuals who are genetically predisposed to develop the disease [3].

The main clinical symptoms include excessive daytime sleepiness (EDS) with typical insurmountable daytime sleep attacks, cataplexy, hypnagogic hallucinations, sleep paralysis and poor quality night sleep [4]. However, these symptoms are not always fully expressed in all patients [5,6]. In clinical practice, we encounter a high variability not only in their actual occurrence, but in the intensity of the difficulties and the degree to which daily are affected. Symptoms are not always completely typical - it is difficult to quantify them and therefore to assess the severity of narcolepsy in a consistent manner. In some, this ambiguity can even lead to a delay of many years between the onset of symptoms and the correct diagnosis [6], significantly reduces the quality of life of patients with narcolepsy [7].

Therefore, there is a need to introduce a simple clinical screening tool that would allow the assessment of the frequency/severity of individual symptoms and their overall impact on daily activities, as well as being a suitable tool for assessing the effect of treatment. Compared to older questionnaires used so far, such as the Epworth Sleepiness Scale (ESS), the Ullanlinna Narcolepsy Scale, the Stanford Sleep Inventory, or the Swiss Narcolepsy Scale [8-10], the Narcolepsy Severity Scale (NSS) of the French authors from 2017 [11] better meets these requirements. Our aim was to validate its psychometric properties in a cohort of NT1 patients in the Czech Republic and to determine whether it reflects the difficulties that patients present with with respect to their daily activities.

Methodology

Participants

The cohort consisted of 78 adult patients with NT1 from 2 sleep centres (65 patients from the Centre for Sleep and Wakefulness Disorders of the 1st Faculty of Medicine of the Charles University, 13 patients from the Department of Sleep Medicine of the National Institute of Sleep Medicine, Klecany and 3. The patients were either patients with a previously established diagnosis who were invited for regular follow-up examinations as part of clinical follow-up. In all patients, the diagnosis was made on the basis of the current International Classification of Sleep Disorders (ICSD-3) criteria: unpredictable daytime sleep attacks > 3 months, unequivocal cataplexy, mean sleep latency on the Multiple Sleep Latency Test (MSLT) \leq 8 min

with the finding of \geq 2 periods of REM sleep (the finding of REM sleep in the first 15 min after falling asleep during the night can replace 1 period of REM sleep in MSLT), e.g. cerebrospinal fluid hypocretin level \leq 110 pg/ml [4]. All patients were found to have the DQB1*0602 allele of the HLA system.

Data collection

The English version was provided to the researchers for the study by MAPI Research Institute, Lyon, France (No 218774). First, a double back-translation of the NSS from English to English was performed by a bilingual native speaker and sleep medicine specialists from both center (JB, KS, SN). The translation was merged and discussed until consensus was reached. Subsequently, 5 patients were selected and to comment on whether the questions were clear and understandable, which they unanimously confirmed.

The Narcolepsy Severity Scale consists of 15 on the 5 main narcoleptic symptoms: sleep attacks and somnolence (7 questions), cataplexia (3 questions), hypnagogic hallucinations (2 questions), sleep paralysis (2 questions), and poor quality night sleep (1 question). All questions refer to the last month of the disease [12]. The questions assessing the frequency of symptoms could be answered using a 6-point Likert scale from 0 to 5, and the other questions assessing the impact of symptoms on daily functioning using a 4-point Likert scale from 0 to 3. The total score was the sum of the scores for all questions, with a range of 0-57, with higher scores indicating greater severity of illness. In 2020, based on the total NSS score, a classification of narcoleptic symptoms was proposed as 0-14 mild, 15-28 moderate, 29-42 severe and \geq 43 very difficult [12,13].

Only question 7 was found to be irrelevant: "To what extent do these sudden daytime falls asleep affect your ability to drive a car?", because in the Czech Republic, under-compensated narcolepsy is not compatible with driving. Non-licensed drivers as well as those who do not experience this limitation consistently responded: 'Does not affect me at all/I do not drive for other reasons' (= 0 points), which may bias the information towards the actual impact of daytime sleepiness on driving. The questionnaire was presented to patients during a diagnostic stay in the sleep laboratory or during an ambulant examination as part of long-term follow-up. No patient completed the questionnaire repeatedly.

In addition to the NSS, patients completed the following questionnaires: the ESS [14], the Fatigue Severity Scale (FSS), the Fatigue Se-

verity Scale (FSS) [15], the Quality of Life Questionnaire-36 (SF-36) [16] and the Hospitalization Anxiety and Depression Rating Scale (HADS) [17].

Statistical methods

A two-sample t-test was used to compare the overall NSS questionnaire scores between the selected patient groups. The duration of disease between treated and untreated patients was compared using the non-parametric Mann-Whitney U test. The nonparametric Spearman's correlation coefficient was used to express the correlation of variables. Consistency of the NSS questionnaire was assessed by Cronbach's α coefficient and Keiser-Meyer-Olkin index. P-values less than 5% were considered statistically significant. The analysis was performed using the statistical software R, version 4.2.1 (R Core Team, Auckland, New Zealand).

Results

Demographic and descriptive data

The study included 78 patients with NT1 diagnosis (29 men, 49 women, mean age 36.1 ± 11.7 years, range 18-71 years), body mass index (BMI) 23.9 ± 5.6 (range 19.1-37.2). The average age at onset was 20 years, 38 patients (49%) had their first symptoms before the age of 18 years, and the average duration of the disease was 16 years. Hypnagogic hallucinations were reported by 35 patients (45%), sleep paralysis by 32 patients (42%). Of the total number of participants, 51 patients were currently being treated, of whom 28 patients were treated with modafinil, 8 patients were taking methylphenidate, 13 patients were taking sodium oxybate, 2 patients were taking pitolisant, 13 patients were taking tricyclic antidepressants (11 mipramine, 1x melipramine, 1x tianeptine), 8 patients were treated with selective serotonin reuptake inhibitors (SSRIs) (escitalopram, citalopram, fluoxetine, sertraline), 5 with venlafaxine, 3 patients took ad hoc clonazepam at night and 1 patient took trazodone at.

The mean NSS score in the study cohort of NT1 patients was 26.94 ± 9.86 points (range 7-50 points). Of the total patients, 11 (14%) showed mild symptoms (0-14 points) and 35 (45%) showed moderate symptoms (15-28 points), 27 (35%) severe (29-42) and 5 patients (6%) very severe (\geq 43 points). Mean scores \pm standard deviation (standard deviation; SD) of individual questions for all patients and separately for treated (n = 51) and untreated

Table 1: Mean Narcolepsy Severity Scale score (± standard deviation) for all patients and for treated/untreated patients with narcolepsy type 1

Narcolepsy severity scale	n= 78	Healing (n= 51)	Untreated (n= 27)	p< 0.05
1. How often do you feel an overwhelming need for sleep during the day?	4.33± 1.15	4.43± 1.20	4.12± 1.03	NS
2. Are you worried about falling asleep during the day (without noticing it, suddenly)?	1.60± 0.98	1.65± 0.96	1.52± 1.05	NS
3. How significantly do these sudden falls asleep interfere with your work/activities?	2.28± 1.04	2.25± 1.00	2.33± 1.14	NS
4. How significantly do they interfere with your social and family life?	1.33± 0.98	1.39± 0.98	1.22± 1.01	NS
5. How do you generally feel after such a sudden daytime sleep?	1.25± 0.65	1.27± 0.70	1.22± 0.58	NS
6. How long after a sudden daytime fall asleep does another sudden fall asleep occur?	2.45± 1.70	2.73± 1.72	1.93± 1.54	NS
7. To what extent do these sudden daytime falls asleep affect your ability to drive?	0.52± 0.91	0.45± 0.90	0.67± 0.92	NS
8. How often do you have episodes of generalized cataplexy? [abbreviated]	1.97± 1.85	2.39± 1.83	1.19± 1.64	NS
9. How often do you have episodes of partial cataplexy? [abbreviated]	2.83± 1.72	3.02± 1.64	2.48± 1.85	NS
10. To what extent is your work, social or family life affected by episodes of cataplexy?	1.10± 0.93	1.18± 0.97	0.96± 0.85	NS
11. How often do you have hallucinations when falling asleep or waking up?	2.08± 1.74	2.16± 1.80	1.93± 1.66	NS
12. To what extent do these hallucinations bother you?	1.06± 1.02	1.20± 1.11	0.81± 0.79	NS
13. How often do you have sleep paralysis when falling asleep or waking up?	1.51± 1.59	1.53± 1.63	1.48± 1.53	NS
14. To what extent do episodes of sleep paralysis bother you?	0.90± 1.05	1.00± 1.11	0.70± 0.91	NS
15. How disturbed is your night's at the moment?	1.62± 0.93	1.73± 0.87	1.41± 1.01	NS

n - number; NS - not significant

≠The treated patients were not significantly different from the untreated patients in terms of age, sex, BMI or age at disease onset. The treated patients had a mean disease duration 6 years longer (p = 0.0379). There was no significant difference in the incidence of hypnagogic hallucinations or sleep paralysis between the treated and untreated NT1 groups.

The mean ESS score was 17.1± 4.4 points (range 7-24), the mean FSS score was 41.5± 11.6 points (range 10-63), HADS-A: 6.1± 4.1 (0-17), HADS-D: 4.9± 4.2 (0-18), SF-16 physical health: 72.1 ± 15.2 (35-96), SF-36 mental : 58.7± 15.9 (9-89).

Psychometric properties of the questionnaire

The internal consistency of the questionnaire was confirmed by Cronbach's α, which 0.80 for the whole cohort of NT1 patients, 0.79 for the group of treated patients and 0.82 for the group of untreated patients. Keiser-

-Meyer-Olkin index for the whole cohort is 0.73, which confirms sufficient structural validity of the questionnaire.

NSS total scores correlated significantly with questions directly to sleepiness (questions 1-4 + 6; Figure 1) - NSS vs. NSS1 (p= 0.0004), NSS2 (p< 0.0001),

NSS3 (p= 0.0328), NSS4 (p< 0.0001), NSS6 (p< 0.0001) - and other narcoleptic symptoms (for questions 5 + 8-15 p< 0.0001 in all cases), only question 7 did not show a significant correlation with the total NSS score (p = 0.2312).

The results further confirmed a higher overall NSS score in patients with current cataplexy (Figure 2).

There was no significant difference in NSS scores between treated and untreated patients (28.37± 9.65 vs. 24.22± 9.86; p= 0.0806).

There was no significant correlation of the total NSS score with age at onset or duration of disease. However, the correlation between the NSS total score and the ESS scale (ρ = 0.61; p < 0.0001) and also between the NSS total score and the FSS scale (ρ= 0.4438; p< 0.0001) was confirmed (Figs. 3, 4).

ESS significantly correlated with FSS (p= 0.0025) but did not correlate with HADS or SF-36 scores.

Discussion

This study demonstrated good psychometric properties of the Czech variant of the NSS in the following cohort of NT1 patients.

The α test confirmed the high level of internal consistency of the questionnaire and its good reliability. In terms of convergent validity, there is a significant correlation between the total NSS and ESS and FSS scores.

The mean NSS score in our NT1 patients was 26.94 ± 9.86, which is consistent with the French study of 21.57± 8.54 [11] and the Chinese validation study in adult NT1 patients of 25.44 ± 11.21 [18]. These mean scores correspond to moderate symptoms in the NSS scale. The most recent study to evaluate the psychometric properties of the NSS to date is the version translated into Brazilian Portuguese, which has a higher total score (33.94± 11.23) and falls into the category of severe narcolepsy symptoms [19]. The authors themselves explain this difference by the poorer availability of narcolepsy treatment in Brazil [19].

Excessive daytime sleepiness is usually an initial symptom of NT1 regardless of age at disease onset and is also the main persistent and disabling symptom encountered in long-term follow-up [20]. The ESS is a basic, widely used questionnaire for the assessment of excessive daytime sleepiness regardless of its etiology [14]. In the literature, the mean ESS score in patients is consistently reported.

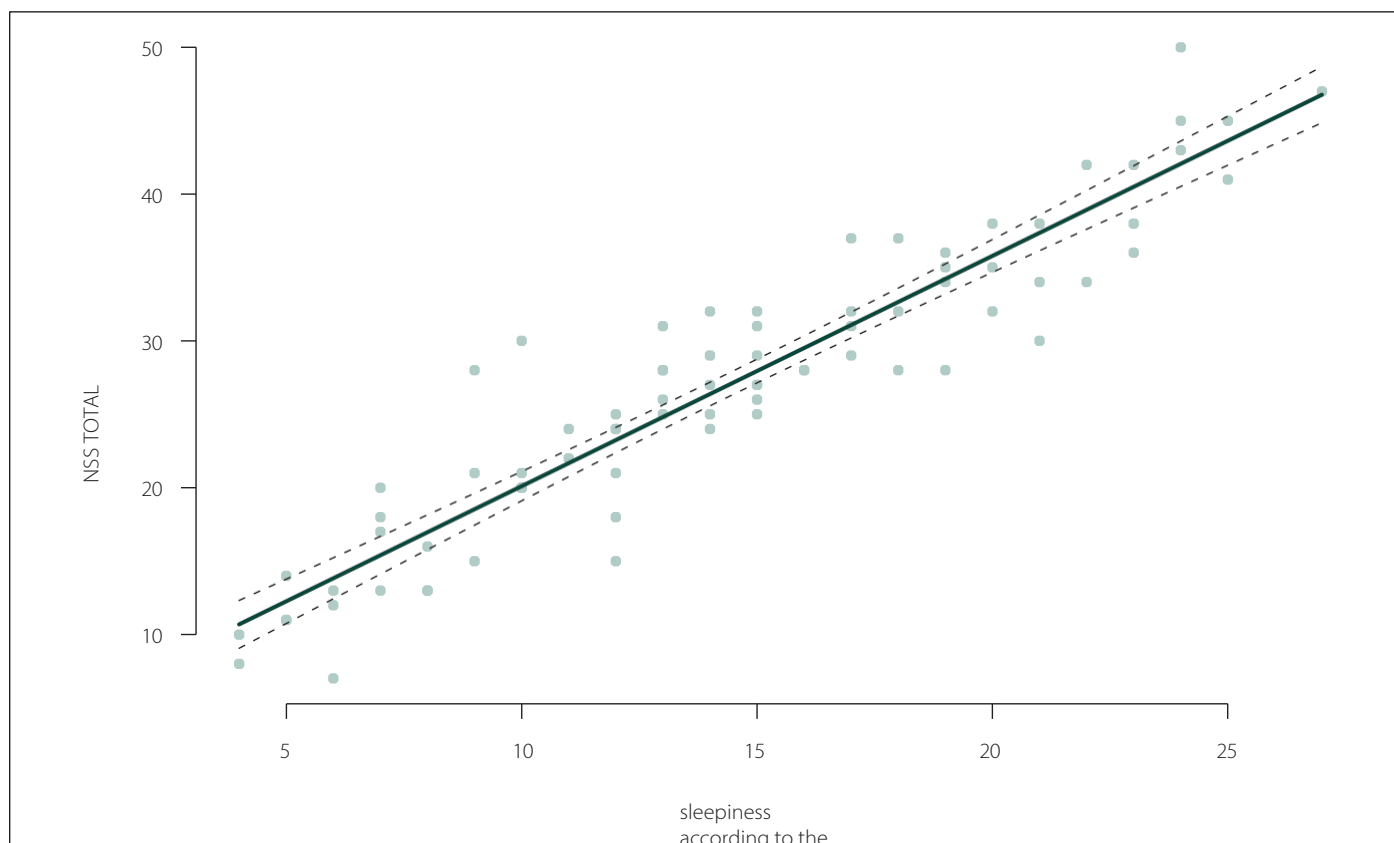
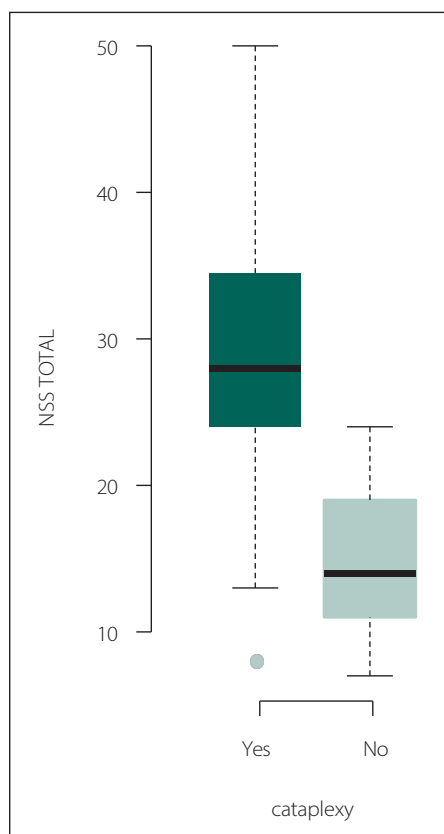


Fig. 1. Correlation of the NSS total score and the NSS excessive daytime sleepiness questions ($\rho = 0.9340$; $p < 0.0001$).

NSS - Narcolepsy Severity Scale

Fig. 1. Correlation of NSS total score and questions targeting excessive daytime sleepiness by NSS ($\rho = 0.9340$; $P < 0.0001$).

NSS - Narcolepsy Severity Scale



patients with NT1 between 17 and 20 points [12,21], which is consistent with our findings. However, this scale focuses exclusively on sleepiness and omits other narcoleptic symptoms, i.e., it does not predict the full severity of the disease. As shown in Figure 2, the presence of ca- taplexia plays a significant role in the subjective assessment of the severity of narcolepsy. Disadvantages of the ESS include its low correlation with MSLT scores and moderate correlation with Maintenance of Wakefulness Test (MWT) scores. Evidence of test-retest reliability is also lacking [22]. Our evidence of a correlation between ESS scores and total NSS scores

Fig. 2. Total NSS score in groups of patients with and without current cataplexy ($p < 0.0001$).

NSS - Narcolepsy Severity Scale

Fig. 2. NSS total score in the groups of patients with and without current occurrence of cataplexy ($P < 0.0001$).

NSS - Narcolepsy Severity Scale

is confirmed by the original work [11] and by two validation studies conducted so far, the Chinese [18] and the Brazilian [19]. In our patient group, there was a simultaneous correlation of individual sleepiness-related questions with the total NSS score, as well as a correlation with the severity of daytime fatigue.

The Ullanlinna Narcolepsy Scale (UNS) has been used as a screening method for narcoleptic symptoms and their differentiation from symptoms of other diseases that may mimic narcolepsy [23-25]. However, its disadvantage is inconsistent specificity in different studies [23-25]. Another tool for assessing narcoleptic symptoms is the Stanford Sleep Inventory (SSI), which is not applicable in routine clinical practice because of its 146 questions [26]. The last of the scales used is the Swiss Scale with 5 questions (3 questions relate to sleepiness and 2 questions relate to cataplexy) [8], is considered a suitable method but does not cover the full spectrum of symptoms and is not suitable for monitoring the effect of treatment. Thus, overall, the NSS compares favourably with the previously widely used ESS, UNS

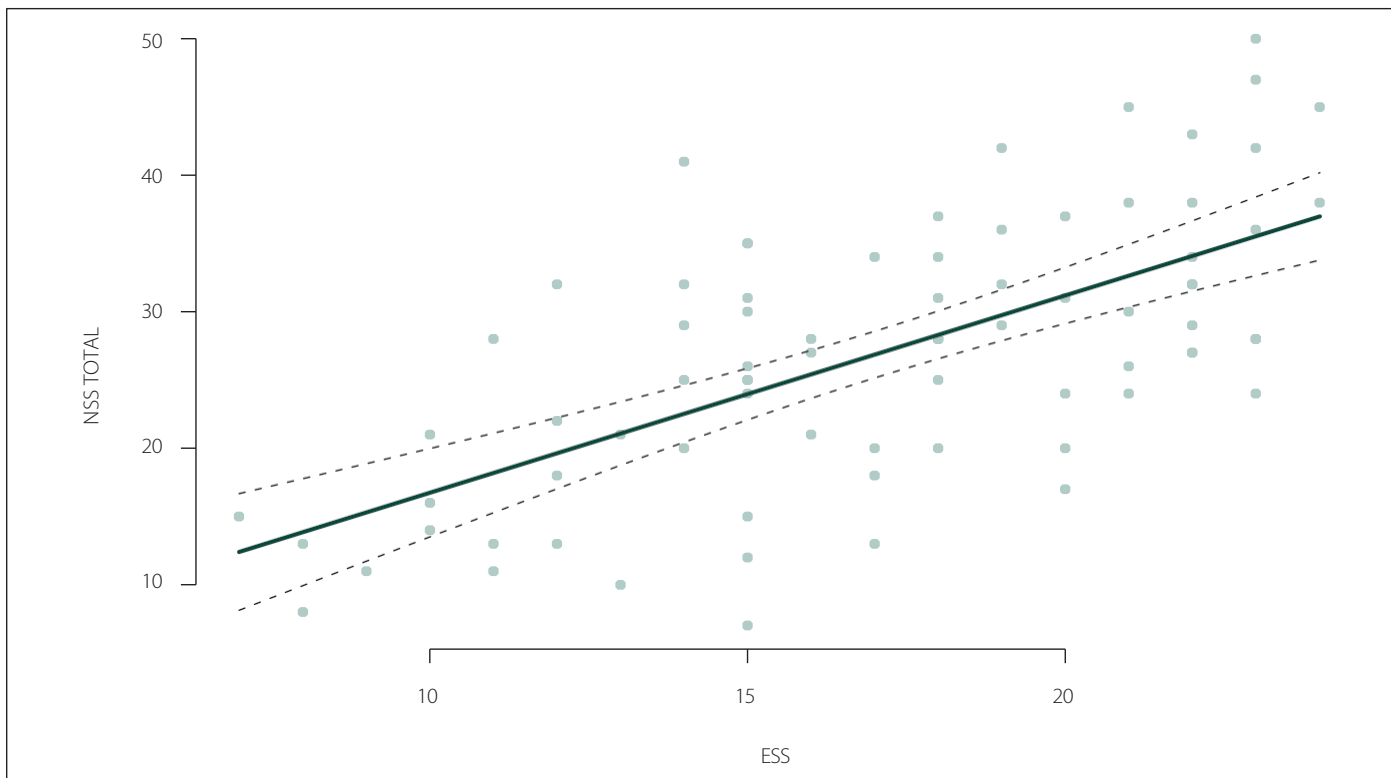


Fig. 3. Correlation between total NSS score and mean ESS score ($\rho = 0.61$; $p < 0.0001$).

ESS - Epworth Sleepiness ; NSS - Narcolepsy Severity Scale

Fig. 3. Correlation of NSS total score and ESS score ($\rho = 0.61$; $P < 0.0001$).

FSS - Epworth Sleepiness Scale; NSS - Narcolepsy Severity Scale

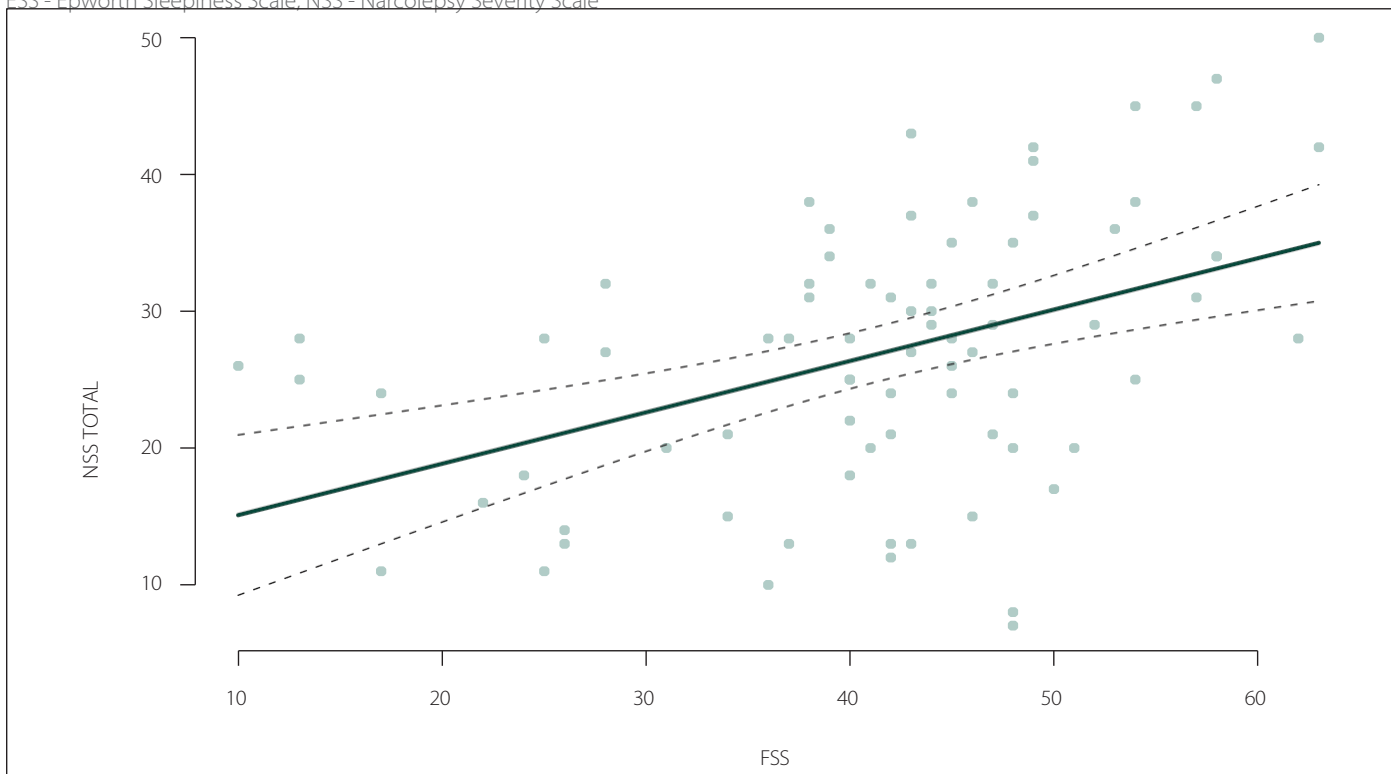


Fig. 4. Correlation between total NSS score and FSS score ($\rho = 0.4438$; $p < 0.0001$).

FSS - Fatigue Severity ; NSS - Narcolepsy Severity Scale

Fig. 4. Correlation of NSS total score and FSS score ($\rho = 0.4438$; $P < 0.0001$).

FSS - Fatigue Severity Scale; NSS - Narcolepsy Severity Scale

and the Swiss Narcolepsy Scale (SNS) appears to be a convenient and useful tool.

The NSS was also developed to reduce the effect of treatment and to optimise it. The French mid-term study as well as two follow-up studies confirm the suitability of the NSS scale for this purpose [12,18,19]. These observational cohorts included NT1 patients who completed the questionnaire 2 times, once as untreated and several months later as treated, and a decrease in the total NSS score was observed in all of these studies. Our cohort did not provide such an opportunity for paired testing. Due to the low incidence of NT1, a sufficiently large cohort of new patients could not be created in the Czech Republic in a reasonable time to be tested repeatedly. Our follow-up of treated and untreated patients predominantly remained in the moderate-symptom range. There are several reasons for the comparable NSS in the two groups. The untreated patients were mostly not at the beginning of their illness or recently diagnosed - they were who previously chosen not to take medication, usually because of the mild severity of their symptoms. In addition, most of them had the possibility of an optimal daily regimen with scheduled daily sleep and minimal emotional stimuli, which is another reason why they did not need long-term pharmacotherapy and rated their clinical condition as rather mild. The fact that sleepiness - as the main symptom of NT1 - and its other clinical manifestations were influenced by the possibility of a freer scheduling of daytime naps and prolonged nighttime sleep during the COVID-19 pandemic may also play a role. In particular, teleworkers at this time reported overall lower sleepiness intensity and fewer cataplexes [27]. Some narcoleptic symptoms may also improve as a result of lifestyle changes, identification and avoidance of exacerbating/triggering factors, and as a result of the natural progression of the disease [28-30]. The present study did not investigate the influence of pandemic on subjective perceptions of the severity of narcolepsy, but it cannot be excluded that psychosocial and economic factors associated with narcolepsy may have influenced the results of correlations of NSS with anxiety/depressive experience and self-reported quality of life. The persistence of higher NSS scores in treated patients may also have been influenced by the fact that some patients falling into the severe/very severe symptom band were not sufficiently pharmacoresponsive.

In , the NSS presents a short, internally consistent and easy-to-apply clinical tool to determine

severity of clinical symptoms of narcolepsy type 1 and their consequences. Previous studies have also demonstrated the appropriateness of its use for monitoring the effect of treatment.

Ethical aspects

The work was carried out in accordance with the Helsinki Declaration of 1975 and its revisions in 2004 and 2008. The conduct of the study was approved by the ethics committees of both departments (VFN in Prague: no. 16/19 Grant AZV VES 2020 VFN, approval date 23 May 2019 and National Institute of Mental Health, Klecany: c.j. 141/19, date of approval 19.6.2019). All patients signed an informed consent to participate in the study.

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Conflict of interest

The authors declare that they have no conflict of interest in relation to the subject of the study.

Literature

- Luca G, Haba-Rubio J, Dauvilliers Y et al. Clinical, polysomnographic and genome-wide association analyses of narcolepsy with cataplexy: a European Narcolepsy Network study. *J Sleep Res* 2013; 22(5): 482-495. doi: 10.1111/jsr.12044.
- Longstreth WT Jr, Koepsell TD, Ton TG et al. The epidemiology of narcolepsy. *Sleep* 2007; 30(1): 13-26. doi: 10.1093/sleep/30.1.13.
- Liblau RS, Vassalli A, Seifinejad A et al. Hypocretin (orexin) biology and the pathophysiology of narcolepsy with cataplexy. *Lancet Neurol* 2015; 14(3): 318-328. doi: 10.1016/S1474-4422(14)70218-2.
- American Academy of Sleep Medicine. International classification of sleep disorders - third edition (ICSD-3). Darien, IL: American Academy of Sleep Medicine 2014.
- Bassetti CLA, Adamantidis A, Burdakov D et al. Narcolepsy - clinical spectrum, aetiopathophysiology, diagnosis and treatment. *Nat Rev Neurol* 2019; 15(9): 519-539. doi: 10.1038/s41582-019-0226-9.
- Zhang Z, Dauvilliers Y, Plazzi G et al. Idling for decades: a European study on risk factors associated with the delay before a narcolepsy diagnosis. *Nat Sci Sleep* 2022; 14: 1031-1047. doi: 10.2147/NSS.S359980.
- Ohayon MM. Narcolepsy is complicated by high medical and psychiatric comorbidities: a comparison with the general population. *Sleep Med* 2013; 14(6): 488-492. doi: 10.1016/j.sleep.2013.03.002.
- Kallweit U, Schmidt M, Bassetti CL. Patient-reported measures of narcolepsy: the need for better assessment. *J Clin Sleep Med* 2017; 13(5): 737-744. doi: 10.5664/jcsm.6596.
- Akerstedt T, Gillberg M. Subjective and objective sleepiness in the active individual. *Int J Neurosci* 1990; 52(1-2): 29-37. doi: 10.3109/00207459008994241.
- MacLean AW, Fekken GC, Saskin P et al. Psychometric evaluation of the Stanford Sleepiness Scale. *J Sleep Res* 1992; 1(1): 35-39. doi: 10.1111/j.1365-2869.1992.tb00006.x.
- Dauvilliers Y, Beziat S, Pesenti C et al. Measurement of narcolepsy symptoms: the Narcolepsy Severity Scale. *Neurology* 2017; 88(14): 1358-1365. doi: 10.1212/WNL.0000000000003787.
- Dauvilliers Y, Barateau L, Lopez R et al. Narcolepsy Severity Scale: a reliable tool assessing symptom sever-

ity and consequences. *Sleep* 2020; 43(6): zsa009. doi: 10.1093/sleep/zsa009.

13. Pimentel Filho LH, Frange C, Coelho FMS. Narcolepsy Severity Scale: experience of a Brazilian Sleep Center. *Sleep* 2020; 43(9): zsa113. doi: 10.1093/sleep/zsa113.

14. Johns MW. A new method for measuring daytime sleepiness: the Epworth sleepiness scale. *Sleep* 1991; 14(6): 540-545. doi: 10.1093/sleep/14.6.540.

15. Hjollund NH, Andersen JH, Bech P. Assessment of fatigue in chronic disease: a bibliographic study of fatigue measurement scales. *Health Qual Life Outcomes* 2007; 5: 12. doi: 10.1186/1477-7525-5-12.

16. Ware JE Jr, Gandek B. Overview of the SF-36 health survey and the International Quality of Life Assessment (IQOLA) project. *J Clin Epidemiol* 1998; 51(11): 903-912. doi: 10.1016/s0895-4356(98)00081-x.

17. Zigmund AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand* 1983; 67(6): 361-370. doi: 10.1111/j.1600-0447.1983.tb09716.x.

18. Li C, Spruyt K, Zhang C et al. Reliability and validity of the Chinese version of Narcolepsy Severity Scale in adult patients with narcolepsy type 1. *Sleep Med* 2021; 81: 86-92. doi: 10.1016/j.sleep.2021.02.008.

19. Pimentel Filho LH, Gomes ACD, Frange C et al. Validation of the Brazilian Portuguese version of the narcolepsy severity scale. *Sleep Med* 2020; 76: 134-139. doi: 10.1016/j.sleep.2020.10.016.

20. Ohayon MM, Ferini-Strambi L, Plazzi G et al. Frequency of narcolepsy symptoms and other sleep disorders in narcoleptic patients and their first-degree relatives. *J Sleep Res* 2005; 14(4): 437-445. doi: 10.1111/j.1365-2869.2005.00476.x.

21. Frauscher B, Ehrmann L, Mitterling T et al. Delayed diagnosis, range of severity, and multiple sleep comorbidities: a clinical and polysomnographic analysis of 100 patients of the Innsbruck narcolepsy cohort. *J Clin Sleep Med* 2013; 9(8): 805-812. doi: 10.5664/jcsm.2926.

22. Kendzerska TB, Smith PM, Brignardello-Petersen R et al. Evaluation of the measurement properties of the Epworth sleepiness scale: a systematic review. *Sleep Med Rev* 2014; 18(4): 321-331. doi: 10.1016/j.smrv.2013.08.002.

23. Sturzenegger C, Bassetti CL. The clinical spectrum of narcolepsy with cataplexy: a reappraisal. *J Sleep Res* 2004; 13(4): 395-406. doi: 10.1111/j.1365-2869.2004.00422.x.

24. Wing YK, Li RH, Ho CK et al. A validity study of Ullanlinna Narcolepsy Scale in Hong Kong Chinese. *J Psychosom Res* 2000; 49(5): 355-361. doi: 10.1016/s0022-3999(00)00179-3.

25. Hublin C, Kaprio J, Partinen M et al. The Ullanlinna Narcolepsy Scale: validation of a measure of symptoms in the narcoleptic syndrome. *J Sleep Res* 1994; 3(1): 52-59. doi: 10.1111/j.1365-2869.1994.tb00104.x.

26. Anic-Labat S, Guilleminault C, Kraemer HC et al. Validation of a cataplexy questionnaire in 983 sleep-disorders patients. *Sleep* 1999; 22(1): 77-87. doi: 10.1093/sleep/22.1.77.

27. Nigam M, Hippolyte A, Dodet P et al. Sleeping through a pandemic: impact of COVID-19-related restrictions on narcolepsy and idiopathic hypersomnia. *J Clin Sleep Med* 2022; 18(1): 255-263. doi: 10.5664/jcsm.9556.

28. Zhang J, Han F. Sleepiness in narcolepsy. *Sleep Med Clin* 2017; 12(3): 323-330. doi: 10.1016/j.jsmc.2017.03.008.

29. Pizza F, Franceschini C, Peltola H et al. Clinical and polysomnographic course of childhood narcolepsy with cataplexy. *Brain* 2013; 136(Pt 12): 3787-3795. doi: 10.1093/brain/awt277.

30. Kovalská P, Kemlink D, Topinková E et al. Higher body mass index in narcolepsy with cataplexy: life-long experience. *Sleep Med* 2017; 32: 277. doi: 10.1016/j.sleep.2016.11.010.