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A case-control study of sexualised behaviour in sleep: A strong association with psychiatric comorbidity and relationship difficulties



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ABSTRACT

Sexualised behaviour in sleep (SBS) is a relatively rare parasomnia consisting of instinctive behaviours of a sexual nature occurring during non-rapid-eye movement (NREM) sleep. Little information exists at present regarding the clinical features and onset of this condition as well as its link to psychiatric comorbidity, other sleep disorders and history of adverse early life experience. Aims were to typify the condition further and compare features of SBS patients to those with other NREM parasomnias.

Methods: Details of 335 consecutive patients presenting to a single tertiary sleep centre with non-rapid eye movement (NREM)-parasomnias over a 15-year period (2005–2020) were examined. Data were collated by reviewing case-notes for anthropometric data, past medical history, clinical findings, and video polysomnography. SBS patients were compared to a cohort of 270 non-SBS, NREM-sleep disorder patients (case-control) to ascertain whether they had any distinguishing features from other parasomnias classified in this group.

Results: Sixty-five patients with SBS were identified: 58 males, 7 females (comprising 19.4% of the cohort overall). Mean age at presentation was 33(±9.5) years. Onset of behaviours was commoner in adulthood in the SBS cohort, whereas non-SBS, NREM-parasomnia onset (n = 270) was commoner in childhood: 61.1% and 52.9% respectively (p = 0.007). An association was identified between the presence of psychiatric diagnoses and onset of SBS (p = 0.028). Significant triggers for SBS behaviours included alcohol consumption (p < 0.001), intimate relationship difficulties (p = 0.009) and sleep deprivation (p = 0.028). Patients with SBS were significantly more likely to report sleepwalking as an additional NREM behaviour (p < 0.001). Males were more likely to present at clinic together with their bedpartner and females presented alone. A history of SBS appeared to be more common in those working in the armed forces or the police compared to those presenting with non-SBS, NREM-parasomnias (p = 0.004).

Conclusions: SBS is more common in clinical practice than previously described and presents with some distinguishing features within the NREM disorder category. This study is the first to identify that onset in childhood or lack of amnesia does not preclude the condition and that patterns of presentation differ between men and women. Sleepwalkers particularly should be asked about SBS. Comorbid psychiatric conditions, profession and intimate partner difficulties are strong determinants of the presentation.

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1. Introduction

Sexual behaviour during sleep (SBS) has been described as a distinct variant of sleepwalking, occurring during NREM sleep and during sleep-wake transitional states [1]. It was first described in 1986 and has attracted attention due to its potential medico-legal

implications within common-law jurisdictions [2,3]. SBS is classified primarily as a confusional arousal by the ICSD-3 and comprises of instinctive behaviours of a sexual nature arising from NREM sleep [4]. A confusional arousal occurs when an individual is neither in a state of deep sleep nor in REM sleep, however, has not yet attained full consciousness [4]. Some studies suggest that SBS should not be categorised as a variant of confusional arousal due to several pertinent differences. One such difference is the widespread autonomic activation associated with sexual arousal including: erection, vaginal lubrication or ejaculation [4].

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Individuals with SBS engage or attempt to engage in sexual intercourse or sexual behaviour, often in inappropriate ways. This behaviour may include masturbation, attempting sexual activity with a bedpartner, or sexual vocalisation [5,6]. The individual with SBS is reported not be conscious of this behaviour and often has limited/no recall the following morning [5,6]. Several recent publications on SBS have documented co-morbid sleep disorders [5,7,8], epilepsy [9], and psychological and employment factors playing a role in the manifestation of this parasomnia [10,11], but these have comprised largely single case-reports, small cohorts or reviews of cases published in the literature. The only case-control study to date of SBS patients from a single centre, compared 17 subjects to 'normal' controls and sleepwalkers [12].

In this study, we aimed to describe the clinical features of 65 patients presenting to a single tertiary referral sleep clinic with a history of sexual behaviours during sleep in comparison to patients without SBS but with other NREM-parasomnias to ascertain whether there were any specific differences between the groups. We hypothesized that people with a prior psychiatric history or history of adverse early life experiences would be more likely to manifest SBS. We also hypothesized that SBS would be more common in those with other comorbid sleep disorders and that there would be differences in the presentation between males and females since SBS is reported rarely in the latter.

2. Methods

This study comprised of a retrospective cohort of 335 patients sequentially referred to a single tertiary referral sleep centre in Scotland with suspected NREM parasomnias between 2005 and 2020. Information regarding each patient was collated by reviewing clinical case-notes and overnight video polysomnography (vPSG) as part of a service evaluation. Each patient was formally diagnosed with one or more NREM parasomnias according to the ICSD-3 classification [4]. The ICSD-3 criteria do not require vPSG for diagnosis although it can be used to provide corroborative evidence in support of the diagnosis [4]. General diagnostic criteria for NREM parasomnias include recurrent episodes of incomplete awakening from sleep, inappropriate or absent responsiveness to efforts of others to intervene or redirect the person during the episode, limited or no associated cognition, partial or complete amnesia for the episode, and episodes unable to be explained by any other sleep disorder, mental disorder, medical condition, medication, or substance use [4].

Where a history of psychological trauma was recorded, it was graded by age at occurrence. Traumatic experience was defined as bearing witness to "a stressful event or situation (of either brief or long duration) of an exceptionally threatening or catastrophic nature, which is likely to cause pervasive distress in almost anyone" [13]. Patients were judged to have a psychiatric disorder on the basis of a diagnosis made by a health professional using the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) [14]. Psychiatric disorders were included in analyses on the basis of the individual ever being diagnosed.

Only anonymized, secondary data derived from standard clinical practice were used and the entire dataset was de-identified prior to analysis and presented in aggregated format. All research conformed to the Declaration of Helsinki [15]. Caldicott approval was in place for the data used in this study (Caldicott Application 2176; 03/08/2021) [16] which form part of the Sleep Centre database overall used for service evaluation. The inclusion criteria to this database are a diagnosis of a sleep disorder/s in accordance with ICSD-3 criteria [4] and includes all current categories. Functional disorders and suspected nocturnal dissociation are kept in a separate database. These latter patient categories were not included in the study. In total, 329 patients (98.2%) diagnosed with NREM-

parasomnias had a nocturnal video-polysomnogram (vPSG) and all 335 patients were seen and diagnosed by experienced sleep clinicians. STROBE guidelines were consulted in the writing of the manuscript [17].

2.1. Subjects with SBS and NREM-parasomnias

Sixty-five patients with a primary diagnosis of SBS (diagnosed in accordance with ICSD-3 guidelines [4]) and 270 non-SBS, NREM-parasomnia patients were identified from the Sleep Centre database between 2005 and 2020. In addition to their diagnosis, the database contained anthropometric characteristics, comorbid diagnoses, medications, vPSG data and long-term follow-up data entered after each consultation. Ninety-five percent of patients identified as white. Confusional arousals were difficult to elicit historically due to amnesia and unclear descriptions by patients. No patients had a history of nocturnal seizures, epilepsy or sleep hypermotor epilepsy. All patients had been diagnosed on the basis of ICSD-3 criteria and reviewed by a sleep physician [4]. No patients with a primary diagnosis of nocturnal dissociation were included in this study as it is not considered to be a separate parasomnia in the current ICSD-3 classification [4]. Additionally, nocturnal dissociation is extremely difficult to capture on vPSG and clinical suspicion is insufficient to confirm it without further evidence.

2.2. Video-polysomnography (vPSG)

All patients in this study with non-SBS, NREM-parasomnias and fifty-nine of sixty-five SBS patients (90.7%) underwent overnight vPSG studies using the Compumedics™ system, ProFusion PSG 4 and previous iterations of the software in the sleep medicine laboratory. All vPSG features were scored manually by registered sleep physiologists, using AASM guidelines noting all relevant features [18]. Older studies were reviewed in the context of current guidelines and rescored if necessary. Abnormal behaviours arising out of sleep were recorded using video and described. Studies were undertaken on one night only; the centre does not use sleep deprivation protocols. No patients were taking medication known to suppress NREM sleep, e.g., benzodiazepines. The presence of arousals out of NREM, demonstrating behaviour consistent with a NREM parasomnia, was noted, and used to support the diagnosis.

2.3. Statistical analysis

Statistical analysis was performed using IBM SPSS (Version 25.0. Armonk, NY: IBM Corp.). Continuous data are presented as mean \pm SD or frequencies or as percentage of total patients (with a particular characteristic), as appropriate. Categorical variables were analysed using Chi-squared or Fisher's Exact test. Continuous variables were assessed for normality using the Shapiro-Wilks test; continuous variables were then analysed using the Student's t-test when assumptions of normality were met or the Mann-Whitney *U* test when these assumptions were not met. The Holm correction was deployed in the context of multiple comparisons. Effect sizes were calculated for all significant chi-squared tests using Phi (Φ) coefficient (2×2 table) or Cramer's V (CV) (larger than 2×2 table). Effect sizes were considered to show weak association between 0.10 and 0.20, moderate association between 0.20 and 0.40 and strong association above 0.40 [19]. All tests were two-tailed, and significance was set at $p \leq 0.05$.

3. Results

Of the SBS patients presenting over a 15-year period, 58 were male and 7 females. At the time of diagnosis, the mean age of SBS

patients was 33.0 (±9.5) years, and SBS was the main reason for referral in all patients (see Table 1). Six of seven female patients presented to the clinician alone (without their partner/spouse/family member in the examination room), whereas only 15 men did so.

3.1. Clinical features

All patients engaged in sexual behaviour consistent with their sexual orientation. Of this cohort, only 3 patients self-identified as homosexual.

One female patient described sexual behaviour during sleep commencing at age seven years when her parents found her rubbing her teddy bear against her genitals. Though this could be considered typical developmental behaviour; she identified this as being strongly associated with her presentation with SBS. One male patient fondled his sister's female friends whilst asleep, from the age of eight years. One male developed SBS at the age of 44 years and one female patient developed SBS at age 56 years in the context of severe distress when providing intimate care for her father with severe dementia.

Twenty-two patients (19 male; 3 female) (53.7%) described their sexual behaviour in sleep occurring more frequently than once per week, whereas 16 patients (16 male; 0 female) (39%) reported behaviours occurring only a few times a month.

Table 2 and 3 compares the clinical characteristics of patients with SBS and non-SBS, NREM-parasomnias. Thirty-three patients (61.1%) described their SBS beginning in early adulthood, whereas the majority of non-SBS, NREM-parasomnia patients (143; 52.9%) described the onset of their behaviours in childhood. No patients described SBS behaviours as pleasurable. Both SBS and non-SBS,

NREM-parasomnia groups described their respective behaviours as distressing. Non-SBS, NREM-parasomnias caused more distress to the individual themselves, whereas SBS was reported to cause significantly more distress to the individual's bedpartner (see Table 2).

3.2. Precipitating factors for nocturnal behaviours

Seventeen patients (30.4%) described their SBS as being exacerbated by alcohol consumption, significantly more so than the non-SBS cohort ($p < 0.001$). Quantification of amount consumed was not consistently reported but those with worsening of their behaviour tended to report this as a consequence of drinking to excess. Six patients (10.7%) in the SBS cohort reported relationship difficulties as being a trigger for their SBS behaviours, significantly more than the non-SBS, NREM-parasomnia cohort (eight; 3%). Sleep deprivation was reported to be a significant trigger for SBS, with twelve patients (21.4%) reporting it worsened SBS behaviour (non-significant after correction for multiple comparisons).

3.3. Comorbid disorders in SBS

Thirty-two SBS patients (57.1%) reported concomitant psychiatric diagnoses in their medical history. Eleven patients (21.6%) with SBS also reported problematic relationships, compared to twenty-seven non-SBS patients (10%), as displayed in Table 4.

Twenty-four SBS patients (22 male; 2 female) (37%) reported other co-morbid parasomnias. Three or more co-morbid sleep disorders were present in 23% of SBS patients (14 male; 1 female). Patients with SBS were significantly more likely to report sleep-walking as a co-morbid NREM-parasomnia, in comparison to

Table 1
Characteristics of the SBS cohort.

Characteristic	Male (n = 58)	Female (n = 7)	p-value
Age (years) (min-max)	33.09 ± 8.7 (15–66)	32.3 ± 15.2 (20–34)	0.83
BMI (kg/m ²)	27.6 ± 6.3 (42)	26.0 ± 5.6 (5)	0.61
ESS (n/24)	9.14 ± 5.1 (35)	7.7 ± 2.1 (3)	0.62
Smoker (n/T, %)	Non-smoker	3 (42.9%) (7)	0.28
	Smoker	16 (27.6%) (45)	4 (57.1%) (7)
Caffeine use (n/T, %)	22/43 (37.9%)	3/6 (42.9%)	0.96
Alcohol use (n/T, %)	No	4/6 (57.1%)	0.27
	Occasionally	2/6 (28.6%)	
	Regularly	0/6 (0%)	
	Separated	0/5 (0%)	
Marital status (n/T, %)	Single	4/5 (57.1%)	0.19
	Married	21/42 (36.2%)	1/5 (14.3%)
	Divorced	2/42 (3.4%)	0/5 (0%)
	Separated	1/42 (1.7%)	0/5 (0%)
Shift worker (n/T, %)	6/42 (10.3%)	1/5 (14.3%)	0.88
Anxiety disorder (n/T, %)	17/42 (29.3%)	4/6 (57.1%)	0.24
Depression (n/T, %)	16/42 (27.6%)	3/6 (42.9%)	0.59
Suicide attempt/ideation (n/T, %)	4/42 (6.9%)	1/6 (14.3%)	0.60
Self-harm (n/T, %)	1/42 (1.7%)	0/7 (0%)	0.71
PTSD (n/T, %)	6/42 (10.3%)	0/6 (0%)	0.33
Problematic intimate relationships (n/T, %)	9/42 (15.5%)	1/6 (14.3%)	0.80
Stress (n/T, %)	24/42 (41.4%)	3/6 (42.9%)	0.75
Army or police officer (n/T, %)	6/42 (10.3%)	1/6 (14.3%)	0.33
Victim of assault (n/T, %)	4/42 (6.9%)	1/6 (14.3%)	0.60
Trauma any (n/T, %)	12/42 (20.7%)	1/6 (14.3%)	0.55
Age at which trauma was experienced (n/T, %)	Childhood	7/12 (12.1%)	1/6 (14.3%)
	Adulthood	5/12 (8.6%)	0/6 (0%)
Chronic pain (n/T, %)	3/42 (5.2%)	1/6 (14.3%)	0.44
Chronic fatigue (n/T, %)	1/42 (1.7%)	0/6 (0%)	0.71
Abortion (F) (n/T, %)	n/a	1/6 (14.3%)	n/a
Miscarriage (F) v	n/a	1/6 (14.3%)	n/a

Abbreviations: SBS = sexualised behaviour in sleep, NREM = non-rapid eye movement sleep; SD = standard deviation, BMI = body mass index, kg = kilograms, m = meters, ESS = Epworth sleepiness scale, PTSD = Post-Traumatic Stress Disorder.

The information is presented as: n/T where n is the number of patients with the characteristic and T is the total number of patients within each group for whom information was available regarding that characteristic.

Table 2
Comparison of clinical features between patients with SBS and non-SBS, NREM-parasomnias.

		SBS (n = 65)	Non-SBS, NREM- parasomnia (n = 270)	p-value
Age of onset (n/T, %)	Childhood	18/54 (33.3%)	143/270 (52.9%)	0.007*
	Adolescence	3/54 (5.5%)	23/270 (8.5%)	
	Adulthood	33/54 (61.1%)	98/270 (36.3%)	
Family history of SWS parasomnia (n/T, %)		13/51 (25.5%)	87/270 (32.2%)	0.41
Occurrence in early part of sleep (n/T, %)		14/55 (25.5%)	106/270 (39.3%)	0.05
Number of behaviours (n/T, %)	Single	11/54 (20.4%)	60/257 (23.3%)	0.64
	Multiple	43/54 (79.6%)	197/257 (76.7%)	
Duration of disorder (n/T, %)	<1 year	7/53 (13.2%)	26/249 (10.4%)	0.31
	1–5 years	10/53 (18.9%)	36/249 (14.5%)	
	5–10 years	11/53 (20.8%)	35/249 (14.1%)	
	>10 years	25/53 (47.2%)	152/249 (61%)	
Behaviour frequency (n/T, %)	<1/month	4/44 (9.1%)	30/227 (13.2%)	0.25
	1/month – 1/week	16/44 (36.4%)	56/227 (24.7%)	
	>1/week	24/44 (54.5%)	141/227 (62.1%)	
Greater distress to: (n/T, %)	Self	13/47 (27.7%)	123/226 (54.4%)	0.003**
	Partner	9/47 (19.1%)	22/226 (9.7%)	
	Self and partner	25/47 (53.2%)	81/226 (35.8%)	
Amnesia after behaviour (n/T, %)	Aware	3/49 (6.1%)	7/216 (3.2%)	0.31
	Partial amnesia	9/49 (18.4%)	59/216 (27.3%)	
	Full amnesia	37/49 (75.5%)	150/216 (69.4%)	

Abbreviations: SBS = sexualised behaviour in sleep, SWS = slow-wave sleep; NREM = non-rapid eye movement sleep; df = degrees of freedom; CV = Cramer's V; χ^2 = chi-square; p = p-value; Φ = phi coefficient.

The information is presented as: n/T where n is the number of patients with the characteristic and T is the total number of patients within each group for whom information was available regarding that characteristic.

* χ^2 = 12.04, df = 2, p = 0.007, CV = 0.193.

** χ^2 = 11.65, df = 2, p = 0.003, CV = 0.207.

Table 3
Triggers for patients with SBS and non-SBS, NREM-parasomnia behaviours.

Triggers (n/T, %)	SBS	Non-SBS NREM-parasomnia	p-value
Stress (n/T, %)	30/56 (53.6%)	131/270 (48.5%)	0.49
Better with alcohol (n/T, %)	3/56 (5.4%)	37/270 (13.7%)	0.08
Worse with alcohol (n/T, %)	17/56 (30.4%)	15/270 (5.5%)	<0.001*
Relationship difficulties (n/T, %)	6/56 (10.7%)	8/270 (3.0%)	0.009**
Pregnancy (n/T, %)	1/56 (1.8%)	12/270 (4.4%)	0.36
Menstrual cycle (n/T, %)	1/56 (1.8%)	6/270 (2.2%)	0.84
Sleep deprivation (n/T, %)	12/56 (21.4%)	29/270 (10.7%)	0.03***
Sleep in a foreign environment (n/T, %)	2/56 (3.6%)	15/270 (5.5%)	0.54
External environmental noise (n/T, %)	0/56 (0%)	3/270 (1.1%)	0.43
Recreational drug use (n/T, %)	1/56 (1.8%)	2/270 (0.7%)	0.46
Medication (n/T, %)	0/56 (1.8%)	1/270 (0.4%)	0.65

Abbreviations: SBS = sexualised behaviour in sleep; NREM = non-rapid eye movement sleep; df = degrees of freedom; CV = Cramer's V; χ^2 = chi-square; p = p-value; Φ = phi coefficient.

The information is presented as: n/T where n is the number of patients with the characteristic and T is the total number of patients within each group for whom information was available regarding that characteristic.

* χ^2 = 32.23, df = 1, p = 1.3711E-8, Φ = 0.314.

** χ^2 = 6.78, df = 1, p = 0.009, Φ = 0.144.

*** χ^2 = 4.82, df = 1, p = 0.028, Φ = 0.122.

patients without SBS, who were more likely to experience night terrors. Table 5 summarizes the data.

3.4. Treatment of SBS

Forty SBS patients and 206 non-SBS, NREM-parasomnia patients took medication to treat their disorder. The most common medication prescribed for both groups was clonazepam with 47.1% of SBS patients and 47.8% of non-SBS NREM-parasomnia patients trialing this. Within the SBS cohort, zopiclone was the medication found to be most effective in reducing the frequency and severity of the disorder, with 83.3% of patients using it reporting improvement. However, the comparisons did not reach statistical significance. Three SBS patients no longer considered their behaviors problematic once they separated from their partners. Tables 6 and 7 show treatment options and effect in both cohorts.

3.5. Polysomnography in SBS

Fifty-nine SBS patients (91%) underwent overnight vPSG; only 1 patient (male) demonstrated some sexual behaviour during the night arising directly out of SWS. One female patient refused to undergo a sleep study, and five males did not have a vPSG (reason unknown). The majority of vPSG results were normal, displaying no significant abnormalities, good sleep efficiency, and normal sleep stage distribution. Nine patients (14%) had evidence of significant sleep disordered breathing (AHI \geq 15). (data not shown).

4. Discussion

The novelty of this study lies in it being the largest review of patients presenting primarily with SBS from a single sleep centre, bringing new insights into the variability of presentation (from childhood into older age), the importance of interpersonal issues

Table 4
Comparison of psychiatric comorbidity and traumatic experiences in SBS and non-SBS, NREM-parasomnia cohorts.

	SBS (n = 56)	Non-SBS, NREM-parasomnia (n = 270)	p-value
<i>Psychiatric co-morbidity (n/T, %)</i>			
Any psychiatric comorbidity (n/T, %)	30/51 (58.8%)	111/270 (41.1%)	0.03*
Depression (n/T, %)	20/51 (39.2%)	110/270 (40.7%)	0.84
Anxiety disorder (n/T, %)	23/51 (45.1%)	109/270 (40.4%)	0.53
Self-harm (n/T, %)	1/51 (2.0%)	8/270 (3.0%)	1.00
Chronic fatigue (n/T, %)	2/56 (3.9%)	1/270 (0.4%)	0.012**
<i>Traumatic experiences (n/T, %)</i>			
Abortion (n/T, %)	1/51 (2.0%)	9/270 (3.3%)	1.00
Miscarriage (n/T, %)	2/51 (3.9%)	3/270 (1.1%)	0.18
Victim of assault (n/T, %)	5/51 (9.8%)	21/270 (7.8%)	0.58
Army or police officer (n/T, %)	6/51 (11.8%)	6/270 (2.2%)	0.004#
PTSD, formally diagnosed (n/T, %)	6/51 (11.8%)	13/270 (4.8%)	0.10
Trauma any (n/T, %)	16/51 (31.4%)	90/270 (33.3%)	0.76
Trauma age occurred (n/T, %)			
Childhood	10/51 (19.6%)	60/270 (22.2%)	0.75
Adult	6/51 (11.8%)	30/270 (11.1%)	
Severe	13/51 (25.5%)	70/270 (25.9%)	
Problematic intimate relationship (n/T, %)	11/51 (21.6%)	27/270 (10.0%)	0.02##

Abbreviations: SBS = sexualised behaviour in sleep, NREM = non-rapid eye movement sleep, PTSD = post-traumatic stress disorder; df = degrees of freedom; CV = Cramer's V; χ^2 = chi-square; p = p-value; Φ = phi coefficient.

The information is presented as: n/T where n is the number of patients with the characteristic and T is the total number of patients within each group for whom information was available regarding that characteristic.

* χ^2 = 4.84, df = 1, p = 0.028, Φ = 0.122.

** χ^2 = 6.32, df = 1, p = 0.012, Φ = 0.245.

χ^2 = 8.14, df = 1, p = 0.004, Φ = 0.279.

χ^2 = 5.5, df = 1, p = 0.019, Φ = 0.131.

Table 5
Comparison of comorbid sleep disorders, sleep phenomena and parasomnias between SBS and non-SBS, NREM-patients.

	SBS (n = 56)	Non-SBS, NREM- parasomnia (n = 270)	p-value
Overlap parasomnia (n/T, %)	1/56 (1.8%)	13/270 (4.8%)	0.31
Insomnia (n/T, %)	1/56 (1.8%)	10/270 (3.7%)	0.60
Bruxism (n/T, %)	2/56 (3.6%)	13/270 (4.8%)	
Obstructive Sleep Apnea (n/T, %)	9/56 (16.1%)	28/270 (10.4%)	
Restless Leg Syndrome (n/T, %)	1/56 (1.8%)	6/270 (2.2%)	
Sleep walking (n/T, %)	26/56 (46.4%)	217/270 (80.4%)	<0.001*
Sleep talking (n/T, %)	26/56 (46.4%)	133/270 (49.3%)	0.70
Sleep eating (n/T, %)	4/56 (7.1%)	26/270 (9.6%)	0.56
Night terrors (n/T, %)	14/56 (25%)	145/270 (53.7%)	<0.001**
Vivid dream mentation/nightmares (n/T, %)	12/56 (21.4%)	94/270 (34.8%)	0.05
Sleep paralysis (n/T, %)	5/56 (8.9%)	26/270 (9.6%)	0.87
Violence in sleep (n/T, %)	15/56 (26.8%)	92/270 (34.1%)	0.67

SBS = sexualised behaviour in sleep, NREM = non-rapid eye movement sleep; df = degrees of freedom; CV = Cramer's V; χ^2 = chi-square; p = p-value; Φ = phi coefficient. The information is presented as: n/T where n is the number of patients with the characteristic and T is the total number of patients within each group for whom information was available regarding that characteristic.

* χ^2 = 28.18, df = 1, p = 7.684E-7, Φ = 0.294.

** χ^2 = 15.29, df = 1, p = 0.000092, Φ = 0.217.

Table 6
Treatment options sought by SBS and non-SBS, NREM-parasomnia patients.

	SBS (n = 51)	non-SBS NREM- parasomnia (n = 270)	p-value
CBT (n/T, %)	5/51 (9.8%)	17/270 (6.3%)	0.37
Counselling (n/T, %)	6/51 (11.8%)	30/270 (11.1%)	0.89
Neuropsychological review (n/T, %)	1/51 (2.0%)	13/270 (4.8%)	0.71
Psychiatrist (n/T, %)	6/51 (11.8%)	31/270 (11.5%)	0.95
Hypnosis (n/T, %)	2/51 (3.9%)	3/270 (1.1%)	0.18
Medication (n/T, %)	40/51 (78.4%)	206/270 (76.3%)	0.74
Number of medications taken	1.7 ± 1.7 (N = 49)	1.8 ± 1.9 (N = 268)	0.96

Abbreviations: SBS = sexualised behaviour in sleep, NREM = non-rapid eye movement sleep, CBT = cognitive behavioural therapy.

The information is presented as: n/T where n is the number of patients with the characteristic and T is the total number of patients within each group for whom information was available regarding that characteristic.

with the sexual partner, the role of childhood trauma/abuse and brings to the fore the role that alcohol can play in worsening SBS which is important from a medico-legal standpoint.

Currently, there is little epidemiological information available

regarding SBS in the medical literature. A widely cited but non-validated, internet survey on a reference website for SBS collected 219 responses from those with self-identified sexualised behaviour in sleep and suggested that 92% or reports had multiple episodes of

Table 7
Medication effect in SBS and non-SBS, NREM-parasomnia patients.

	SBS (n = 51)	Non-SBS, NREM- parasomnia (n = 270)	p-value
Amitriptyline	8/51 (15.7%)	28/270 (10.4%)	0.27
Improvement	2/8 (25.0%)	7/28 (25.0%)	1.00
No effect on behaviour	3/8 (37.5%)	10/28 (35.7%)	
Sertraline	5/51 (9.8%)	36/270 (13.3%)	0.49
Improvement	3/5 (60.0%)	18/36 (50.0%)	0.32
No effect on behaviour	1/5 (20.0%)	1/36 (2.8%)	
Melatonin	5/51 (9.8%)	37/270 (13.7%)	0.45
Improvement	1/5 (20.0%)	20/37 (54.1%)	0.27
No effect on behaviour	2/5 (40.0%)	9/37 (24.3%)	
Clonazepam	24/51 (47.1%)	129/270 (47.8%)	0.93
Improvement	12/24 (50.0%)	65/129 (50.4%)	1.00
No effect on behaviour	3/24 (12.5%)	17/129 (13.2%)	
Zopiclone	6/51 (11.8%)	32/270 (11.9%)	0.99
Improvement	5/6 (83.3%)	13/32 (40.6%)	0.55
No effect on behaviour	0/6 (0.0%)	5/32 (15.6%)	

Abbreviations: SBS = sexualised behaviour in sleep, NREM = non-rapid eye movement sleep; n/a = not applicable.

The information is presented as: n/T where n is the number of patients with the characteristic and T is the total number of patients within each group for whom information was available regarding that characteristic.

SBS, with sexual intercourse during sleep being reported by 48% of respondents [20]. Most respondents (69%) were male, and 80% self-identified as heterosexual [20].

Our study suggests SBS is more common than initially thought, accounting for 19.4% of all NREM-parasomnias presenting to a large tertiary sleep clinic over a 15-year period. Our results also show that SBS is more common in males as has previously been documented [12]. Nevertheless, females were just as likely to report aggressive sexualised behaviour as males in this study. Females also displayed a higher rate of abusive behaviours towards a partner. We speculate that violent sexual behaviours in females may have been tolerated longer by male bed partners before presentation or could be ascribed to lower health-seeking behaviours in men. In one study, men on average presented to healthcare 32% less frequently than women [21], suggesting that men may be more reluctant to seek medical attention especially due to the sensitive nature of SBS behaviours. In our experience, female patients independently initiated contact with tertiary healthcare, whereas most male patients were prompted to do so by their partners. When questioned as to whom the patient's sleep disorder behaviours caused most distress, SBS patients reported significantly more distress to their bed partner compared with the non-SBS, NREM-parasomnia cohort who reported more self-distress. This is salient to the interpersonal difficulties reported by SBS sufferers.

A previous review by Schenck et al. of sleep-related disorders and abnormal sexual behaviours noted amnesia or impaired recall was present in 100% of SBS cases [22]. This was not evident in our study. Of forty-nine patients who were directly questioned about their recall of the behaviour, thirty-seven patients (75.5%) reported full amnesia whilst nine (18.4%) and three (6.1%) patients respectively reported partial amnesia or full awareness of the event. These patients woke either during masturbation or penetrative intercourse and experienced recall of the event either immediately or a short time later. This is an important finding as it suggests a lack of recall or memory of the event is not diagnostic of SBS arising out of SWS. In the context of the high prevalence of psychiatric disorders and adverse life events within the SBS cohort, it could also be postulated that impaired recall in some cases might be related to dissociative episodes. Findings from this cohort therefore suggest that a lack of amnesia for SBS events does not preclude diagnosis of the condition, and that further research into dissociative events within this group of patients is necessary (nocturnal dissociation was not diagnosed formally in any of the current cohort included in

our study as discussed above).

Concomitant psychiatric diagnoses were identified in thirty-two SBS patients (57.1%), suggesting a possible link between mental health issues and the development of SBS, also documented in single case-reports in the medical literature [10]. Six patients also had psychiatrically diagnosed PTSD and a history of childhood trauma or sexual abuse was noted in 12 patients (although a formal diagnosis of PTSD was lacking). Stress and anxiety disorders have been frequently linked to problems with sleep onset/maintenance, with insomnia and hypersomnolence being key features of mood disorder [23]. High comorbidity rates have been reported between sleep disorders and anxiety/depressive disorders [24]. Taylor et al. reported insomnia and increased numbers of awakenings during sleep correlating with increased rates of depression and anxiety [25]. This is due in part to the arousal response to anxiety/stress and its effects on cortisol regulation and HPA axis activation [25]. Antecedent stress/anxiety disorders were found to be the most common triggering factor for SBS within our cohort, consistent with the literature [3]. We also report a significant association between alcohol consumption and SBS behaviours, with one-third of patients describing it as an exacerbating factor. This is consistent with the literature which describes a potential link between excessive alcohol/drug use and SBS behaviours in individuals with a background of traumatic psychological stress during childhood [26]. Alcohol excess may potentiate SBS behaviours in individuals who have experienced early life trauma and subsequent psychiatric illness. It is also salient to address the potential medico-legal implications of SBS and therefore, if such behaviours can be mitigated by addressing triggers such as alcohol consumption, then this is an important finding in terms of management.

Within our cohort, multiple comorbid NREM parasomnias were highly prevalent in the SBS patients: sleep talking (47.5%) sleep-walking (45.9%) and sleep-eating (8.2%). This suggests that SBS is a variant phenotype of a shared NREM-sleep pathophysiology [27]. Logically, clinicians should ask directly about SBS when a patient presents with another NREM-parasomnia, especially sleepwalking, as we suspect that many afflicted individuals will choose not to seek therapeutic intervention, largely due to embarrassment/ignorance of the condition [2]. Other de-novo, co-morbid sleep disorders were also present, with arousals resulting from their occurrence possibly increasing the risk of SBS behaviour during the night [7,8,12].

5. Limitations

As with all retrospective studies, there are limitations to our findings including amnesic bias, disclosure bias (reluctance to disclose events such as childhood abuse) and loss to follow-up. A full psychosexual history was not undertaken in many patients or in all partners. A few patients refused to undertake polysomnographic investigation or deemed it futile. Results of those who did undertake PSG investigation are also subject to bias because of an abnormal external environment and lack of bed partner during the investigation, causing the results to be unrepresentative of a 'normal' night's sleep. Finally, although there were some significant differences in presentation between patients with SBS and patients with non-SBS, NREM-parasomnia disorders, the effect sizes fell into the low-to-moderate range. Nevertheless, there is sufficient signal to ensure that clinicians are alerted to additional considerations when taking a history in patients with NREM-parasomnias.

6. Conclusion

To date, this is the largest cohort of SBS patients from a single centre allowing for meaningful analysis of sex and age differences in comparison to a variety of NREM-parasomnia disorders. Longitudinal assessment continues. This study suggests that SBS is not a rare condition; the total number of individuals living with the condition may be far more common than previously believed. Male patients presented most frequently because of distress to a female bedpartner; female patients presented independently. Furthermore, we identified features which may predispose to SBS behaviours including early life trauma and sexual abuse, PTSD, comorbid parasomnias, concomitant psychiatric illness, comorbid sleep disorders, difficult interpersonal relationship with the bed partner and alcohol consumption. Cognizance of these factors provides opportunities for earlier education and intervention for those at increased risk of developing problematic and frequent SBS and may improve the management of this condition which carries significant interpersonal and medico-legal implications.

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Ethics approval

Caldicott approval was in place for the data used in this study (Caldicott Application 2176; 03/08/2021).

Informed consent

Patient consent was waived due to all data being derived through standard clinical care, presented in aggregated format and de-identified.

Data availability

Data are available on written request to the first author, RLR

CRediT authorship contribution statement

Renata L. Riha: Conceptualization, Methodology, Data curation, Writing – original draft, Preparation, Writing – review & editing, Supervision. **Sophie Dodds:** Formal analysis, Investigation, Writing – original draft, Preparation. **Serafeim – Chrysovalantis Kotoulas:** Formal analysis, Data curation, Writing – original draft, Preparation. **Ian Morrison:** Methodology, Writing – original draft,

Preparation, Writing – review & editing.

Declaration of competing interest

The authors declare no conflicts of interest in relation to this work.

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