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Prevalence Rates of Frequent Dream Recall and Nightmares by Age, Gender and Sleep Duration in 16 Countries

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ABSTRACT

The present study aimed to describe the prevalence rates of frequent (i.e., at least weekly) dream recall and nightmares with consideration for differences in age, gender and sleep duration in 16 countries using equivalent assessment methods. The study sample included 15,854 participants (69.9% women) aged 18–99 years ($M = 42.39$, SD = 16.43) collected by the International COVID-19 Sleep Study collaboration, which used a unified online survey to collect data from May to November 2021 across 16 countries. Participants provided demographic information as well as self-reported estimates of their dream recall and nightmare frequency and sleep duration in 2021 and retrospectively for 2019. Frequent dream recall occurred in 54.0% of participants in 2021 and 51.1% in 2019. Frequent

nightmares were reported by 11.0% of participants in 2021 and 6.9% in 2019. Ad hoc regression models found dream recall and sleep duration to have a linear relation, whereas nightmare frequency demonstrated a quadratic relation to sleep duration. Frequent dream recall and nightmare prevalence rates are reported for each of the 16 study countries by age, gender and sleep duration. This is the first multi-continent study to estimate frequent dream recall and nightmare prevalence, which both provides updated prevalence rates during the COVID-19 pandemic as well as extends existing knowledge to previously never studied countries.

1 | Introduction

Prevalence rates of frequent (i.e., at least weekly) nightmares range from 0.9% to 6.8%, while frequent dream recall is more prevalent at nearly 50% (Sandman et al. 2013; Schredl et al. 2022). These statistics are predominately drawn from studies investigating single European countries, each using different assessment methods and at times different degrees of frequency (e.g., 'high' dream recall of ≥ 3 days per week [Fränkl et al. 2021]; exceptions include [Janson 1995; Li et al. 2010]). It is not well known how frequent dream recall and nightmare prevalence rates vary across countries using the same assessment, let alone how rates vary by age, gender and sleep duration. Therefore, the present study aimed to describe the prevalence rates of frequent dream recall and nightmares with consideration for differences in age, gender and sleep duration across 16 countries using equivalent assessment methods. This work was possible through a larger project examining sleep during the COVID-19 pandemic and thus provides descriptive data on frequent dream recall and nightmares during the pandemic as well as retrospectively prior to the pandemic in 2019.

2 | Methods

2.1 | Procedure

These data were collected by the International COVID-19 Sleep Study collaboration, which used a unified online survey to collect data from May to November 2021 across 16 countries (see Merikanto et al. 2022 and Table 1). While most countries/regions in this study aimed to recruit samples characteristic of the general adult population, slight variations in samples between countries/regions occurred from different recruitment strategies. For example, the United States sampled undergraduate students, Italy marketed the survey to attempt to oversample participants with long-COVID and Germany recruited patients from an outpatient sleep clinic amongst other recruitment sources (e.g., healthcare employees, students, patient organizations). Additional recruitment details are reported in our protocol paper (Merikanto et al. 2022). Ethical approval/exemption was sought by each principal investigator as required by their country/setting (Merikanto et al. 2022).

2.2 | Participants

The study sample included 15,854 participants (69.9% women) aged 18–99 years ($M = 42.39$, SD = 16.43). Those younger than 18 years of age were disqualified from participating. Age was categorized by young adults (ages 18–34, 37.0%), middle-aged adults (ages 35–64, 51.5%) and older adults (age ≥ 65, 11.5%).

2.3 | Measures

2.3.1 | Frequent Dream Recall and Nightmares

Participants' frequency of dream recall was assessed by asking, 'How often were you dreaming while sleeping BEFORE the pandemic?' and 'How often do you have dreams while sleeping CURRENTLY?' Nightmares were assessed similarly by asking respondents, 'How often did you have nightmares BEFORE the pandemic (say, in 2019)' and 'How often do you have nightmares CURRENTLY?' Response options for these four questions included: 'Never or less frequently than once per month', 'Less than once per week', 'On 1–2 days per week', 'On 3–5 days per week', and 'Daily or almost daily'. Participants were then dichotomized as having either infrequent (i.e., less than once per week or less) or frequent (i.e., on 1–2 days per week or more) dream recall and nightmares, as has been done in previous research (Bolstad et al. 2024).

2.3.2 | Sleep Duration

Participants reported their average sleep durations in 2019 and 2021 by responding to the following questions, respectively: 'How many hours per night did you sleep on the average BEFORE the pandemic (say, in 2019)?' and 'How many hours per night have you been sleeping on average CURRENTLY?' Responses were provided in hours and minutes. Participants were then categorized in three categories for each year based on their sleep duration responses, in alignment with previous research (Bin et al. 2013): short sleepers (< 6 h), average duration sleepers (6–9 h) and long sleepers (> 9 h).

2.3.3 | Statistical Analyses

Participants with a country code of 'Other' were excluded ($n = 84$). Participants who reported a total sleep time of < 2.5 h or > 16 h were deemed invalid responders and excluded ($n = 90$), which is in accordance with previous research (Korman et al. 2024). Missing data included 15.7%–15.8% of the dream and nightmare data, 13.5% for the sleep duration data, and no missing data were observed for gender or age. Missing data were imputed using the expectation–maximization method (Bennett 2001). Percentages were used to quantify the prevalence rates of frequent dream recall and nightmares in 2019 and 2021 across the whole sample and by country/region with consideration for differences by age, gender and sleep duration. Ad hoc linear regression models were used to examine the observed linear trend of dream recall as a function of sleep duration. Ad hoc linear and quadratic regression models also were compared for best fit to examine the

TABLE 1 | Prevalence rates of weekly or more frequent dream recall and nightmares.

				Age (years)			Gender		Sleep duration[a]		
Country	**Time**	**Total**	**Change**	**18–34**	**35–64**	**65+**	**Men**	**Women**	**<6 h**	**6–9 h**	**>9 h**
Total sample (*n*)	2019	15,680		5800	8081	1799	4718	10,962	1183	13,848	649
	2021								2041	12,947	692
Dream recall	2019	51.1%	2.9%	58.5%	46.5%	47.6%	46.8%	52.9%	47.1%	50.6%	69.2%
	2021	54.0%		63.7%	47.6%	51.3%	50.1%	55.7%	51.0%	53.5%	71.4%
Nightmares	2019	6.9%	4.1%	8.7%	5.3%	8.7%	7.5%	6.7%	10.0%	6.5%	11.7%
	2021	11.0%		12.3%	10.0%	11.2%	10.7%	11.1%	18.4%	9.4%	18.8%
Austria (*n*)	2019	798		230	516	52	182	616	43	722	33
	2021								100	664	34
Dream recall	2019	56.1%	3.9%	62.2%	52.9%	61.5%	53.3%	57.0%	48.8%	55.4%	81.8%
	2021	60.0%		67.0%	56.6%	63.5%	53.8%	61.9%	49.0%	60.8%	76.5%
Nightmares	2019	5.8%	7.9%	7.8%	4.8%	5.8%	5.5%	5.8%	4.7%	5.1%	21.2%
	2021	13.7%		14.8%	13.4%	11.5%	9.3%	14.9%	22.0%	11.9%	23.5%
Brazil (*n*)	2019	369		224	131	14	102	267	18	333	18
	2021								50	297	22
Dream recall	2019	60.4%	7.9%	64.3%	54.2%	57.1%	54.9%	62.5%	61.1%	59.2%	83.3%
	2021	68.3%		76.3%	56.5%	50.0%	67.6%	68.5%	60.0%	68.4%	86.4%
Nightmares	2019	8.9%	10.1%	9.8%	7.6%	7.1%	7.8%	9.4%	16.7%	8.7%	5.6%
	2021	19.0%		18.8%	20.6%	7.1%	14.7%	20.6%	34.0%	15.2%	36.4%
Bulgaria (*n*)	2019	643		171	451	21	135	508	11	604	28
	2021								51	558	34
Dream recall	2019	46.8%	1.3%	56.7%	42.6%	57.1%	44.4%	47.4%	45.5%	46.2%	60.7%
	2021	48.1%		57.9%	43.9%	57.1%	45.9%	48.6%	54.9%	46.6%	61.8%
Nightmares	2019	3.7%	4.1%	5.3%	3.1%	4.8%	2.2%	4.1%	18.2%	3.3%	7.1%
	2021	7.8%		8.2%	7.5%	9.5%	5.2%	8.5%	29.4%	6.1%	2.9%
Canada (*n*)	2019	890		179	561	150	218	672	41	821	28
	2021								114	744	32
Dream recall	2019	53.5%	3.1%	62.6%	49.9%	56.0%	55.5%	52.8%	41.5%	53.5%	71.4%
	2021	56.6%		64.8%	52.8%	61.3%	57.8%	56.3%	53.5%	56.3%	75.0%
Nightmares	2019	3.9%	5.5%	5.6%	3.9%	2.0%	3.7%	4.0%	9.8%	3.4%	10.7%
	2021	9.4%		11.2%	10.2%	4.7%	7.8%	10.0%	15.8%	7.8%	25.0%
Croatia (*n*)	2019	758		182	523	53	158	600	30	711	17
	2021								88	656	14
Dream recall	2019	47.0%	−1.8%	54.4%	44.9%	41.5%	43.0%	48.0%	53.3%	46.6%	52.9%
	2021	45.4%		54.4%	42.1%	47.2%	41.8%	46.3%	46.6%	45.1%	50.0%
Nightmares	2019	2.9%	1.6%	4.4%	2.5%	1.9%	2.5%	3.0%	10.0%	2.5%	5.9%
	2021	4.5%		5.5%	4.4%	1.9%	4.4%	4.5%	12.5%	3.4%	7.1%
Finland (*n*)	2019	1673		621	932	120	246	1427	33	1533	107
	2021								82	1416	175

(Continues)

TABLE 1 | (Continued)

				Age (years)			Gender		Sleep duration[a]		
Country	**Time**	**Total**	**Change**	**18–34**	**35–64**	**65+**	**Men**	**Women**	**<6 h**	**6–9 h**	**>9 h**
Dream recall	2019	59.1%	4.3%	64.7%	56.0%	54.2%	59.8%	59.0%	72.7%	58.1%	69.2%
	2021	63.4%		72.8%	57.8%	58.3%	62.6%	63.6%	62.2%	61.9%	76.6%
Nightmares	2019	5.7%	5.0%	6.6%	5.3%	5.0%	5.7%	5.7%	18.2%	5.5%	5.6%
	2021	10.7%		11.4%	10.1%	11.7%	8.9%	11.0%	24.4%	9.2%	16.6%
France (*n*)	2019	579		173	370	36	127	452	19	527	33
	2021								50	502	27
Dream recall	2019	46.3%	1.9%	55.5%	42.4%	41.7%	44.9%	46.7%	42.1%	44.4%	78.8%
	2021	48.2%		63.6%	41.9%	38.9%	45.7%	48.9%	44.0%	46.4%	88.9%
Nightmares	2019	5.2%	6.9%	9.2%	3.2%	5.6%	3.1%	5.8%	0.0%	4.9%	12.1%
	2021	12.1%		12.7%	11.9%	11.1%	7.9%	13.3%	26.0%	9.4%	37.0%
Germany (*n*)	2019	596		101	407	88	337	259	96	482	18
	2021								117	449	30
Dream recall	2019	33.7%	5.4%	31.7%	33.4%	37.5%	27.0%	42.5%	54.2%	28.0%	77.8%
	2021	39.1%		40.6%	36.6%	48.9%	31.5%	49.0%	56.4%	33.6%	53.3%
Nightmares	2019	6.9%	4.2%	4.0%	5.7%	15.9%	4.5%	10.0%	2.1%	7.5%	16.7%
	2021	11.1%		6.9%	11.1%	15.9%	8.9%	13.9%	11.1%	10.9%	13.3%
Hong Kong/China (*n*)	2019	520		236	240	44	174	346	38	464	18
	2021								65	440	15
Dream recall	2019	47.9%	5.4%	52.1%	47.5%	27.3%	48.3%	47.7%	36.8%	48.5%	55.6%
	2021	53.3%		57.6%	52.1%	36.4%	53.4%	53.2%	46.2%	53.6%	73.3%
Nightmares	2019	8.3%	2.5%	10.2%	7.1%	4.5%	8.0%	8.4%	2.6%	8.2%	22.2%
	2021	10.8%		11.9%	10.8%	4.5%	11.5%	10.4%	6.2%	11.1%	20.0%
Israel (*n*)	2019	642		388	226	28	138	504	66	560	16
	2021								82	548	12
Dream recall	2019	53.9%	4.7%	63.9%	38.9%	35.7%	44.9%	56.3%	42.4%	55.0%	62.5%
	2021	58.6%		73.2%	36.3%	35.7%	50.7%	60.7%	58.5%	58.4%	66.7%
Nightmares	2019	1.2%	2.2%	1.5%	0.9%	0.0%	0.0%	1.6%	3.0%	1.1%	0.0%
	2021	3.4%		3.6%	3.5%	0.0%	1.4%	4.0%	12.2%	1.8%	16.7%
Italy (*n*)	2019	1521		766	660	95	441	1080	55	1390	76
	2021								185	1265	71
Dream recall	2019	53.7%	1.1%	64.2%	43.8%	37.9%	50.8%	54.9%	49.1%	52.9%	72.4%
	2021	54.8%		67.1%	42.7%	40.0%	54.6%	54.9%	53.0%	54.3%	69.0%
Nightmares	2019	4.8%	6.3%	7.7%	1.8%	2.1%	5.4%	4.5%	7.3%	4.5%	9.2%
	2021	11.1%		12.1%	10.8%	5.3%	9.8%	11.7%	26.5%	8.9%	9.9%
Japan (*n*)	2019	2985		744	1509		1582	1403	484	2473	28
	2021								538	2411	36
Dream recall	2019	43.4%	1.9%	43.8%	42.3%	44.9%	43.4%	43.3%	38.6%	44.0%	64.3%
	2021	45.3%		45.8%	43.9%	47.8%	46.0%	44.6%	41.6%	45.9%	61.1%

(Continues)

TABLE 1 | (Continued)

				Age (years)			Gender		Sleep duration[a]		
Country	**Time**	**Total**	**Change**	**18–34**	**35–64**	**65+**	**Men**	**Women**	**<6 h**	**6–9 h**	**>9 h**
Nightmares	2019	11.5%	1.9%	11.3%	9.9%	14.8%	13.0%	9.8%	9.7%	11.8%	14.3%
	2021	13.4%		14.4%	11.3%	16.7%	15.1%	11.5%	12.1%	13.6%	19.4%
Norway (*n*)	2019	1133		508	566	59	348	785	109	959	65
	2021								235	834	64
Dream recall	2019	46.5%	5.1%	53.1%	41.5%	37.3%	41.4%	48.8%	55.0%	44.2%	66.2%
	2021	51.6%		66.3%	39.8%	39.0%	47.4%	53.5%	52.8%	50.2%	65.6%
Nightmares	2019	6.5%	3.6%	8.1%	5.5%	3.4%	3.7%	7.8%	15.6%	4.5%	21.5%
	2021	10.1%		14.2%	6.7%	6.8%	6.6%	11.6%	21.7%	5.8%	23.4%
Portugal (*n*)	2019	674		252	392	30	158	516	30	605	39
	2021								49	596	29
Dream recall	2019	52.1%	4.7%	58.7%	48.5%	43.3%	53.2%	51.7%	60.0%	51.1%	61.5%
	2021	56.8%		68.7%	49.5%	53.3%	52.5%	58.1%	57.1%	55.7%	79.3%
Nightmares	2019	4.6%	4.3%	6.7%	3.6%	0.0%	1.3%	5.6%	13.3%	4.0%	7.7%
	2021	8.9%		12.7%	6.9%	3.3%	7.6%	9.3%	18.4%	7.7%	17.2%
Sweden (*n*)	2019	969		113	579	277	107	862	52	879	38
	2021								106	801	62
Dream recall	2019	57.3%	3.8%	58.4%	56.3%	58.8%	57.0%	57.3%	65.4%	56.3%	68.4%
	2021	61.1%		69.9%	58.5%	62.8%	67.3%	60.3%	55.7%	61.2%	69.4%
Nightmares	2019	5.9%	4.7%	11.5%	5.5%	4.3%	6.5%	5.8%	15.4%	4.9%	15.8%
	2021	10.6%		12.4%	12.3%	6.5%	12.1%	10.4%	17.9%	8.6%	24.2%
USA (*n*)	2019	930		912	18	0	265	665	58	785	87
	2021								129	766	35
Dream recall	2019	65.6%	−0.9%	65.5%	72.2%	—	63.0%	66.6%	60.3%	65.5%	70.1%
	2021	64.7%		64.6%	72.2%	—	64.9%	64.7%	62.8%	64.8%	71.4%
Nightmares	2019	14.4%	0.1%	14.6%	5.6%	—	8.7%	16.7%	22.4%	14.0%	12.6%
	2021	14.5%		14.6%	11.1%	—	11.3%	15.8%	30.2%	11.6%	20.0%

[a]2019 sleep duration estimates were used for 2019 dream recall and nightmare rates, and 2021 sleep duration estimates were used for 2021 dream recall and nightmare rates.

apparent U-shaped relation of nightmare frequency as a function of sleep duration. All analyses were conducted in SPSS Version 29, and results are depicted in Table 1.

3 | Results

3.1 | Prevalence of Frequent Dream Recall & Association With Sleep Duration

Weekly or more frequent dream recall occurred in 54.3% of participants in 2021, which was 2.9% higher than in 2019. In 2021, frequent dream recall was most common in Brazil (68.3%) and least common in Germany (39.1%). In 2019, the United States reported the highest rates of frequent dream recall (65.6%), and Germany reported the lowest (33.7%). Frequent dream recall occurred more often in younger adults than in middle-aged or older adults. Women reported more frequent dream recall than men. Sleep duration and frequent dream recall demonstrated a linear trend, with more frequent dream recall noted with increasing sleep duration. The linear regression models confirmed this trend was significant in both 2019 ($R^2 = 0.015$, $F[1, 15{,}678] = 243.57$, $p < 0.001$) and 2021 ($R^2 = 0.014$, $F[1, 15{,}678] = 223.48$, $p < 0.001$).

3.2 | Prevalence of Frequent Nightmares & Association With Sleep Duration

In the total sample, weekly or more frequent nightmares were reported by 11.0% of participants in 2021, and this was 4.1% higher than in 2019. Brazil had the highest rate of frequent

nightmares in 2021 (19.0%), whereas Israel had the lowest rate (3.4%). In 2019, the United States had the highest rates of frequent nightmares (14.4%), whereas Israel continued to have the lowest prevalence of frequent nightmares (1.2%). Frequent nightmares were reported most often in younger adults, followed by older and middle-aged adults. In 2021, women reported more frequent nightmares than men, but this finding reversed for the retrospective 2019 estimate. The prevalence of frequent nightmares demonstrated a U-shaped trend with sleep duration, as short and long sleepers reported higher rates of frequent nightmares than participants with an average sleep duration.

To verify the apparent U-shaped trend, linear and quadratic regression models were compared. For both years, the quadratic regression models demonstrated a better fit. The quadratic regression was better fitting for the 2019 data, $R^2 = 0.007$, $F(2, 15{,}677) = 53.73$, $p < 0.001$, than the linear regression, $R^2 = 0.001$, $F(1, 15{,}678) = 9.45$, $p = 0.002$. This was also found using the 2021 data (quadratic $R^2 = 0.013$, $F[2, 15{,}677] = 102.07$, $p < 0.001$; linear $R^2 = 0.00$, $F[1, 15{,}678] = 6.16$, $p = 0.013$).

4 | Discussion

This study aimed to describe the prevalence rates of frequent dream recall and nightmares in 16 countries by age, gender and sleep duration using equivalent assessment methods. This is the first study, to our knowledge, to report on frequent dream recall and nightmare prevalence across several countries and continents using the same assessment with consideration for age, gender and sleep duration. Our findings estimated frequent nightmare prevalence to be higher than that of previous reports in countries like Germany (2.4%) (Schredl 2010), Norway (2.8%) (Bjorvatn et al. 2010), Finland (3.9%) (Sandman et al. 2015), Sweden (3.9%–6.8%) (Janson 1995) and Hong Kong (5.1%) (Li et al. 2010). This may be due to methodological differences, the COVID-19 pandemic, increasing rates of psychopathology or declining stigma promoting reports. Rates of frequent dream recall and nightmares varied by country, which may be related to cultural or regional differences, differences in COVID-19 rates or restrictions, or variance in comorbid factors such as symptoms of PTSD. Examination of these potential explanatory differences is beyond the scope of this short report and is limited by a lack of data on most of these variables. The relation between PTSD symptoms and frequent dream recall and nightmares in this sample has been examined elsewhere (Holzinger et al. 2022). In respect to the relation between frequent dream recall and nightmares with sleep duration, we found a linear relation between sleep duration and frequent dream recall, with more frequent dream recall observed with increasing sleep duration, whereas we replicated the U-shaped association between frequent nightmares and sleep duration noted in past research (Sandman et al. 2015). We suspect insomnia may explain the relation between nightmares and short sleep duration, while increased REM sleep may explain the association between long sleep duration and dream recall and nightmares. Examination of these variables is beyond the scope of this brief report.

5 | Limitations

One limitation of this study was the use of 2-year retrospective self-reported estimates of participants' dream recall and nightmare frequency as well as sleep duration. Because of this, we did not examine statistical differences between estimates of 2019 and 2021. We found it important to report findings from both 2019 and 2021, as each offers important contributions. For instance, findings from 2019 provide an estimate of frequent dream recall and nightmares before the COVID-19 pandemic, while findings from 2021 provide current prevalence estimates during the COVID-19 pandemic. An additional limitation was our use of convenience sampling and slight differences in recruitment strategies between countries/regions. Given these limitations, we refrained from conducting statistical comparisons between countries, opting to rather provide descriptions of the demographics in each country/region alongside the prevalence rates of frequent dream recall and nightmares. Our results are also limited by the range of variables considered, as we only examined prevalence rate differences by age, gender and sleep duration and did not examine other variables which may contribute to prevalence differences (e.g., symptoms of psychopathology, sleep problems, having COVID-19). Finally, our findings are limited by the timing of data collection occurring during the COVID-19 pandemic. Although this is also a strength of the study, we recognize our findings may not generalize outside the pandemic, particularly for those experiencing COVID-19 or long-COVID, as we have previously documented frequent nightmares are more common in those with COVID-19 and long-COVID (Bolstad et al. 2024). This underscores the importance of including pre-pandemic (i.e., 2019) retrospective estimates of frequent dream recall and nightmares in this report.

6 | Implications & Conclusion

These findings expand our knowledge of the prevalence of frequent dream recall and nightmares globally. Much of the previous work in this area has been conducted in European countries, often with differing assessment methods. This study provides estimates of frequent dream recall and nightmares across four continents using the same questionnaire. Further, our findings add specificity to the literature base by reporting prevalence rates of frequent dream recall and nightmares with consideration for age, gender and sleep duration. This report underscores the prevalence of nightmares broadly, but also highlights nightmare prevalence in countries/regions never examined before.

Author Contributions

Courtney J. Bolstad: conceptualization, methodology, data curation, investigation, formal analysis, supervision, visualization, project administration, resources, writing – original draft, writing – review and editing. **Bjørn Bjorvatn:** conceptualization, data curation, investigation, supervision, writing – review and editing. **Ngan Yin Chan:** methodology, data curation, project administration, writing – review and editing. **Frances Chung:** methodology, data curation, investigation, supervision, funding acquisition, resources, writing – review and editing. **Yves Dauvilliers:** data curation, investigation, writing – review

and editing. **Luigi De Gennaro:** conceptualization, methodology, data curation, investigation, validation, supervision, writing – review and editing. **Colin A. Espie:** conceptualization, methodology, data curation, investigation, supervision, project administration, resources, writing – review and editing. **Brigitte Holzinger:** conceptualization, methodology, data curation, investigation, supervision, project administration, resources, writing – review and editing. **Yuichi Inoue:** data curation, writing – review and editing. **Maria Korman:** software, data curation, writing – review and editing. **Adrijana Koscec Bjelajac:** conceptualization, methodology, investigation, project administration, writing – review and editing. **Anne-Marie Landtblom:** data curation, investigation, writing – review and editing. **Tainá Macêdo:** data curation, writing – review and editing. **Kentaro Matsui:** resources, writing – review and editing. **Ilona Merikanto:** methodology, data curation, investigation, project administration, resources, writing – review and editing. **Charles M. Morin:** conceptualization, methodology, data curation, investigation, supervision, project administration, resources, writing – review and editing. **Sérgio Mota-Rolim:** conceptualization, investigation, writing – review and editing. **Thomas Penzel:** data curation, writing – review and editing. **Giuseppe Plazzi:** investigation, writing – review and editing. **Cátia Reis:** conceptualization, methodology, data curation, investigation, project administration, writing – review and editing. **Serena Scarpelli:** methodology, data curation, investigation, supervision, writing – review and editing. **Yun Kwok Wing:** conceptualization, methodology, data curation, investigation, supervision, resources, writing – review and editing. **Michael R. Nadorff:** conceptualization, methodology, data curation, investigation, supervision, project administration, resources, writing – review and editing.

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Disclosure

Courtney J. Bolstad reports that the contents of this publication do not represent the views of the US Department of Veterans Affairs or the United States Government.

Ethics Statement

Ethical approval/exemption was sought by each principal investigator as required by their country/setting.

Conflicts of Interest

Frances Chung reports grants from the Ontario Ministry of Health Innovation Grant, the ResMed Foundation and the University Health Network Foundation, and consultation fees from Takeda Pharma, outside the submitted work. Luigi De Gennaro received fees from Idorsia, outside of the current work. Colin A. Espie reports being a shareholder in Big Health (developer of Sleepio), outside the submitted work. Yves Dauvilliers has been an AB member for Jazz, Bioprojet, Idorsia, Takeda and Orexia, outside of the current work. Giuseppe Plazzi has been an AB member for Jazz, Bioprojet, Idorsia, Takeda and Orexia, outside of the current work. Yuichi Inoue reports grants from Takeda Pharmaceutics Co and Teijin Pharma Co, and personal fees for delivering lectures from Eisai Co, Aculys Pharma Co, Astellas Co and MSD Co, outside the submitted work. Anne-Marie Landtblom reports honoraria from Takeda, UCB, Jazz Pharma and Apo Orphan Drugs. Kentaro Matsui received speaker's honoraria from Eisai, Japan Blood Products Organization, Meiji Seika Pharma, Mitsubishi Tanabe Pharma, Mochida Pharmaceutical, MSD, Nobelpharma, Otsuka Pharmaceutical, Sumitomo Pharma and Takeda Pharmaceutical outside the submitted work. Charles M. Morin received research grants from Eisai, Idorsia and Lallemand Health; served as a consultant on advisory boards with Eisai, Idorsia and Pear Therapeutics; and received royalties from Mapi Research Trust, all outside of the submitted work. Thomas Penzel received grants from Cidelec, Löwenstein Medical and speaker fees from Bioprojet, Idorsia, Jazz Pharma, Löwenstein Medical and honoraria from Bayer Healthcare, Cerebra and Sleepimage outside the submitted work. Yun Kwok Wing reported personal fees for delivering a lecture–Eisai Co. Ltd and personal fees from Sponsorship from Lundbeck HK Ltd, outside the submitted work. The other authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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