

RESEARCH ARTICLE



The associations between paranormal beliefs and sleep variables

Betul Rauf¹ | Rotem Perach^{1,2} | Juan J. Madrid-Valero³ | Dan Denis⁴ |
 Brian A. Sharpless^{1,5} | Giulia Lara Poerio⁶ | Christopher C. French¹ |
 Alice M. Gregory¹

¹Department of Psychology, Goldsmiths, University of London, London, UK

²School of Social Sciences, University of Westminster, London, UK

³Department of Health Psychology, Faculty of Health Sciences, University of Alicante, Alicante, Spain

⁴Department of Psychology, University of York, York, UK

⁵Department of Psychology, Pennsylvania State University, State College, Pennsylvania, USA

⁶School of Psychology, University of Sussex, Brighton, UK

Correspondence

Alice M. Gregory and Betul Rauf, Department of Psychology, Goldsmiths, University of London, New Cross, London SE14 6NW, UK. Email: a.gregory@gold.ac.uk and brauf001@gold.ac.uk

Funding information

WA Sceptics; BBC Science Focus Magazine

Summary

Previous studies have found significant associations between paranormal beliefs and sleep variables. However, these have been conducted on a small scale and are limited in the number of sleep variables investigated. This study aims to fill a gap in the literature by investigating paranormal beliefs in relation to a wide range of sleep variables in a large sample. Participants ($N = 8853$) completed a survey initiated by the BBC Focus Magazine. They reported on their demographics, sleep disturbances and paranormal beliefs. Poorer subjective sleep quality (lower sleep efficiency, longer sleep latency, shorter sleep duration and increased insomnia symptoms) was associated with greater endorsement of belief in: (1) the soul living on after death; (2) the existence of ghosts; (3) demons; (4) an ability for some people to communicate with the dead; (5) near-death experiences are evidence for life after death; and (6) aliens have visited earth. In addition, episodes of exploding head syndrome and isolated sleep paralysis were associated with the belief that aliens have visited earth. Isolated sleep paralysis was also associated with the belief that near-death experiences are evidence for life after death. Findings obtained here indicate that there are associations between beliefs in the paranormal and various sleep variables. This information could potentially better equip us to support sleep via psychoeducation. Mechanisms underlying these associations are likely complex, and need to be further explored to fully understand why people sometimes report “things that go bump in the night”.

KEYWORDS

anomalistic, anomalous experiences, exploding head syndrome, paranormal, parasomnia, sleep paralysis

1 | INTRODUCTION

Night-time can be a frightening experience for some. Indeed, ostensibly paranormal experiences, such as having seen a ghost or an

extra-terrestrial, are often reported during the night (Wing et al., 1994). Previous research has revealed significant relationships between a small number of sleep variables and ostensibly paranormal experiences and beliefs (Denis et al., 2018; Denis & Poerio, 2017; Drinkwater et al., 2020; Ramsawh et al., 2008). Specifically, sleep paralysis (SP)—a temporary inability to move typically occurring at sleep

This study was performed at the Goldsmiths University of London.

This is an open access article under the terms of the [Creative Commons Attribution](https://creativecommons.org/licenses/by/4.0/) License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited.

© 2023 The Authors. *Journal of Sleep Research* published by John Wiley & Sons Ltd on behalf of European Sleep Research Society.

onset or upon awakening (Santomauro & French, 2009; Waters et al., 2016) —has been associated with different factors including spirituality and paranormal beliefs. One study that investigated possible risk factors for isolated sleep paralysis (ISP; i.e. SP that occurs independently of narcolepsy and other medical conditions; Sharpless, 2016) found that those reporting ISP held significantly more spiritual beliefs (e.g. endorsing the belief that the mind and soul can leave the body and travel) than those without (Ramsawh et al., 2008). Similarly, a review of SP ($N = 42$ studies) found that people who reported experiencing SP were more likely to hold paranormal beliefs (e.g. believing in witchcraft, demonic assault) than those who did not (Denis et al., 2018).

Research has also explored the specific characteristics and beliefs associated with SP in samples from specific cultures. In Egypt, a commonly held belief is that SP is caused by *jinn*—supernatural beings that attack their victims (Jalal & Hinton, 2013). In Italy, SP has been proposed as reflecting an assault by the *Pandafeche*—an evil witch or terrifying humanoid cat (Jalal et al., 2015). It is noteworthy that attribution of supernatural explanations to episodes has been linked to heightened levels of anxiety (Fukuda et al., 1987; Wing et al., 1994). A study of American college students catalogued the non-human beings perceived during ISP, with “shadow people” and ghosts most frequently reported (Sharpless & Kličová, 2019). Although the perceived beings vary, SP episodes are generally associated with fear and distress, though not always (Kličová et al., 2021). In contrast, another study found that the vast majority (95%) of their respondents (Danish participants) endorsed the view that their SP has a physiological origin (e.g. brain malfunctioning; Jalal & Hinton, 2013).

Exploding head syndrome (EHS) is a sleep disorder characterized by loud noises or a perception of explosion in one's head during wake-sleep or sleep-wake transitions (Sharpless, 2014). This experience has also been linked to belief in the supernatural and reported ostensibly paranormal experiences. Specifically, one study found positive correlations between EHS episodes and anomalous beliefs (Sherwood, 1999). A more recent study, using the dataset reported in this current paper (the BBC Science Focus dataset), found that 2.8% of sufferers endorsed the belief that EHS was the result of non-biological, supernatural causes, and 2.3% believed it to be due to electronic devices (i.e. possibly indicating some conspiratorial thinking). The study also found that those who experienced EHS had shorter sleep durations, longer sleep-onset latencies, poorer subjective sleep quality and lower sleep efficiency; effect sizes, however, were small (Sharpless et al., 2020). Similarly, in an international sample, insomnia symptoms were positively associated with EHS episodes (Denis et al., 2019).

Despite the value of the work that has been published to date in addressing a largely ignored area of research, existing research has often been conducted on a small scale or has been relatively limited in the range of sleep variables investigated. However, other sleep variables are also likely associated with paranormal beliefs, and this needs further investigation. For example, a disturbed sleep pattern can trigger SP (Denis et al., 2018), which can involve hallucinations. Fear of ostensibly paranormal experiences could also interfere with or prevent sleep from occurring. Indeed, some paranormal beliefs (e.g. belief in aliens) can be deemed unhelpful as they have been associated with

increased sleep disturbances, especially sleep disturbances that can produce vivid sensory imagery (e.g. SP, hypnagogic and hypnopompic hallucinations; Denis et al., 2018; McNally & Clancy, 2005; Sharpless et al., 2020). Thus, the aim of this study is to examine a wider range of sleep variables in relation to paranormal beliefs to further unpack associations between sleep and the paranormal using a large set of data collected through research collaboration with the BBC Science Focus Magazine. Specifically, the current study aims to address the following research question: What are the associations between paranormal beliefs and sleep variables? In particular, we focus on six paranormal beliefs and their associations with sleep quality variables (i.e. sleep efficiency, duration, latency, insomnia symptoms) as well as ISP and EHS.

Research of this type is important as understanding these links can represent a first step towards obtaining information that could potentially be provided in psychoeducation aimed at supporting some of those struggling with sleep.

2 | METHODS

2.1 | Procedure

This online cross-sectional study was initiated by the BBC Science Focus Magazine. Ethical approval for this study was obtained from Goldsmiths, University of London. Those who participated had to be at least 18 years old, agreed to the terms of the study and provided informed consent. The study was publicized through the BBC Science Focus Magazine, popular press interviews with study authors (Brian A. Sharpless, Christopher C. French, Alice M. Gregory), as well as social media. UK nationals were invited to enter a prize draw to receive gift cards. The dataset used herein has been used previously to investigate EHS, its clinical features, theories about aetiology, and prevention techniques (Sharpless et al., 2020). The current study has different research aims, investigates a different part of the data, and has minimal overlap with the aforementioned publication (i.e. both studies report the prevalence of EHS).

2.2 | Measures

2.2.1 | Paranormal beliefs

Four paranormal beliefs were evaluated using a sub-scale from the Paranormal Assessment Scale (Reiner & Wilson, 2015). These were: “Do you believe that you have a soul that will live on after you die?”, “Do you believe in the existence of ghosts?”, “Do you believe that some people can communicate with the dead?”, “Do you believe that near death experiences are evidence for life after death?”. Two additional items developed by the authors were also included: “Do you believe in the existence of demons?” and “Do you believe that aliens have visited earth or have interacted with humans?”. Response options for all six items ranged from 1 (*Definitely not*) to 5 (*Definitely yes*). All items were analysed separately.

2.2.2 | Sleep variables

Subjective sleep quality variables

Sleep efficiency, the ratio between sleep duration and the total time dedicated to sleep in bed expressed as a percentage, was measured using three items (“during the past month, what time have you usually gone to bed at night”, “what time have you usually gotten up in the morning” and “how many hours of actual sleep did you get at night”) from the Pittsburgh Sleep Quality Index (Buysse et al., 1989), which has shown to have good reliability and validity (Backhaus et al., 2002). Insomnia symptoms were measured using items from the Insomnia Severity Index (ISI; Morin et al., 2011), which has demonstrated good reliability and validity (Bastien et al., 2001). In our survey, our first item (“Please rate your overall difficulties sleeping (i.e. falling asleep, staying asleep or waking up too early) in the past 2 weeks”) summarised three items regarding sleep difficulties from the ISI. In addition, two other items (i.e. interference and sleep satisfaction) from the ISI were used. Response options for each item used different wording, but ranged from 1 (indicative of no problem) to 5 (indicative of a very severe problem). Together, all three items showed a Cronbach's alpha of 0.89. The overall range for the current study is 3–15, with higher scores indicating greater insomnia. The term “subjective sleep quality” is used in this study to refer to sleep efficiency, sleep latency, sleep duration and insomnia symptoms altogether.

Other sleep variables

EHS and ISP were assessed using 11 items each adapted from the EHS Interview (Sharpless, 2015) and the Fearful Isolated Sleep Interview (Sharpless et al., 2010; Sharpless & Doghramji, 2015), which assess EHS and ISP based on the International Classification of Sleep Disorders—Third Edition criteria (Sateia, 2014). Participants were asked questions relevant to differential diagnoses (e.g. “Have you ever been diagnosed with narcolepsy?”) There were also free response items to assess for other psychological and medical conditions (e.g. “Have you ever actually done the things that you've dreamed) (e.g. kicking your bed partner while having a dream about fighting someone?”).

2.3 | Statistical analysis

Given the large sample size, we did not transform variables for skewness and kurtosis if their measures were between -2 and $+2$, as recommended by George (2011). Consequently, parametric as well as non-parametric analyses, including Chi-square tests were used. The Bonferroni correction was used (original p -value 0.05 divided by the number of comparisons) for Chi-square pairwise multiple comparisons to minimise type I errors (MacDonald & Gardner, 2000). Multiple regression analyses (age and gender were added as covariates) were run to determine if paranormal beliefs predicted sleep efficiency, sleep duration, sleep latency and insomnia symptoms. All paranormal belief variables, along with ISP and EHS were treated as categorical variables. Sleep efficiency, sleep duration, sleep latency and insomnia symptoms were treated as continuous.

3 | RESULTS

3.1 | Descriptive statistics

Of the 12,873 people that started the study, 8853 (69%) completed it. Of those completing the study, participants classified themselves as White ($N = 8099$, 92.9%), mixed ethnicity ($N = 240$, 2.8%), Asian ($N = 190$, 2.2%), with the remaining identifying as Black or “other”. The sample was primarily female (67%), and the sample mean age was 47.04 years ($SD = 15.63$; range = 18–94 years). Detailed descriptive statistics are reported in Table 1. In order to increase confidence that only idiopathic cases of both EHS and ISP were investigated, we excluded diseases and disorders with potentially overlapping symptoms (e.g. narcolepsy) in the analyses involving the EHS and ISP variables. The final numbers of those reporting at least one EHS or ISP episode were 3286 (52.7%) and 3523 (51.7%), respectively (see Figure S1 for participant flow and exclusions). Note that the exclusions for diseases and disorder do not apply when looking at the other sleep variables. The mean sleep efficiency for all participants was 84.42% ($SD = 12.85$). Mean sleep latency was 28 min ($SD = 32.38$ min), and the mean sleep duration was 6 hr and 51 min ($SD = 1:10$ hr). The mean for insomnia symptoms was 8.13 ($SD = 3.0$).

Of the participants, there were some strong believers in the paranormal (i.e. those who gave a response of “definitely yes”). For example, 12.7% (872/6867) strongly believed that the soul will live on after death, 8.1% (558/6869) strongly believed in the existence of ghosts, 5.6% (382/6859) believed that some people can communicate with the dead, 3.4% (235/6855) strongly believed that near-death experiences (NDEs) are evidence for life after death, 4.7% (321/6855) strongly believed in the existence of demons, and 3.4% (236/6855) strongly believed that aliens have visited earth/interacted with humans. Differences in numbers across the measures are due to missing data.

3.2 | Multiple regressions: Paranormal beliefs and subjective sleep quality variables

Multiple regressions were run to predict subjective sleep quality variables from paranormal beliefs (Table S1; see Figure 1 for illustration of means of subjective sleep quality variables by paranormal beliefs), controlling for age and gender (Table S2). All paranormal beliefs predicted all subjective sleep quality variables, even when controlling for age and gender ($p < 0.05$ for all); R^2 ranging from 0.01 to 0.04 for the regressions with age and gender entered.

3.3 | Associations between paranormal beliefs and ISP and EHS

Figure 2 shows the percentages of those reporting 1) EHS and 2) ISP within each category of the belief that aliens have visited earth or

TABLE 1 Descriptive statistics for all variables

Variable	Categories	N	%
Gender	Male	2894	33.0
	Female	5868	67.0
Ethnicity	White	8099	92.9
	Mixed/multiple ethnic groups	240	2.8
	Asian/Asian British	190	2.2
	Black/Black British	57	0.7
	Other	135	1.5
Soul after death	Definitely not	1731	25.2
	I do not think so	1592	23.2
	Not sure	1584	23.1
	I think so	1088	15.8
	Definitely yes	872	12.7
Ghosts exist	Definitely not	2179	31.7
	I do not think so	1630	23.7
	Not sure	1439	20.9
	I think so	1063	15.5
	Definitely yes	558	8.1
Communicate with the dead	Definitely not	2824	41.2
	I do not think so	1608	23.4
	Not sure	1308	19.1
	I think so	737	10.7
	Definitely yes	382	5.6
NDEs evidence life after death	Definitely not	2295	33.5
	I do not think so	1967	28.7
	Not sure	1771	25.8
	I think so	587	8.6
	Definitely yes	235	3.4
Demons exist	Definitely not	3541	51.7
	I do not think so	1520	22.2
	Not sure	975	14.2
	I think so	498	7.3
	Definitely yes	321	4.7
Aliens visited earth	Definitely not	2324	33.9
	I do not think so	2115	30.9
	Not sure	1575	23.0
	I think so	605	8.8
	Definitely yes	236	3.4
EHS frequency	Never	2954	44.2
	Once	244	3.6
	Twice or several times in life	1493	22.3
	Several times a year	1255	18.8
	Monthly	357	5.3
	Weekly	192	2.9
	Several times a week	191	2.9

TABLE 1 (Continued)

Variable	Categories	N	%
SP frequency	Never	3288	47.8
	Once	353	5.1
	Twice or several times in life	1624	23.6
	Several times a year	1027	14.9
	Monthly	336	4.9
	Weekly	130	1.9
	Several times a week	123	1.8
EHS	Yes	3732	55.8
	No	2954	44.2
SP	Yes	3593	52.2
	No	3288	47.8
	Range	N	Mean (SD)
Age	18–94	8853	47.04 (15.63)
Sleep efficiency	20–100	6057	84.42 (12.85)
Sleep latency	0–360 min	5780	28.39 (32.38)
Sleep duration	3:00–12:00 hr	6141	6:51 (1:10)
Insomnia symptoms	3–15	6954	8.13 (3.00)

Note: Sleep duration is reported in hr:min. Sleep duration (16:00 and 23:45 hr) and sleep latency (450, 507 and 508 min) included outliers that were not included in the table above (for presentation purposes). However, those participants were still included in all analyses as their participation did not affect the results. Note that the descriptive statistics are reported for the entire sample. Idiopathic cases of EHS and ISP were reported by 3286 and 3523 participants, respectively.

Abbreviation: EHS, exploding head syndrome; NDEs, near-death experiences; SP, sleep paralysis.

interacted with humans. Chi-square tests were performed to examine the relation between paranormal beliefs and the remaining two sleep variables (i.e. EHS and ISP; Table S3). The belief that aliens have visited earth or interacted with humans was significantly associated with EHS, $\chi^2(4, N = 6120) = 23.56, p < 0.001$, Cramer's $V = 0.06$, and ISP, $\chi^2(4, N = 6701) = 33.69, p < 0.001$, Cramer's $V = 0.07$. Post-hoc tests showed that those reporting EHS (vs. non-EHS) and ISP (vs. non-ISP) held stronger beliefs about aliens (Tables S4 and S5, respectively). Additionally, the belief that NDEs are evidence for life after death was associated with ISP, $\chi^2(4, N = 6701) = 11.30, p = 0.023$, Cramer's $V = 0.04$ (Table S3). Post-hoc tests found that a larger proportion of the ISP group responded “definitely yes” to the belief that NDEs are evidence for life after death compared with the non-ISP group, $\chi^2(4, N = 1953) = 9.0, p = 0.003$, Cramer's $V = 0.07$ (Table S6). See Figure 3 for percentages of those reporting ISP within each category of the belief that NDEs are evidence for life after death.

Finally, the belief that the soul lives on after death was associated with ISP, $\chi^2(4, N = 6713) = 10.48, p = 0.033$, Cramer's $V = 0.04$ (Table S3). However, it was not significant after applying Bonferroni correction during post hoc pairwise comparisons when $p < 0.005$ (Table S7).

In a separate dataset (Denis et al., 2019; Denis & Poerio, 2017), we attempted to replicate our primary results. Overall, the dataset showed a broadly similar pattern of results to our primary analyses, although not all tests reached statistical significance (Appendix S1), which may be due to the smaller sample size.

4 | DISCUSSION

The present study aimed to examine the associations between a wide range of paranormal beliefs and sleep variables. The results demonstrated that various anomalous beliefs were associated with ISP, EHS and subjective sleep quality (i.e. sleep efficiency, sleep duration, sleep latency and insomnia).

We found that the belief that aliens have visited earth was more common in those who reported ISP or EHS compared with those who did not. This is consistent with previous research suggesting that paranormal beliefs are associated with SP (Denis et al., 2018) and EHS (Sherwood, 1999). These findings are interesting because as SP involves different types of hallucinations, including auditory and visual (Sharpless & Kličková, 2019), and EHS typically involves a bang (Sharpless et al., 2020), our findings suggest that the belief in aliens may be associated with sleep disturbances that produce sounds or images (i.e. ISP and EHS). One explanation for these associations is therefore that someone experiencing sounds or images associated with sleep could interpret this as evidence that aliens or other supernatural beings exist—although future research is required to test this further and rule out alternative explanations. In addition, the belief that NDEs are evidence for life after death was more prevalent in ISP reporters than non-reporters. To the best of our knowledge, this is a novel finding worthy of further examination. EHS was not associated with the other paranormal beliefs.

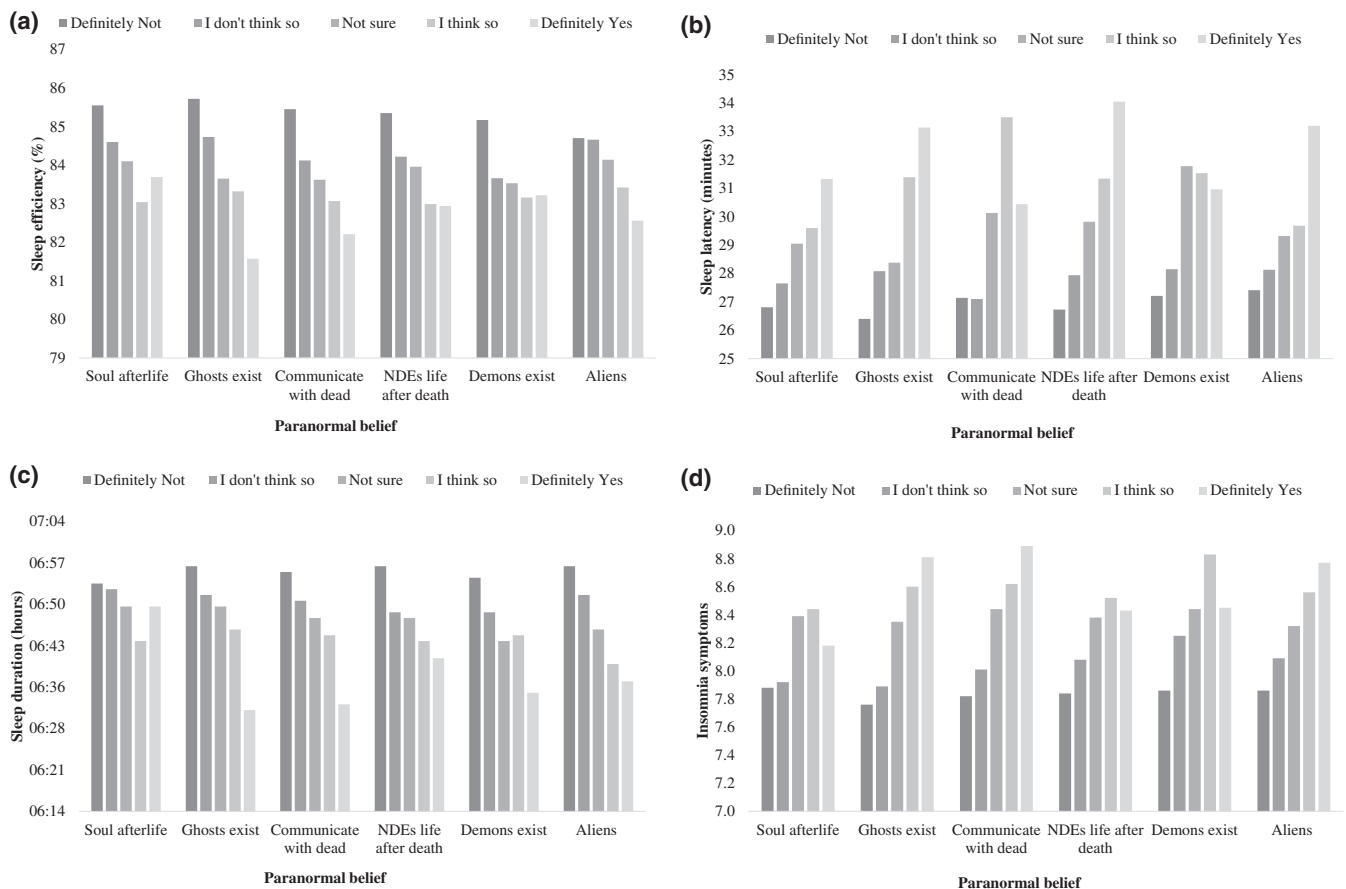


FIGURE 1 Relationship between paranormal beliefs and subjective sleep quality variables. All regression analyses focusing on the associations between paranormal beliefs and subjective sleep quality variables (controlling for age and gender) were significant (see Table S2 for further details). NDEs, near-death experiences

Links between paranormal beliefs and the other sleep variables were also revealed—and for all associations, it was found that a higher level of paranormal belief was associated with a poorer subjective sleep quality, even when controlling for age and gender effects. More specifically, participants who reported stronger beliefs in the soul living on after death, the existence of ghosts, that some people can communicate with the dead, that NDEs are evidence for life after death, that demons exist, and that aliens have visited earth also tended to report lower sleep efficiency, longer sleep latency, shorter sleep duration and increased insomnia symptoms. Likewise, in our separate dataset, those reporting stronger beliefs in the existence of a devil also reported increased insomnia symptoms.

While most of the associations reported here appear to be linear (i.e. stronger belief in paranormal experiences was associated with poorer subjective sleep quality), some associations appeared to be more u-shaped. For example, there appeared to be an inverse u-shaped association between insomnia symptoms and a belief that the soul lives on after death. In particular, while overall a greater belief that the soul lives on after death is associated with an increased likelihood of reporting insomnia symptoms—those who reported very strong beliefs here reported fewer insomnia symptoms than those who held some uncertainty. Should these results be replicated, one

possible explanation for these findings is that uncertainty and indecisiveness (in this case uncertain beliefs) may lead to anxiety, which in turn can interfere with sleep. This finding also underscores the need for further research in this field to consider different aspects of paranormal beliefs separately as associations with sleep may differ.

An explanation for more general association between sleep and paranormal belief is whether some of these associations could be explained by anxiety about certain paranormal beliefs (e.g. the existence of ghosts and demons/devil) interfering with sleep. However, it is more difficult to explain the links between other paranormal beliefs (e.g. belief in the soul and in life after death) using such an explanation. It may also be important to assess for the presence of other forms of psychopathology (e.g. depression, post-traumatic stress disorder), which could both disrupt sleep and impact beliefs. In addition, potential mediators/moderators such as education, personality differences and religious beliefs should be examined in future research given their associations with both sleep (Gray & Watson, 2002; Hill et al., 2018; Moore et al., 2002) and belief in the paranormal (Aarnio & Lindeman, 2005; Williams et al., 2007). Future longitudinal and experimental studies are needed to establish the direction of effects, as well as consider other underlying factors between the assessed variables.

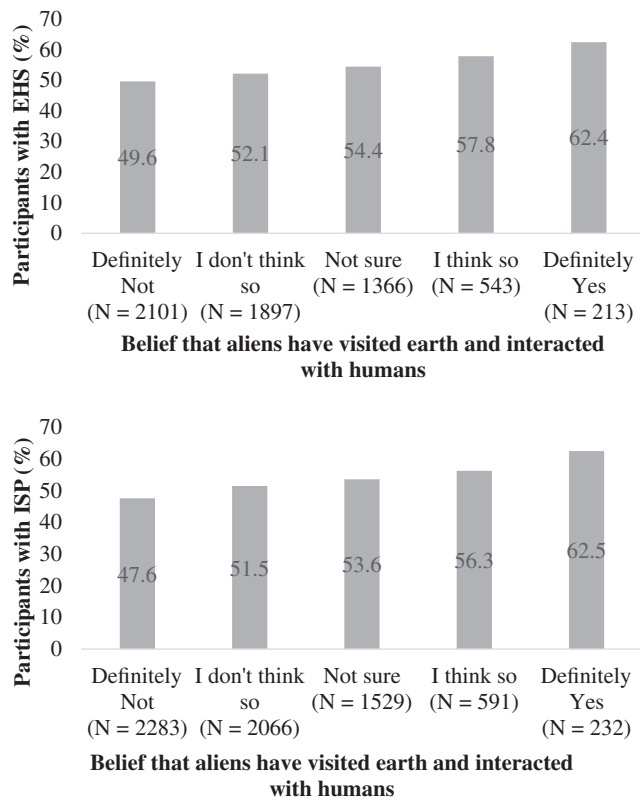


FIGURE 2 Belief that aliens have visited earth or interacted with humans, and exploding head syndrome (EHS) and isolated sleep paralysis (ISP). The figures are showing the percentages of participants reporting 1) EHS and 2) ISP within each of the five response categories about the belief in aliens. Further analyses showed that people reporting EHS held stronger beliefs that aliens have visited earth than the non-EHS group, $\chi^2(4, N = 6120) = 23.56, p < 0.001$ for the whole model (Table S3). Likewise, people reporting ISP held stronger beliefs that aliens have visited earth than the non-ISP group, $\chi^2(4, N = 6701) = 33.69, p < 0.001$ for the whole model. See Tables S4 and S5 for additional information (i.e. differences between the groups)

Although the results revealed small effect sizes, there is growing recognition that small effects are common in research on complex psychological processes (Götz et al., 2022). Our findings are nonetheless noteworthy as they may have significant real-world consequences (Funder & Ozer, 2019) given that most behaviours and attitudes are the consequence of the cumulative small effects of several factors as opposed to a large effect of a single factor (Götz et al., 2022).

4.1 | Limitations

Despite the many strengths of this report, including the focus on an under-researched topic and the sample size—which was much larger than most of the previous studies within this domain, a number of limitations should be considered. First, given that the study employed a cross-sectional design, cause-and-effect relationships cannot be established. Second, despite the large sample size, participants were

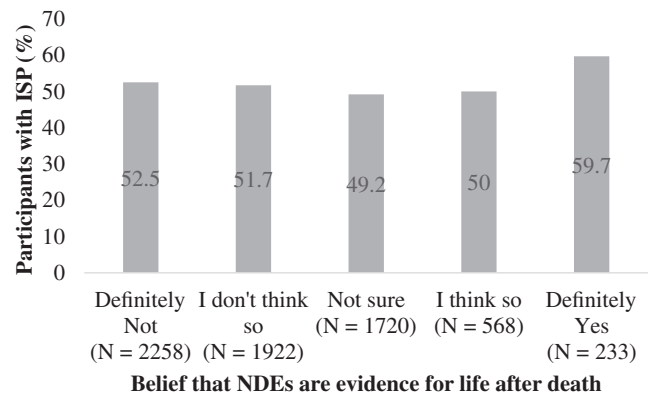


FIGURE 3 Belief that near-death experiences (NDEs) are evidence for life after death and isolated sleep paralysis (ISP). The whole model was statistically significant, $\chi^2(4, N = 6701) = 11.30, p = 0.023$. Additional information (i.e. differences between groups with Bonferroni correction applied) is found in Table S6

self-selected and unlikely to be representative of the general population. For example, the seemingly high rates of ISP and EHS could indicate that individuals with these symptoms were more likely than others to be interested in taking part in this study. Third, other phenomena that may contribute to these beliefs were not assessed (e.g. dissociative phenomena; other forms of sleep-related hallucinations). Fourth, as most participants identified as White, the results may not generalise across different groups. Future work should attempt to recruit from a more diverse sample. Finally, the measures were all self-report, and future work examining some of the sleep variables (such as sleep efficiency) using objective measures would be valuable.

4.2 | Clinical/practice implications

Results from the current study may help clinicians avoid misdiagnosis when they are faced with patients endorsing ostensibly paranormal beliefs/experiences. Reports of paranormal activity or anomalous beliefs could be mistaken as prima facie evidence for more severe disorders, such as schizophrenia, schizotypal personality disorder, or depression with psychotic features (American Psychiatric Association, 2013; Bastien et al., 2001; Waters et al., 2016). The results provided here may encourage clinicians to assess for relevant sleep disturbances and parasomnias in addition to other forms of psychopathology. Clearly, accurate differential diagnosis could have important treatment implications (e.g. a course of cognitive behavioural therapy for either insomnia or ISP versus antipsychotic medications and supportive psychotherapy).

Additionally, knowledge of the potential clinical contributions to ostensibly paranormal beliefs—and their lack of rarity in the population—could allow providers to more effectively support their patients by enhancing their understanding and familiarity with the topic, as well as offer possible explanations for their reported experiences.

More generally, psychoeducation may help reduce the overall prevalence of beliefs that some find frightening (e.g. belief in ghosts).

5 | CONCLUSION

In summary, our findings demonstrate that there are significant associations between a wide range of paranormal beliefs and sleep variables. To our knowledge, we are the first to investigate and report associations between a relatively broad spectrum of anomalous and sleep-related variables using a large international study sample. The study findings can help support patients' experiences by increasing healthcare practitioners' understanding with regards to people reporting such events. In addition, these findings may decrease misdiagnosis of psychiatric disorders that share similar features with various sleep experiences. Future research is encouraged to provide unique insight into the causal relationships between sleep and the paranormal.

AUTHOR CONTRIBUTIONS

Betul Rauf: conceptualisation; software; formal analysis; writing – original draft preparation. Rotem Perach: methodology; software; formal analysis; resources; data curation; supervision; writing – review and editing. Juan J. Madrid-Valero: validation; resources; visualisation; writing – review and editing. Dan Denis: conceptualization; data curation; writing – review and editing. Brian A. Sharpless: conceptualization; data curation; resources; writing – review and editing. Giulia Lara Poerio: data curation; resources; writing – review and editing. Christopher C. French: supervision; conceptualisation; data curation; resources; writing – review and editing. Alice M. Gregory: funding acquisition; supervision; conceptualisation; data curation; resources; writing – review and editing.

ACKNOWLEDGEMENTS

The authors wish to thank the participants involved in the study. The authors also acknowledge the support from BBC Science Focus Magazine, especially Ellen Keld and Daniel Bennett—who initiated the study and provided support in kind (administrative support, financing the prize draw and promoting the study). Thanks also to Isabella Badini who helped in the early stages of the study, as well as those who contributed to the qualitative analysis of the data (i.e. Matthew Hutton, Hannah Laurence, Kamila Pawlowska, Chloe Sergeant and Ryan Stewart).

FUNDING INFORMATION

BBC Science Focus Magazine provided support in kind (administrative support, financing the prize draw and promoting the study). The write-up of this report was funded by a grant from WA Sceptics to AMG to support the work of BR.

CONFLICT OF INTEREST

Alice Gregory is an advisor for a project initially sponsored by Johnson's Baby. She is a consultant for Perrigo (2021+). She receives royalties for two books: *Nodding Off* (Gregory, 2018); and *The Sleepy*

Pebble (Gregory & Kirkpatrick, 2019). She has another contract with Lawrence King Publishers (publication due 2023). She is a regular contributor to BBC Focus Magazine, and has contributed to other outlets (such as The Conversation, The Guardian and Balance Magazine). She occasionally receives sample products related to sleep (e.g. blue-light-blocking glasses), and has given a paid talk to a business (Investec). Alice Gregory was previously a CEO of Sleep Universal LTD (2022). She is a specialist subject editor at JCPP (sleep) for which she receives a small honorarium. She has contributed a paid article to Neurodiem. Brian Sharpless receives royalties for three books published through Oxford University Press (*Sleep Paralysis*, 2015; *Unusual and Rare Psychological Disorders*, 2017; and *Psychodynamic Therapy Techniques*, 2019). He is currently under contract with Chicago Review Press for his fourth. He occasionally receives sample products related to sleep (e.g. blue-light-blocking glasses), and frequently gives paid public lectures on sleep disorders and other clinical topics.

DATA AVAILABILITY STATEMENT

The data underlying this article are not currently publicly available due to data protection policies. Reasonable requests for access to data should be made to the corresponding author.

ORCID

Betul Rauf  <https://orcid.org/0000-0001-8963-7603>

REFERENCES

- Aarnio, K., & Lindeman, M. (2005). Paranormal beliefs, education, and thinking styles. *Personality and Individual Differences*, 39(7), 1227–1236. <https://doi.org/10.1016/j.paid.2005.04.009>
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders: DSM-5* (5th ed.). American Psychiatric Association.
- Backhaus, J., Junghanns, K., Broocks, A., Riemann, D., & Hohagen, F. (2002). Test-retest reliability and validity of the Pittsburgh sleep quality index in primary insomnia. *Journal of Psychosomatic Research*, 53(3), 737–740. [https://doi.org/10.1016/S0022-3999\(02\)00330-6](https://doi.org/10.1016/S0022-3999(02)00330-6)
- Bastien, C. H., Vallières, A., & Morin, C. M. (2001). Validation of the insomnia severity index as an outcome measure for insomnia research. *Sleep Medicine*, 2(4), 297–307. [https://doi.org/10.1016/S1389-9457\(00\)00065-4](https://doi.org/10.1016/S1389-9457(00)00065-4)
- Buysse, D. J., Reynolds, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh sleep quality index: A new instrument for psychiatric practice and research. *Psychiatry Research*, 28(2), 193–213. [https://doi.org/10.1016/0165-1781\(89\)90047-4](https://doi.org/10.1016/0165-1781(89)90047-4)
- Denis, D., French, C. C., & Gregory, A. M. (2018). A systematic review of variables associated with sleep paralysis. *Sleep Medicine Reviews*, 38, 141–157. <https://doi.org/10.1016/j.smrv.2017.05.005>
- Denis, D., & Poerio, G. L. (2017). Terror and bliss? Commonalities and distinctions between sleep paralysis, lucid dreaming, and their associations with waking life experiences. *Journal of Sleep Research*, 26(1), 38–47. <https://doi.org/10.1111/jsr.12441>
- Denis, D., Poerio, G. L., Derveeuw, S., Badini, I., & Gregory, A. M. (2019). Associations between exploding head syndrome and measures of sleep quality and experiences, dissociation, and well-being. *Sleep*, 42(2), zsy216. <https://doi.org/10.1093/sleep/zsy216>
- Drinkwater, K. G., Denovan, A., & Dagnall, N. (2020). Lucid dreaming, nightmares, and sleep paralysis: Associations with reality testing deficits and paranormal experience/belief. *Frontiers in Psychology*, 11, 471. <https://doi.org/10.3389/fpsyg.2020.00471>

- Fukuda, K., Miyasita, A., Inugami, M., & Ishihara, K. (1987). High prevalence of isolated sleep paralysis: Kanashibari phenomenon in Japan. *Sleep*, 10(3), 279–286. <https://doi.org/10.1093/sleep/10.3.279>
- Funder, D. C., & Ozer, D. J. (2019). Evaluating effect size in psychological research: Sense and nonsense. *Advances in Methods and Practices in Psychological Science*, 2(2), 156–168. <https://doi.org/10.1177/2515245919847202>
- George, D. (2011). *SPSS for windows step by step: A simple study guide and reference*, 17.0 update, 10/e. Pearson Education India.
- Götz, F. M., Gosling, S. D., & Rentfrow, P. J. (2022). Small effects: The indispensable foundation for a cumulative psychological science. *Perspectives on Psychological Science*, 17(1), 205–215. <https://doi.org/10.1177/1745691620984483>
- Gray, E. K., & Watson, D. (2002). General and specific traits of personality and their relation to sleep and academic performance. *Journal of Personality*, 70(2), 177–206. <https://doi.org/10.1111/1467-6494.05002>
- Gregory, A. M. (2018). *Nodding Off. Sleep from cradle to grave*. Bloomsbury Sigma.
- Gregory, A. M., & Kirkpatrick, C. (2019). *The sleepy pebble and other stories*. Flying Eye.
- Hill, T. D., Deangelis, R., & Ellison, C. G. (2018). Religious involvement as a social determinant of sleep: An initial review and conceptual model. *Sleep Health*, 4(4), 325–330. <https://doi.org/10.1016/j.sleh.2018.04.001>
- Jalal, B., & Hinton, D. E. (2013). Rates and characteristics of sleep paralysis in the general population of Denmark and Egypt. *Culture, Medicine, and Psychiatry: An International Journal of Cross-Cultural Health Research*, 37(3), 534–548. <https://doi.org/10.1007/s11013-013-9327-x>
- Jalal, B., Romanelli, A., & Hinton, D. E. (2015). Cultural explanations of sleep paralysis in Italy: The Pandafeche attack and associated supernatural beliefs. *Culture, Medicine, and Psychiatry: An International Journal of Cross-Cultural Health Research*, 39(4), 651–664. <https://doi.org/10.1007/s11013-015-9442-y>
- Klíková, M., Sharpless, B. A., & Bušková, J. (2021). Could sleep paralysis be pleasant? *Journal of Sleep Research*, 30(3), e13154. <https://doi.org/10.1111/jsr.13154>
- MacDonald, P. L., & Gardner, R. C. (2000). Type I error rate comparisons of post hoc procedures for I j Chi-Square tables. *Educational and Psychological Measurement*, 60(5), 735–754. <https://doi.org/10.1177/00131640021970871>
- McNally, R. J., & Clancy, S. A. (2005). Sleep paralysis, sexual abuse, and space alien abduction. *Transcultural Psychiatry*, 42(1), 113–122. <https://doi.org/10.1177/1363461505050715>
- Moore, P. J., Adler, N. E., Williams, D. R., & Jackson, J. S. (2002). Socioeconomic status and health: The role of sleep. *Psychosomatic Medicine*, 64(2), 337–344. <https://doi.org/10.1097/00006842-200203000-00018>
- Morin, C. M., Belleville, G., Bélanger, L., & Ivers, H. (2011). The insomnia severity index: Psychometric indicators to detect insomnia cases and evaluate treatment response. *Sleep*, 34(5), 601–608. <https://doi.org/10.1093/sleep/34.5.601>
- Ramsawh, H. J., Raffa, S. D., White, K. S., & Barlow, D. H. (2008). Risk factors for isolated sleep paralysis in an African American sample: A preliminary study. *Behavior Therapy*, 39(4), 386–397. <https://doi.org/10.1016/j.beth.2007.11.002>
- Reiner, T. W., & Wilson, A. M. (2015). Assessing belief in the paranormal: An exploratory and confirmatory factor analysis. *Journal of Scientific Psychology*, 14.
- Santomauro, J., & French, C. C. (2009). Terror in the night. *The Psychologist*, 22(8), 672–675.
- Sateia, M. J. (2014). International classification of sleep disorders-third edition. *Chest*, 146(5), 1387–1394. <https://doi.org/10.1378/chest.14-0970>
- Sharpless, B. A. (2014). Exploding head syndrome. *Sleep Medicine Reviews*, 18(6), 489–493. <https://doi.org/10.1016/j.smrv.2014.03.001>
- Sharpless, B. A. (2015). Exploding head syndrome is common in college students. *Journal of Sleep Research*, 24(4), 447–449. <https://doi.org/10.1111/jsr.12292>
- Sharpless, B. A. (2016). A clinician's guide to recurrent isolated sleep paralysis. *Neuropsychiatric Disease and Treatment*, 12, 1761–1767. <https://doi.org/10.2147/NDT.S100307>
- Sharpless, B. A., Denis, D., Perach, R., French, C. C., & Gregory, A. M. (2020). Exploding head syndrome: Clinical features, theories about etiology, and prevention strategies in a large international sample. *Sleep Medicine*, 75, 251–255. <https://doi.org/10.1016/j.sleep.2020.05.043>
- Sharpless, B. A., & Doghramji, K. (2015). *Sleep paralysis: Historical, psychological, and medical perspectives*. Oxford University Press.
- Sharpless, B. A., & Klíková, M. (2019). Clinical features of isolated sleep paralysis. *Sleep Medicine*, 58, 102–106. <https://doi.org/10.1016/j.sleep.2019.03.007>
- Sharpless, B. A., McCarthy, K. S., Chambless, D. L., Milrod, B. L., Khalsa, S.-R., & Barber, J. P. (2010). Isolated sleep paralysis and fearful isolated sleep paralysis in outpatients with panic attacks. *Journal of Clinical Psychology*, 66(12), 1292–1306. <https://doi.org/10.1002/jclp.20724>
- Sherwood, S. J. (1999). Relationship between childhood hypnagogic, hypnopompic, and sleep experiences, childhood fantasy proneness, and anomalous experiences and beliefs: An exploratory WWW survey. *Journal of the American Society for Psychical Research*, 93(2), 167–197.
- Waters, F., Blom, J. D., Dang-Vu, T. T., Cheyne, A. J., Alderson-Day, B., Woodruff, P., & Collerton, D. (2016). What is the link between hallucinations, dreams, and hypnagogic-hypnopompic experiences. *Schizophrenia Bulletin*, 42(5), 1098–1109. <https://doi.org/10.1093/schbul/sbw076>
- Williams, E., Francis, L. J., & Robbins, M. (2007). Personality and paranormal belief: A study among adolescents. *Pastoral Psychology*, 56(1), 9–14. <https://doi.org/10.1007/s11089-007-0094-x>
- Wing, Y.-K., Lee, S. T., & Chen, C.-N. (1994). Sleep paralysis in Chinese: Ghost oppression phenomenon in Hong Kong. *Sleep: Journal of Sleep Research & Sleep Medicine*, 17(7), 609–613. <https://doi.org/10.1093/sleep/17.7.609>

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Rauf, B., Perach, R., Madrid-Valero, J. J., Denis, D., Sharpless, B. A., Poerio, G. L., French, C. C., & Gregory, A. M. (2023). The associations between paranormal beliefs and sleep variables. *Journal of Sleep Research*, e13810. <https://doi.org/10.1111/jsr.13810>