Impact of the COVID-19 Pandemic on Sleep and Dreams: Study in a Portuguese Sample

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Research has shown that during the COVID-19 pandemic, there were significant changes in sleep quality and dream activity. An increase in dream and nightmare recall frequency and a predominance of aversive emotional and phantasmatic dream content were recorded. The objective of the study was to analyze the pandemic's socio-occupational, psychological and experiential impact, focusing on sleep quality, dream/nightmare recall, and the emotional content of dreams in a sample of Portugal's adult resident population. Online data collection involved 1,020 adults ≥ 18 years (67.1% women). The research protocol included several questions regarding demographics, subjective experience of the pandemic, and its perceived impact on respondents' personal social networks, sleep habits, and dream content. The pandemic substantially affected participants' social interactions and mental health, with 17.2% reporting the death of a significant person. Overall sleep quality decreased during the pandemic, whereas dream/nightmare recall increased, and 27% of the respondents dreamed about COVID-19, reporting negative emotions and sensations in these dreams. Higher dream/nightmare recall was especially related to changes in sleep patterns, namely, increased nocturnal awakenings and sleep latency. Younger people, those belonging to a high-risk group, those reporting a higher subjective concern about the pandemic, those experiencing the death of a significant person, and those with self-reported employment and mental health problems were more likely to dream about COVID-19. Our findings add to psychological sleep and dream research regarding the function of dreams during collective stressful events. Considering the significant connection among mental health, sleep patterns, and dream content, research and clinical implications are discussed.

Keywords: pandemic, COVID-19, sleep, dreams

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ISSN: 1053-0797
https://doi.org/10.1037/drm0000231

The COVID-19 pandemic has had an unprecedented impact on mental health. Between 2019 and 2021, wearing masks, being confined, maintaining social/physical distance from others, and undergoing periods of mandatory quarantine became a way of life for billions of people worldwide. The plethora of disruptions in interpersonal interactions and socio-occupational activities and the uncertainty and anxiety about the future have posed significant challenges to mental health maintenance for most individuals.

Some recently published studies have reported the impact of the COVID-19 pandemic and its containment measures on physical and mental health, namely, in the psychological, emotional, social, and economic domains (Ganesan et al., 2021; Holmes et al., 2020; Torales et al., 2020). At the same time, other studies have highlighted both an increase in phobic anxiety and in the risk of developing posttraumatic stress disorder (Coelho et al., 2020; Xiong et al., 2020; Zhang et al., 2021) and a higher relative frequency of anxiety and stress disorders and depressive symptomatology, with accompanying decreased sleep quality (Cellini et al., 2020; Huang & Zhao, 2020; Mazza et al., 2020; Xiong et al., 2020).

Considering that sleep and psychological/psychosomatic equilibrium are intimately related (Stewart et al., 2020), evaluating the pandemic's impact on sleep quality seems particularly relevant. In this regard, a recent nonsystematic literature review indicated an increased prevalence of sleep disorders in 2020, associated with isolation, quarantine, anxiety, situational stress, and financial losses (Partinen, 2021). Furthermore, several studies, including a multicenter study (Trakada et al., 2020), have found that respondents tend to sleep substantially more but have poorer sleep quality compared with the prepandemic situation (Fränkl et al., 2021; Gorgoni et al., 2021; Gualano et al., 2020; Gupta et al., 2020; Paiva et al., 2021; Pesonen et al., 2020). Among sleep issues, an increase in nocturnal awakenings (Paiva et al., 2021; Pesonen et al., 2020; Pinto-Silva & Rolland-Sobral, 2021) and moderate or severe insomnia (Gualano et al., 2020; Paiva et al., 2021; Pinto-Silva & Rolland-Sobral, 2021) were reported. Sleep problems were observed predominantly in women (Gualano et al., 2020; Paiva et al., 2021; Pinto-Silva & Rolland-Sobral, 2021), employed people, and students, the latter complaining of difficulty falling asleep and changes in sleep–wake cycles (Paiva et al., 2021; Pinto-Silva & Rolland-Sobral, 2021).

Several studies have also reported significant changes in oneiric activity during the pandemic, with an average increase in nightmares (Fränkl et al., 2021; Paiva et al., 2021; Pesonen et al., 2020; Pinto-Silva & Rolland-Sobral, 2021) and dream recall (Fränkl et al., 2021; Giovanardi et al., 2022). In addition, increased dream recall was more common among women (Giovanardi et al., 2022). Taking into account experimental evidence, Bottary et al. (2020) proposed the hypothesis that increased dream recall during the COVID-19 pandemic may be attributed to increased sleep fragmentation (more awakenings during the night) caused by the (natural) sleep extension during the pandemic.

As for the emotional oneiric content, research has shown that dreams have been negatively affected, with less positive and more negative emotions and anxiety or depressive symptoms (Barrett, 2020a; Giovanardi et al., 2022; Gorgoni et al., 2021; Iorio et al., 2020; Mota et al., 2020; Scarpelli et al., 2021; Schredl & Bulkeley, 2020), especially in women (Barrett, 2020a; Gorgoni et al., 2021; Iorio et al., 2020; Scarpelli et al., 2021; Schredl & Bulkeley, 2020), younger respondents (Gorgoni

et al., 2021; Iorio et al., 2020), and those with higher levels of education (Schredl & Bulkeley, 2020). Wang et al. (2020) and Mota et al. (2020) found that changes in dream content seemed to be linked with mental distress associated with social isolation. On the other hand, research findings reported more dreams with distressing, pandemic-related content (Giovanardi et al., 2022; MacKay & DeCicco, 2020; Pesonen et al., 2020; Schredl & Bulkeley, 2020) or with bizarre themes (Gorgoni et al., 2021).

Given that dream activity can be understood as an expression of the individual's existential situation (Fränkl et al., 2021), the main results of the abovementioned studies are indicators of suffering in the global population, emphasizing the importance of research on dreams during crises and their relation to the psychological well-being of affected groups. Now, this subjective perception of intensified dream activity during the COVID-19 pandemic can be understood from several theoretical perspectives.

The continuity hypothesis suggests that dreams are continuous with waking life. From this perspective, dream content reflects, to a large extent, the dreamer's real life; in other words, the concerns, interests, and perceptions expressed in dreams are largely the same as those experienced in waking life (Domhoff, 1996). Schredl and Hofmann (2003) added that although continuity between dreaming and waking life is supported by empirical evidence, highly focused cognitive activities, such as reading and using a computer, seldom appear in dreams. This suggests that an unspecific, global formulation of the continuity hypothesis is not valid and that the type of waking life experience influences the probability of incorporation in dreams. These authors also suggested that emotional involvement in waking life experiences is important (Schredl & Hofmann, 2003). Schredl's (2006) study supported the idea that the incorporation in dreams of waking life events is influenced by their emotional intensity but not their emotional tone. Another study by Schredl and Piel (2006) revealed that emotionally intense life experiences have long-lasting effects on dreams, thus supporting the importance of dream content analysis in evaluating the impact of events on people's inner lives.

The idea of an adaptive function of dreaming goes back to psychoanalytic theory, which suggests that dreams can be interpreted either as a masked fulfillment of (repressed) desires (Freud, 1955) or as the result of a compensatory process, following the balancing function of the unconscious (Giovanardi et al., 2022; Jung, 1960). In Jung's perspective, dreams involve a process of self-regulation, resolving potential disharmonies stemming from the encounter of unconscious drives aimed at individuation with the societal push toward collective adaptation (Giovanardi et al., 2022; Jung, 1960). According to Bion (1962), dreaming is a creative process entirely focused on the unconscious mind, which allows the unfolding of formally unknowable and unthinkable "beta-screen" elements, thus generating meaning that can be used in the outside world (Meltzer, 2009). Dreaming then has the function of processing or "digesting" neurophysiological protomental phenomena into thinkable representative imagery (Bion, 1961; Giovanardi et al., 2022).

During the 20th century, some neurocognitive theories relegated the phenomenological complexity of dreaming to the status of random noise derived from REM sleep's physiological activity, therefore having no useful function. However, a reassessment of empirical evidence has prompted the formulation of comprehensive hypotheses that recapitulated the psychoanalytic assertion of the meaningfulness

and importance of dreams. The threat simulation theory (Revonsuo, 2000), anchored in evolutionary psychology, proposed that the human brain evolved with a selective pressure to incorporate threat-simulation mechanisms that increased the probability of reproductive success in ancestral human populations. In this sense, dream consciousness is an organized and selective simulation of the perceptual world, specialized in the simulation of potentially dangerous and threatening events and activated by the exposure to real ones, that aims to rehearse threat perception and avoidance, thus enhancing performance during waking state (Revonsuo, 2000). In this sense, Giovanardi et al. (2022) found that dream content during the COVID-19 pandemic often included risk of contagion, crowds and gatherings, references to infection and death, and fear of the unfamiliar "other." However, participants who explicitly dreamt about COVID-19 reported lower perceived distress. The authors interpreted these results by resorting to the threat simulation theory, suggesting that dreams about COVID-19 indicate a sense of mastery over the threats posed by the disease.

The emotional regulation theory has suggested that dreams regulate emotions through neurological and cognitive mechanisms, resulting in the resolution of emotional problems and the elimination of memories associated with fear (Mota et al., 2020; Nielsen & Lara-Carrasco, 2007). According to this theory, dreaming is a protected and nonaversive virtual reality that increases exposure to emotionally negative situations, leading to memory reconsolidation with reduced emotional load. Nightmares would be an extreme situation that pushes this mechanism to the limit (Mota et al., 2020; Nielsen & Lara-Carrasco, 2007).

Finally, the social simulation theory proposed that dream activity aims to simulate, also in a safe environment, social interactions, perceptions, and behaviors, with more or less realistic avatars of familiar persons and strangers. This theory is anchored by evidence that suggests that dreaming is an intensely social, albeit solipsistic, experience populated by a vast array of characters with whom the dream-self interacts. Similar to threat simulation theory, social simulation theory is also anchored in an evolutionary background, namely, in the importance of social interactions to survival in the ancestral environment, but its originality resides in the fact that it offers an explanation for nonthreatening dreams or for the simulation of positive and/or neutral events (Revonsuo et al., 2015). Wang et al. (2020) found a higher frequency of threatening events in the dreams of a sample immersed in an epidemic situation than those reported by a nonepidemic sample. However, no significant differences were found in the frequency of positive/neutral social interaction/perception events, as predicted by social simulation theory. Giovanardi et al. (2022) also found that amicable relationships were prominently featured in pandemic dreams. These results suggest that social and threat simulation theories are not mutually exclusive and may predict dream content more or less accurately depending on the circumstances.

The emergence of pandemic dreams concerning the profound changes, concerns, and impact of COVID-19 reported in several research articles seems to support the general continuity hypothesis of dreaming. In addition, the literature review also evidenced changes in dreams' narrative and emotional content that suggest self-regulatory and simulative functions aligned with the more specific theories of dreaming. In this sense, dreams seem to aim at achieving a better adapted response to the pandemic.

In conclusion, there seems to be a scientifically tenable consensus that the subjective experience of the pandemic substantially influences dream activity, which in turn affects the subject's psychic response to the long and stressful interpersonal restrictions imposed by health authorities. Therefore, this study aimed to analyze the impact of the COVID-19 pandemic on sleep quality and dream activity in a sample of the adult population residing in Portugal. We also intended to present epidemiological data on the perceived impact of the pandemic in several areas of life and conduct a correlational analysis between the quality of sleep, dream activity and content and selected sociodemographic variables.

Method

Procedure

The present study was part of the research project, *COVIDreams: Dreams and Sleep Patterns During the COVID-19 Pandemic in Portugal*, which aimed to assess the effects of the pandemic on sleep quality, habits and duration, dream activity, mental health, loneliness, and mentalization/reflective functioning. This project received approval from the Miguel Torga Institute of Higher Education research ethics committee (CE-P11-21). The survey included questions about sociodemographic information, subjective experience of the pandemic and its perceived impact on personal social networks, sleep patterns, and dream content. Three additional psychometric instruments (mental health, loneliness, and mentalization/reflective function) were included but were not part of the current study. Google Forms was selected as the survey platform due to its ease of dissemination and access by participants. The research team pretested the survey, and some aspects were corrected. The online survey started with a description of the scope and objectives of the study, followed by an online informed consent, which guaranteed anonymity and confidentiality, and that all answers would only be used for research purposes. The study was published on online social networks (Facebook/Instagram) and mailing lists from several organizations. Participants were also asked to share the survey with friends and family. Data collection took place between January 20 and March 15, 2021.

Participants

The inclusion criteria were age ≥18 years (age of legal majority in Portugal; parental consent is required for children up to 18 years old) and being a Portuguese resident. A total of 1,035 responses were collected, and 15 were excluded for not meeting all the inclusion criteria, with a final sample of 1,020 participants. Participants ages varied from 18 to 84 years ($M = 43.15$; $SD = 14.00$). The remaining sociodemographic details are presented in Table 1.

Instruments

The first part of the online survey focused on sociodemographic data. The respondents were then required to provide information about their subjective experience of the COVID-19 pandemic, including (a) positive diagnosis, testing,

Table 1
Sociodemographic Characteristics

Variables	*n*	Percentage
Gender		
Female	684	67.1
Male	336	32.9
Regions[a]		
North	69	6.8
Algarve	41	4.0
Center	609	59.7
Lisbon metropolitan area	181	17.7
Alentejo	37	3.7
Azores	7	0.7
Madeira	46	4.5
Educational level		
Primary (4–9 years)	35	3.4
Secondary/High school (10–14 years)	246	24.1
Higher education (≥15 years)	738	72.4
Household		
Alone	116	11.4
Friends and/Or colleagues	29	2.8
Nuclear family	888	87.0
Extended family	13	1.3

Note. $N = 1{,}020$.
[a] Thirty (2.9%) people did not answer.

isolation, being part of a high-risk group defined by the Portuguese Directorate-General for Health ("yes"/"no"), perceived impact and level of concern (5-point Likert scales); (b) impact of the disease on their personal social network due to the infection, hospitalization, or death of a significant person ("yes"/"no"/"don't know"); and (c) perceived negative effects of the pandemic on the following areas: physical health, employment, finances, social, and mental health ("yes/"no").

The online survey also included a sleep and dream questionnaire with two sections. Question content and wording were based on a literature review (Pesonen et al., 2020; Schredl et al., 2014) and aimed to assess sleep patterns and dream content/recall changes. As previously stated, this questionnaire and the survey regarding sociodemographics and pandemic experiences were pretested in a small sample of 10 respondents to ensure that the instructions were understood and data collected were aligned with study goals and to ascertain if additional questions were required (questions regarding areas affected by the pandemic, changes in daytime sleepiness, and sleep quality were added during this stage). In the first section, respondents were asked to indicate whether they identified variations in five sleep parameters (sleep duration, sleep latency, nocturnal awakenings, daytime sleepiness, and general sleep quality) and in two concerning dream activity (number of dreams and nightmares experienced/remembered on waking) since the beginning of the first confinement period (March 2020). The response options were "increased," "decreased," and "no change." The second section, concerning oneiric content, inquired about the occurrence of dreams related to the virus/pandemic or its socioeconomic disruptions (having a COVID-19 dream; "yes"/"no"). If the participant responded "yes," additional questions addressed the content of the most striking or vivid pandemic dream: "Was it a nightmare?"; "Was it a recurring dream?"; "Did you experience any of the following emotions/feelings?" (e.g., shame, joy); "Did

you experience any of the following sensations/affective states?" (e.g., heat, breathlessness, anxiety).

Statistical Analysis

We used the IBM SPSS software Version 27.1 for data analysis. Descriptive analyses were used for sociodemographic characteristics, pandemic experiences, and sleep/dream variables. Goodness-of-fit χ^2 tests were performed to verify whether there were significant differences in the proportions of responses reported. After ensuring that assumptions were met (Pallant, 2016), we performed binary logistic regression analyses to test multiple predictors of each of the sleep/dream parameters assessed. Binary logistic regressions were also computed to identify predictor variables of oneiric content, namely, of having a COVID-19 dream.

Results

Regarding the subjective experience of the pandemic, a positive diagnosis was relatively rare among participants, but a significant proportion reported being tested for COVID-19 and belonging to a high-risk group (Table 2). Participants indicated that they were very concerned with the pandemic and that it had greatly impacted their lives. The effect of the disease on participants' personal social networks appears to have been substantive: Concerning significant people, participants reported a high number of infections and fewer, but already relevant, hospitalizations and deaths from COVID-19. Finally, participants reported an average of two areas of life affected, with the following distribution: 3.4% were affected in all five areas evaluated, 9.0% in four areas, 21.9% in three areas, 34.2% in two areas, 28.4% in one area, and 3.1% were not affected at all. Approximately three-quarters

Table 2
COVID-19 Pandemic Experience, Personal Social Network Impact, and Areas Affected

Variables	*n*	Percentage	*M*	*SD*
Pandemic experience				
Positive diagnosis	93	9.1		
Testing	289	28.3		
Home confinement	225	22.1		
High-risk group	291	28.5		
Concern about the pandemic			3.91	0.84
Perceived impact			3.98	0.79
Personal social network impact				
Significant person infected	722	73.0		
Significant person hospitalized	284	28.9		
Death of significant person	169	17.2		
Areas affected[a]				
Physical health (e.g., difficulties accessing medical treatments)	260	25.7		
Mental health (e.g., increased anxiety, stress, or depression)	549	54.4		
Employment (e.g., loss, layoff, or drastic change)	309	30.6		
Finances (e.g., loss of income and/or savings)	256	25.3		
Social (e.g., canceled trips/meetings)	782	77.4		
Other	24	2.4		
Number of areas affected (sum score)			2.16	1.13

Note. $N = 1{,}020$.
[a] Ten missing cases due to questions being added later to the survey.

reported an effect on social relations, and more than half signaled a negative impact on mental health.

Women reported being more concerned about the pandemic ($M = 4.07$; $SD = .78$ vs. $M = 3.59$; $SD = .86$; $t_{(616.38)} = 8.75$; $p < .001$; $d = .58$) and signaled a larger impact in their lives ($M = 4.06$; $SD = .78$ vs. $M = 3.82$; $SD = .78$; $t_{(1018)} = 4.57$; $p < .001$; $d = .31$). Women also indicated that, on average, more areas of their lives were affected by the pandemic ($M = 2.22$; $SD = 1.11$ vs. $M = 2.04$; $SD = 1.18$; $t_{(1018)} = 2.43$; $p < .05$; $d = .16$). Younger people also tended to be more concerned ($r = -.11$; $p < .01$), to perceive a greater impact ($r = -.19$; $p < .001$), and to identify a larger number of affected areas ($r = -.21$; $p < .001$), even though all effect sizes were very small. Regarding these three variables, no statistically significant associations with the level of education were found.

A significant number of participants reported some change in sleep patterns and dream activity during the pandemic (Table 3). Sleep duration, as well as perceived sleep quality, seems to have decreased (although approximately one fifth of respondents signaled an increase). On the other hand, sleep latency, nocturnal awakenings, and daytime sleepiness increased. Regarding oneiric activity, a significant number of respondents report an increase in dream/nightmare recall.

Binary logistic regressions were then performed to assess the impact of several variables on the likelihood that respondents reported changes in sleep patterns. All the models were statistically significant and included 17 variables, distributed by four groups: demographics, pandemic experience, impact on the respondent's personal social networks, and areas of life affected (Table 4).

Regarding demographics, sex emerged as a significant predictor of changes in all sleep variables, except for sleep duration. Women were more likely to report increased sleep latency, nocturnal awakenings, and daytime sleepiness and decreased overall sleep quality. Age only contributed significantly to the daytime sleepiness model (younger respondents tended to report increased daytime sleepiness) and education to the sleep latency model (lower educational levels were associated with increased sleep latency).

Perceived impact on one's life emerged as the strongest predictor included in the pandemic experience variables, making unique statistically significant contributions to sleep duration, nocturnal awakenings, and sleep quality models. Higher

Table 3
Changes in Sleep Patterns and Dream/Nightmare Recall During the COVID-19 Pandemic

Variable	Increased (%)	Decreased (%)	No change (%)	χ^2
Sleep patterns				
Sleep duration	19.1	37.3	43.6	98.97***
Sleep latency	37.4	8.3	54.3	330.89***
Nocturnal awakenings	47.8	3.9	48.2	397.08***
Daytime sleepiness[a]	37.4	7.5	55.0	399.39***
Sleep quality[a]	9.2	48.6	42.2	646.33***
Oneiric activity				
Dreams recalled	34.0	7.5	58.5	349.79***
Nightmares recalled	24.9	5.9	69.2	270.81***

Note. $N = 1{,}020$. Goodness-of-fit chi-square.
[a] Ten missing cases due to questions being added later to the survey.
*** $p < .001$.

Table 4
Regression Analyses for Sleep Variables

	Sleep duration (decreased vs. no change/increased)				Sleep latency (increased vs. decreased/no change)				Nocturnal awakenings (increased vs. decreased/no change)				Daytime sleepiness (increased vs. decreased/no change)				Sleep quality (decreased vs. no change/increased)			
Predictors	*B*	*SE*	OR	95% CI	*B*	*SE*	*OR*	95% CI	*B*	*SE*	*OR*	95% CI	*B*	*SE*	*OR*	95% CI	*B*	*SE*	*OR*	95% CI
Demographic																				
Sex	−0.09	0.17	0.91	[0.65, 1.28]	**−0.55****	**0.18**	**0.58**	**[0.41, 0.82]**	**−0.65*****	**0.17**	**0.53**	**[0.38, 0.73]**	**−0.60*****	**0.18**	**0.55**	**[0.39, 0.78]**	**−0.56*****	**0.17**	**0.57**	**[0.41, 0.79]**
Age	0.01	0.01	1.01	[1.00, 1.02]	0.00	0.01	1.00	[0.99, 1.01]	0.01	0.01	1.01	[1.00, 1.02]	**−0.01***	**0.01**	**0.99**	**[0.97, 1.00]**	−0.01	0.01	1.00	[0.98, 1.01]
Education	0.11	0.15	1.11	[0.84, 1.48]	**−0.35***	**0.15**	**0.71**	**[0.53, 0.94]**	0.01	0.15	1.01	[0.76, 1.34]	−0.09	0.14	0.91	[0.69, 1.21]	0.01	0.14	1.01	[0.76, 1.33]
Pandemic experience																				
Diagnosed	0.06	0.28	1.06	[0.62, 1.83]	−0.16	0.29	0.85	[0.49, 1.49]	0.24	0.28	1.27	[0.74, 2.17]	−0.09	0.28	0.91	[0.53, 1.57]	0.20	0.27	1.22	[0.72, 2.08]
Tested	**0.34***	**0.16**	**1.41**	**[1.02, 1.94]**	0.25	0.17	1.28	[0.92, 1.79]	0.14	0.17	1.15	[0.83, 1.59]	0.08	0.17	1.08	[0.78, 1.49]	−0.03	0.17	0.97	[0.70, 1.34]
Confined	−0.11	0.19	0.90	[0.62, 1.31]	0.13	0.19	1.14	[0.78, 1.66]	−0.23	0.19	0.79	[0.55, 1.15]	0.20	0.19	1.22	[0.84, 1.76]	0.12	0.19	1.13	[0.78, 1.63]
High-risk group	0.08	0.18	1.09	[0.76, 1.55]	0.32	0.19	1.38	[0.96, 1.99]	0.02	0.18	1.02	[0.71, 1.46]	**0.45***	**0.18**	**1.56**	**[1.09, 2.23]**	0.12	0.18	1.13	[0.79, 1.61]
Concern about the pandemic	0.14	0.10	1.15	[0.94, 1.40]	0.20	0.11	1.23	[1.00, 1.51]	0.11	0.10	1.11	[0.92, 1.35]	−0.02	0.10	0.98	[0.80, 1.20]	0.07	0.01	1.08	[0.89, 1.31]
Perceived impact	**0.38*****	**0.11**	**1.46**	**[1.17, 1.82]**	0.16	0.12	1.17	[0.93, 1.47]	**0.31***	**0.11**	**1.36**	**[1.10, 1.69]**	0.15	0.11	1.16	[0.94, 1.45]	**0.30***	**0.11**	**1.35**	**[1.09, 1.67]**
Personal social network																				
Infected significant person	0.14	0.18	1.15	[0.81, 1.63]	−0.25	0.18	0.78	[0.54, 1.11]	0.05	0.18	1.05	[0.74, 1.48]	−0.24	0.18	0.79	[0.56, 1.12]	−0.08	0.18	0.92	[0.65, 1.30]
Hospitalized signif. person	0.08	0.19	1.08	[0.75, 1.57]	0.11	0.19	1.11	[0.76, 1.63]	0.01	0.19	1.01	[0.70, 1.47]	0.21	0.19	1.23	[0.85, 1.79]	0.04	0.19	1.04	[0.71, 1.50]
Death of significant person	−0.01	0.22	0.99	[0.64, 1.52]	0.25	0.23	1.29	[0.83, 2.01]	0.06	0.22	1.07	[0.69, 1.65]	−0.07	0.23	0.94	[0.60, 1.45]	0.15	0.22	1.16	[0.75, 1.80]
Areas affected																				
Physical health	0.33	0.17	1.38	[1.00, 1.92]	**0.41***	**0.17**	**1.50**	**[1.07, 2.10]**	0.20	0.17	1.22	[0.87, 1.72]	0.08	0.17	1.08	[0.78, 1.51]	0.21	0.17	1.24	[0.88, 1.73]
Employment	0.05	0.17	1.05	[0.75, 1.47]	0.15	0.18	1.16	[0.82, 1.64]	0.13	0.17	1.14	[0.82, 1.60]	−0.21	0.17	0.81	[0.58, 1.14]	0.05	0.17	1.06	[0.76, 1.47]
Finances	−0.02	0.18	0.99	[0.69, 1.41]	−0.24	0.19	0.78	[0.54, 1.14]	−0.09	0.18	0.92	[0.64, 1.32]	−0.13	0.19	0.88	[0.61, 1.27]	0.02	0.18	1.02	[0.71, 1.46]
Social interactions	−0.28	0.18	0.76	[0.53, 1.07]	−0.14	0.18	0.87	[0.61, 1.24]	**−0.48***	**0.18**	**0.62**	**[0.43, 0.88]**	0.13	0.18	1.14	[0.80, 1.62]	0.02	0.18	1.02	[0.72, 1.45]
Mental health	**1.05*****	**0.16**	**2.86**	**[2.08, 3.95]**	**1.35*****	**0.17**	**3.85**	**[2.76, 5.36]**	**1.38*****	**0.16**	**3.95**	**[2.89, 5.41]**	**1.19*****	**0.17**	**3.29**	**[2.38, 4.54]**	**1.27*****	**0.16**	**3.55**	**[2.61, 4.82]**

Note. $N = 1{,}020$. *OR* = odds ratio. Significant predictors are in bold.
* $p < .05$. ** $p < .01$. *** $p < .001$.

perceived impact was associated with decreased sleep duration and quality and increased nocturnal awakenings. Belonging to a high-risk group was associated with increased daytime sleepiness, and being tested for COVID-19 was related to reduced sleep duration.

Finally, those who identified a negative effect of the pandemic on their physical health (e.g., difficulties in accessing medical treatments for other health issues) were more likely to report increased sleep latency. Those not affected by the pandemic in their social interactions presented a higher probability of reporting increased nocturnal awakenings. It should be underscored, however, that the variable with the most noticeable impact on sleep patterns was affected mental health, which made statistically significant contributions to all the models.

Binary logistic regressions were also computed to assess which variables were associated with heightened dream and nightmare recall, but this time, sleep variables were also included in the models (Table 5). Some of these proved to be strong predictors of both increased dream and nightmare recall, namely, increased nocturnal awakenings and sleep latency. Decreased sleep quality only made a statistically significant contribution to the nightmare recall model. Women and younger respondents were more likely to report increased dream/nightmare recall. Those that did not experience a confinement period had a higher probability of reporting an increase in the number of dreams recalled. Also, increased nightmare recall was associated with the death of a significant person and with physical and mental health affected due to the pandemic.

Next, we analyzed changes in dream content. A total of 278 individuals (27.3%) reported that they had a dream related to the virus/pandemic or the social/economic disruption caused by the outbreak. Half of the respondents ($n = 133$) had a dream in 2020, and the remaining 50.0% in 2021. Twelve people did not answer this question. The month in which most dreams occurred (38.4%, $n = 104$) was January 2021, when the number of infected people increased dramatically. Of the 278 respondents who reported a COVID-19 dream, 202 (72.7%) signaled that it was a nightmare, and 56 (20.1%) that it was a recurring dream. Fear (64.0%), anguish (60.1%), and sadness (57.6%) were the most commonly identified emotions/feelings in COVID-19 dreams. The most frequently mentioned affective states, on the other hand, were anxiety (76.3%), emotional discomfort (56.8%), and depressive emptiness (26.3%).

In the regression analysis for having a COVID-19 dream (Table 5), concern about the pandemic emerged for the first time as a significant predictor. Again, affected mental health had a statistically significant association with the dependent variable, alongside employment disruption. Younger respondents and those that belonged to a high-risk group had a higher probability of dreaming about the pandemic. Finally, having experienced the death of a significant person in their personal social networks also seemed to influence respondents' dream content.

Discussion

This study aimed to analyze the impact of the COVID-19 pandemic and its consequences on sleep patterns and dreams in a sample of adults living in Portugal. The results reveal that social interactions and mental health were the areas of life most affected by the pandemic. Participants reported a significant impact of the disease

Table 5
Regression Analyses for Dream/Nightmare Recall and Having a COVID-19 Dream

	Dream recall (increased vs. decreased/no change)				Nightmare recall (increased vs. decreased/no change)				COVID-19 dream			
Predictors	*B*	*SE*	*OR*	95% CI	*B*	*SE*	*OR*	95% CI	*B*	*SE*	*OR*	95% CI
Demographic												
Sex	**−0.40***	**0.19**	**0.67**	**[0.47, 0.96]**	**−0.75****	**0.24**	**0.47**	**[0.30, 0.76]**	−0.29	0.19	0.75	[0.51, 1.10]
Age	**−0.02***	**0.01**	**0.98**	**[0.97, 1.00]**	**−0.03*****	**0.01**	**0.97**	**[0.96, 0.99]**	**−0.02***	**0.01**	**0.98**	**[0.97, 1.00]**
Education	−0.02	0.15	0.98	[0.73, 1.31]	−0.08	0.17	0.92	[0.66, 1.29]	0.22	0.16	1.25	[0.91, 1.72]
Pandemic experience												
Diagnosed	0.11	0.29	1.12	[0.63, 1.96]	−0.10	0.34	0.91	[0.46, 1.78]	0.11	0.31	1.12	[0.62, 2.04]
Tested	−0.11	0.17	0.90	[0.64, 1.26]	−0.05	0.21	0.95	[0.64, 1.43]	0.18	0.18	1.20	[0.85, 1.71]
Confined	**−0.46***	**0.20**	**0.63**	**[0.42, 0.93]**	−0.31	0.23	0.73	[0.46, 1.16]	−0.33	0.21	0.72	[0.48, 1.09]
High-risk group	0.16	0.19	1.18	[0.81, 1.71]	0.13	0.23	1.14	[0.74, 1.78]	**0.43***	**0.20**	**1.54**	**[1.05, 2.25]**
Concern about the pandemic	−0.01	0.11	0.99	[0.80, 1.22]	0.02	0.13	1.02	[0.79, 1.31]	**0.37****	**0.11**	**1.44**	**[1.16, 1.80]**
Perceived impact	−0.09	0.12	0.91	[0.73, 1.14]	−0.05	0.14	0.95	[0.72, 1.25]	0.03	0.12	1.03	[0.81, 1.31]
Personal social network												
Infected significant person	0.02	0.18	1.02	[0.71, 1.46]	−0.15	0.22	0.86	[0.56, 1.33]	−0.19	0.19	0.83	[0.57, 1.21]
Hospitalized significant person	0.07	0.20	1.07	[0.73, 1.58]	0.33	0.23	1.39	[0.89, 2.17]	0.05	0.21	1.05	[0.71, 1.58]
Death of significant person	0.40	0.23	1.49	[0.95, 2.34]	**0.64***	**0.27**	**1.90**	**[1.12, 3.21]**	**0.51***	**0.24**	**1.66**	**[1.05, 2.64]**
Areas affected												
Physical health	0.18	0.18	1.20	[0.85, 1.69]	**0.79*****	**0.20**	**2.20**	**[1.49, 3.26]**	0.03	0.18	1.03	[0.72, 1.47]
Employment	−0.09	0.18	0.91	[0.64, 1.29]	0.07	0.21	1.08	[0.71, 1.62]	**0.43***	**0.18**	**1.54**	**[1.07, 2.19]**
Finances	0.23	0.19	1.26	[0.87, 1.83]	0.20	0.22	1.22	[0.79, 1.90]	0.18	0.20	1.19	[0.81, 1.75]
Social interactions	−0.18	0.18	0.83	[0.58, 1.19]	−0.32	0.22	0.72	[0.47, 1.11]	−0.18	0.19	0.83	[0.57, 1.21]
Mental health	0.11	0.18	1.11	[0.78, 1.59]	**0.54***	**0.22**	**1.71**	**[1.11, 2.65]**	**1.14*****	**0.19**	**3.12**	**[2.16, 4.50]**
Sleep pattern changes												
Sleep duration	0.08	0.18	1.08	[0.76, 1.55]	−0.01	0.21	0.99	[0.66, 1.50]	—	—	—	—
Sleep latency	**0.56****	**0.18**	**1.76**	**[1.23, 2.50]**	**0.65****	**0.21**	**1.92**	**[1.28, 2.88]**	—	—	—	—
Nocturnal awakenings	**0.77*****	**0.19**	**2.16**	**[1.50, 3.13]**	**1.12*****	**0.23**	**3.06**	**[1.95, 4.79]**	—	—	—	—
Daytime sleepiness	0.25	0.17	1.28	[0.91, 1.79]	0.19	0.20	1.21	[0.82, 1.78]	—	—	—	—
Sleep quality	0.28	0.21	1.32	[0.88, 1.98]	**0.63****	**0.24**	**1.87**	**[1.16, 3.01]**	—	—	—	—

Note. $N = 1{,}020$. *OR* = odds ratio. Significant predictors are in bold.
* $p < .05$. *** $p < .001$. *** $p < .01$.

on their personal social networks and several changes in sleep patterns particularly associated with sex, overall perceived impact, and affected mental health. On the other hand, increased dream/nightmare recall was especially linked to changes in sleep latency and nocturnal awakening frequency. More than a quarter of respondents identified a dream related to COVID-19. Predictors of pandemic dream content included age, belonging to a high-risk group, subjective concern about the pandemic, death of a significant person, and perceived negative effect on employment and mental health.

Consistent with previous studies (Fränkl et al., 2021; Kilius et al., 2021; Schredl & Bulkeley, 2020), our results also indicate heightened dream and nightmare recall during the COVID-19 pandemic associated with altered and disruptive sleep patterns, namely, increased nocturnal awakenings and sleep latency. As Bottary et al. (2020) suggested, the increased dream recall during the pandemic might thus be explained by the arousal-retrieval model of dream recall, which posits that more frequent nocturnal awakenings facilitate the long-term memory storage of dream content. Also, increased sleep latency might indicate sleep onset insomnia, which is correlated with frequent nighttime awakenings. Thus, as Schredl and Bulkeley (2020) pointed out, the increase in insomnia prevalence due to the pandemic might also have contributed to the heightened dream recall recorded. As our results suggest, the disruption of these sleep behaviors is particularly associated with the perceived impact of the pandemic, negative effects on mental health, and participants' demographic characteristics.

In this sense, it should be noted that changes in sleep parameters and dream/nightmare recall were more pronounced among women and younger respondents, groups that also signaled to be more concerned with and affected by the pandemic. Women reported negative changes in four sleep parameters and increased dream and nightmare recall, consistent with previous research (Giovanardi et al., 2022; Iorio et al., 2020). According to Barrett (2020a), these results might be due to sex inequalities that were intensified during the pandemic; for example, women are usually the caregivers of sick family members, which increases the risk of infection; they constitute 70% of health-care personnel and occupy lower salary/authority jobs that are less supplied with adequate protective equipment; women are also underrepresented in clinical trials for vaccines and in decision-making organizations; they are at greater risk of domestic violence during confinement periods (Barrett, 2020a). Even though older people garnered considerable attention during the crisis due to their vulnerability to the physical effects of COVID-19, substantially more younger people felt a negative impact of the pandemic on physical and mental health, reporting curtailed opportunities for education, diminished social interactions, and insecure labor market integration (Giovanardi et al., 2022; Mental Health Commission of New South Wales, 2022; Timonen et al., 2021). These results may explain why younger respondents in our study reported more often increased daytime sleepiness, dream/nightmare recall, and COVID-19 dream content.

The percentage of COVID-19-related dreams recorded in our sample suggests that waking life concerns and experiences have found their way into respondents' dream realm. This result is consistent with the continuity hypothesis of dreaming (Domhoff, 2018; Schredl, 2003) and with previous findings regarding dream imagery during the pandemic (Giovanardi et al., 2022; MacKay & DeCicco, 2020). Iorio et al. (2020) also found similar values in their analysis of the dream content of Italian

persons during the pandemic, with 20% of dream reports collected including explicit COVID-19 references.

It should be noted, however, that our results also point to other more specific theories of dreaming. In this sense, even though we have no prepandemic baseline data to compare our findings, the prevalence of negative emotions and affective states in COVID-19 dreams is consistent with the emotional regulation theory. Likewise, Mota et al. (2020) found changes in the emotional content of dream reports recorded during the pandemic compared with those collected previously, suggesting a higher emotional load being processed.

The association among the loss of a significant person, COVID-19 dream content, and increased nightmare recall can also be interpreted according to the emotional regulation theory of dreaming. Several authors have manifested their concerns that the circumstances of COVID-19-related deaths have potentially traumatic characteristics that can lead to an increased prevalence of prolonged grief disorders and persistent complex bereavement disorders (Eisma et al., 2021; Goveas & Shear, 2020; Kokou-Kpolou et al., 2020). Besides the increased probability of unexpected deaths and "bereavement overload" due to the experience of multiple deaths, containment measures and social/physical restrictions have impaired the social support received by the bereaved, placed severe limitations on ritual ceremonies, and restricted visits to dying persons in the hospitals (Eisma & Tamminga, 2020; Kokou-Kpolou et al., 2020). Aligned with these concerns, Eisma et al. (2021) found that COVID-19 bereavement yields higher grief levels than natural bereavement, and Iorio et al. (2020) found that participants who knew people who died from COVID-19 reported higher emotional intensity and sensory impressions in their most recent dreams.

Consistent with the threat simulation theory of dreaming (Revonsuo, 2000), COVID-19 dream content also appeared connected with subjective concern and belonging to a high-risk group. It seems that respondents who were more preoccupied with the pandemic and who were at higher risk of developing severe symptoms had a higher probability of dreaming about the disease and its consequences. Aligned with these results, Giovanardi et al. (2022) found a link among COVID-19-related dreams, anxiety, and fear of contagion. Dream reports in the Mota et al. (2020) study also reflected fear of contamination and the processing of strategies to avert infection. During a COVID-19 lockdown, Pesonen et al. (2020) identified dreams that potentially prepare the dreamer for possible future negative events. COVID-19 dreams may thus be an expression of a preparatory process to deal with existential threats during the pandemic period, favoring more adaptive behaviors (Gorgoni et al., 2021).

Still regarding dream content, we should underline that one fifth of respondents who identified a COVID-19-related dream also stated that it was recurrent. There is an overall consensus among dream theorists that recurrent dreams are associated with the dreamer's unresolved difficulties (Zadra, 1996), an idea that stems from Freud's work, and was later developed by post-Freudian, ego-psychology, self-psychology, and object relations theorists. Based on an extensive literature review, Zadra (1996) stated that adults' recurrent dreams tend to occur in times of stress, are usually characterized by negative contents, and are related to deficits in psychological well-being. Furthermore, the cessation of recurrent dreams in adulthood is associated with increased psychological well-being, suggesting that changes from

repetitive to progressive dream patterns might be an important indicator of an individual's adaptation to life circumstances. Although this phenomenon might be a complex trauma symptom, dream recurrence could also be associated with one of the COVID-19 pandemic's distinguishing features: Unlike other collective disasters, such as terrorist attacks and natural disasters, the pandemic was not limited to a single event but involved a prolonged crisis with a high degree of uncertainty about the future (Schredl & Bulkeley, 2020).

Finally, we cannot overemphasize the significant and intimate connection among mental health, sleep patterns, and dream content. Respondents who signaled a negative impact of the pandemic on their mental health were more likely to report negative changes in all sleep parameters evaluated, increased nightmare recall, and COVID-19 dream content. These findings are aligned with previous research (Cellini et al., 2020; Mota et al., 2020; Pesonen et al., 2020; Schredl & Bulkeley, 2020) and have implications for subsequent research, prevention strategies, and therapeutic interventions within a mental health care framework.

More than 100 years ago, Freud (1955) argued that dream interpretation was the "royal road" to the unconscious mind, thus an essential element in the psychological treatment of neurotic patients. Nowadays, dream researchers seem to be rediscovering the valuable therapeutic effect of dream sharing, discussion, and analysis. Schredl and Bulkeley (2020, p. 196) affirmed that "talking about dreams enables the expression of complex feelings, memories, and concerns that cannot be easily articulated in other ways." Mota et al. (2020, p. 10) reported that participants in their study positively evaluated the process of observing and reporting their dreams, leading the authors to conclude that "this may indicate a relatively safe way for self-observation and mental health management that can be recommended during this period of uncertainty in waking life," with a positive impact on mental health. Also focusing this period of health-related turmoil, Barrett (2020b) suggested dream sharing and interpretation to promote self insight, incubating problem-solving dreams to address daily issues raised by the pandemic, and fostering mastery dreams in cases of repetitive traumatic nightmares.

Sleep and dream monitoring could also be an asset in public mental health assessment, helping to identify vulnerable or high-risk groups during collective crises and contributing to the prevention of psychopathological and sleep disorders (Mota et al., 2020; Scarpelli et al., 2021; Schredl & Bulkeley, 2020).

Limitations

Online data collection through convenience and snowball sampling procedures may have implied volunteer bias, attracting respondents with sleep problems who recently experienced a pandemic-related dream or who have a more pronounced interest in dreams (Cellini et al., 2020; Pesonen et al., 2020). In addition, participation was limited to Internet users. It should be noted, however, that online surveys remain one of the best strategies to attain large samples, particularly during lockdown periods (Gorgoni et al., 2021). Our sample was unbalanced regarding sex, area of residence, and educational attainment, compromising generalizability at an epidemiological level. Finally, the cross-sectional design limits conclusions about the observed phenomena. Future research on sleep and dreams during collective

crises should consider longitudinal designs to monitor the evolution of key variables (Scarpelli et al., 2022).

Conclusions

In conclusion, we hope that this study encourages the development of clinical and experimental research about sleep patterns and quality, dream contents, and their complex relationship with the psychological well-being of populations exposed to "collective trauma" (Fränkl et al., 2021). Although responding to a dream survey during a period of crisis might convey in itself a cathartic effect (Mota et al., 2020; Schredl & Bulkeley, 2020), future research could provide respondents with feedback, useful information, coping strategies, and direct links to mental health care resources (MacKay & DeCicco, 2020; Schredl & Bulkeley, 2020). These endeavors seem particularly relevant at the beginning of a second millennium pervaded by global health emergencies and major sociopolitical conflicts.

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