

Quality and readability of online information resources on insomnia

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Abstract The internet is a major source for health information. An increasing number of people, including patients with insomnia, search for remedies online; however, little is known about the quality of such information. This study aimed to evaluate the quality and readability of insomnia-related online information. Google was used as the search engine, and the top websites on insomnia that met the inclusion criteria were evaluated for quality and readability. The analyzed websites belonged to nonprofit, commercial, or academic organizations and institutions such as hospitals and universities. Insomnia-related websites typically included definitions (85%), causes and risk factors (100%), symptoms (95%), and treatment options (90%). Cognitive behavioral therapy for insomnia (CBT-I) was the most commonly recommended approach for insomnia treatment, and sleep drugs are frequently mentioned. The overall quality of the websites on insomnia is moderate, but all the content exceeded the recommended reading ease levels. Concerns that must be addressed to increase the quality and trustworthiness of online health information include sharing metadata, such as authorship, time of creation and last update, and conflicts of interest; providing evidence for reliability; and increasing the readability for a layman audience.

Keywords insomnia; internet; readability; information quality; health literacy; cognitive behavioral therapy; treatment

Introduction

The increasing penetration of the internet and the awareness of information accessibility in the past few decades have drastically increased the number of people seeking information online. The internet has become the primary knowledge source for numerous anxious patients searching health-related information. More than 60% of adults internet users seek health information online in Europe and North America [1]. Millions of internet users worldwide seek online health information everyday [2]; considering the ever-increasing internet accessibility and the emphasis on online information resources, these trends are expected to keep increasing.

Numerous people use the internet to obtain health information, often either before or after consulting their

clinicians. Pre-visit information seeking on the internet has increased considerably, and more than 50% of patients consult a medical professional because of the information they have discovered online [3]. Because access to reliable information is linked to reduced anxiety [4], increased feelings of self-efficacy, and reduced ambulatory care use [3], high-quality webpages are those that provide necessary, comprehensive, and clear information on definitions, causes, treatment options, and medications. Online resources are education opportunities; however, patient misinterpretations of online information have been identified [5]. Low-quality information can induce bias and low follow-up rate [6]. Therefore, the quality of online information has been much emphasized.

The information quality of health-related resources remains unclear in several medical fields, particularly for chronic diseases, such as insomnia, on which patients seek additional information. Patients with insomnia prefer to expand their knowledge and seek alternative treatments online. Insomnia and its treatment

options are increasingly more studied and documented [7]; however, the information quality of insomnia websites remains unclear. Therefore, this study extended the literature by assessing the quality of insomnia-related information in the top websites returned by a Google search, evaluating the readability of the information, and identifying the most commonly recommended remedies.

Evaluation on health-related online information

Search tool and search strategy

Most people and the majority of patients (85%) [3] seek online health information by using general search engines, such as Google and Yahoo [3,8]. Google (<http://www.google.com>) is the largest and most widely used search engine worldwide, with a market share of more than 70% and ranking number one in terms of the number of visits [9]; hence, it was used as the search tool in this study. We performed a Google search on June 1, 2015, at Boston, Massachusetts, USA, by using the keyword “insomnia” to identify insomnia-related online resources. People seldom search for information beyond the first 20 links retrieved by search engines [10], and most probably analyze only the first page of results, stopping when their search intentions are met [11]. Therefore, the top 20 websites obtained in our search were included in this analysis; weblogs and

irrelevant and primarily commercial websites were excluded.

Quality evaluation

The websites were independently evaluated and scored during the same period by sleep specialists by using three instruments typically used for online information assessment studies: the DISCERN instrument, quality and content checklist, and Flesch–Kincaid grade for readability.

DISCERN instrument

DISCERN, an instrument developed jointly by researchers at the Oxford University and the British Library, was primarily designed for providing a valid and reliable means for assessing the quality of written information on treatment choices for a health problem [12–14]. It is a validated rating tool [12] and is available online (www.discern.org.uk) for free. DISCERN is a 16-item scale with three sections (Table 1): publication reliability (questions 1–8), quality of information on treatment choices (questions 9–15), and overall rating of the publication (question 16). Each question is rated on a scale of 1–5 (1 = *a definite no* and 5 = *a definite yes*), depending on whether the publication satisfied the question criteria. A rating of 2–4 suggests that a few criteria of the question were satisfied (3

Table 1 16 items of DISCERN and mean scores of the included websites

DISCERN	Scores	95% CI
SECTION 1: Is the publication reliable?		
1. Are the aims clear?	4.3	(4.1, 4.5)
2. Does it achieve its aims?	3.8	(3.5, 4.1)
3. Is it relevant?	4.3	(4.1, 4.5)
4. Is it clear what sources of information were used to compile the publication (other than the author or producer)?	3.1	(2.6, 3.6)
5. Is it clear when the information used or reported in the publication was produced?	2.9	(2.4, 3.4)
6. Is it balanced and unbiased?	3.8	(3.5, 4)
7. Does it provide details of additional sources of support and information?	3.4	(2.9, 3.8)
8. Does it refer to areas of uncertainty?	2.1	(1.8, 2.4)
SECTION 2: How good is the quality of information on treatment choices?		
9. Does it describe how each treatment works?	3.4	(3, 3.8)
10. Does it describe the benefits of each treatment?	3.5	(3.1, 3.8)
11. Does it describe the risks of each treatment?	2.8	(2.4, 3.2)
12. Does it describe what would happen if no treatment is used?	3.1	(2.7, 3.4)
13. Does it describe how the treatment choices affect overall quality of life?	2.8	(2.4, 3.1)
14. Is it clear that there may be more than one possible treatment choice?	3.8	(3.4, 4.1)
15. Does it provide support for shared decision-making?	3.1	(2.6, 3.5)
SECTION 3: Overall rating of the publication		
16. Based on the answers to all of the above questions, rate the overall quality of the publication as a source of information about treatment choices	3.3	(2.9, 3.7)

= *partially present*). The scores for each question were averaged, and a final overall score was assigned for each website. DISCERN has been used in many medical studies [15–23] to evaluate the quality of health-related websites.

Quality and content checklists

Daraz *et al.* [24] proposed a quality checklist consisting of 10 questions in 7 categories: authorship, content, currency, usefulness, disclosure, user support and feedback, and privacy and confidentiality. All questions have *yes* or *no* as the responses. This tool has not been validated but is based on a structured review of the health information quality assessment of existing web evaluation tools. We customized the checklist by adding items related to insomnia treatment and recorded the recommended treatment approaches from each website for analysis.

Insomnia-related content from the included websites were analyzed according to the information provided and treatment modality recommended. The website content was analyzed for the following information: definitions, prevalence, causes and risk factors, symptoms, classification and types, diagnoses, complications, treatment options, side effects, prognoses, and suggestions for medical consultation.

Readability scores

The American Medical Association and National Institutes of Health (NIH) recommend that patient education resources be readable and that written resources must be designed for readability at the fourth- to sixth-grade levels, thus ensuring adequate readability for the majority of adults [25–27]. In this study, we analyzed the main content from the included websites for readability by using 4 of the most commonly used and NIH-recommended indices (Table 2): Flesch Reading Ease Score (FRES), Flesch–Kincaid Grade Level (FKGL), Gunning-Fog index (GFOG), and Simple Measure of Gobbledygook (SMOG).

FRES is calculated using the formula $206.835 - (1.015 \times \text{average sentence length [ASL]}) - (84.6 \times \text{average number of syllables per word [ASW]})$. FKGL is a modified version of the FRES scale and is calculated as $(0.39 \times \text{ASL}) + (11.8 \times \text{ASW}) - 15.59$. FKGL and FRES are automated in older versions of Microsoft Word and in several online calculators; these instruments are reliable and valid [28]. FKGL yields a score corresponding to a US school grade level; that is, the scores indicate the number of years of education typically required to understand the analyzed text. For example, a FKGL score of 6 indicates that a sixth-grade education level is required to comprehend the resource. A grade level of 6–8, corresponding to ages 11–13 years, is recommended for health information targeted at a layman audience [29].

The GFOG estimates the number of years of formal education required to understand the text on first reading. A GFOG score of 12 corresponds to the reading level of a US high school senior (aged approximately 18 years). Texts for a layman audience typically require a GFOG score of < 12. SMOG is a measure of readability that estimates the years of education required for understanding the analyzed text [30]. It was developed as an instrument that is more accurate and easy compared with GFOG; however, SMOG is most accurate for grade levels ≥ 6 and is based on 100% comprehension and is the recommended measure of readability for evaluating consumer-oriented healthcare resources [31]. SMOG and GFOG scores range from 0 to 19+ and represent the reading level of the document. Scores of 0–6 correlate with low-literacy resources, 7–8 with resources comprehensible by junior high school students, 9–12 by high school students; 13–16 by college students; 17–18 by graduates; and 19+ by those with higher professional qualifications.

Statistical analyses

SPSS (Version 19.0. Armonk, NY: IBM Corp) was used for the statistical analyses. Standard descriptive statistical

Table 2 Readability score/index and equivalent readability level, US school grade level and UK School Age

Readability	Equivalent grade level in the US	British school age	FRES	FKGL	GFOG or SMOG
Extremely easy	4th or below		Over 100	0	0–6
Very easy	5th	9–12 years	90–100	1–5	
Easy	6th		80–89		
Fairly easy	7th	12–15 years	70–79		
Standard	8th–9th		60–69	6–8	7–8
Fairly difficult	10th–12th	15–17 years	50–59	9–14	9–12
Difficult	College		30–49		13–16
Very confusing	Above college		0–29	≥ 15	17–19

FRES, Flesch Reading Ease Score; FKGL, Flesch–Kincaid Grade Level; GFOG, Gunning-Fog index; SMOG, Simple Measure of Gobbledygook.

calculations were tabulated as mean \pm standard deviation of the mean.

Quality and readability of insomnia related online information

Websites and information quality

The keyword search on Google yielded 53 million results. The first 25 links were accessed, and 5 were excluded because they were primarily commercial or irrelevant websites; the remaining top 20 websites (Table 3) were analyzed. The websites were predominantly managed by nonprofit and commercial institutions and academic organizations, including official organizations (e.g., National Institutes of Health), professional societies (e.g., American Academy of Sleep Medicine, National Sleep Foundation), hospitals (e.g., Mayo Clinic), and clinical and health information websites (e.g., WebMD, Medscape). The mean DISCERN score was 53.3 ± 10.4 and ranged from 37.0 to 68.8, indicating that the quality of the websites varied widely. Information

from Medscape Reference, Mayo Clinic, Wikipedia, eMedicineHealth, and National Sleep Foundation were of high quality. These websites had a high rate of *yes* (mean, 68%) on the quality checklist, indicating that most key elements were included in the resource (Table 3 and Fig. 1).

Readability

The readability analyses of the included websites revealed that the mean FRES was 44.1 ± 10.8 , mean FKGL was 11.7 ± 2.0 , mean GFOG index was 14.6 ± 2.2 , and the mean SMOG index was 10.9 ± 1.5 . None of the included websites provided resources at easy-to-read or standard reading levels. According to the FRES score ranging 28.5–58.3, nine (45%) websites were at high school level, which was considered fairly difficult, and the others were at or above college level, which was considered difficult to read. The FKGL scores ranged 8.7–14.7, indicating that at least 8–15 years of education was required to understand the analyzed online information. Moreover, the GFOG index ranging 10.4–18.3, and the SMOG index ranging 8.7–13.5 indicated difficult reading levels for readers.

Table 3 Quality and readability of included 20 websites

The studied websites	Quality		Readability			
	DISCERN	Checklist	FRES	FKGL	GFOG	SMOG
Reference score/recommended level	0–80	Yes (%)	60–69	6–8	<12	<10
WebMD	55.5	80%	50.1	11.1	13.4	10.4
National Sleep Foundation	62.8	70%	50.6	11.4	14.4	10.6
Mayo Clinic	62.5	90%	57.8	8.9	11.7	8.7
Helpguide.org	64.5	80%	58.3	9.5	12.6	9.2
Wikipedia	67.5	80%	30.2	13.8	17.2	12.8
MNT Knowledge Center	48.0	90%	28.5	13.6	16.7	12.3
eMedicineHealth	62.5	90%	37.2	12.2	15.2	11.3
American Academy of Sleep Medicine	50.0	70%	46.7	10.9	14.0	10.4
Dr. Weil	40.3	50%	51.3	9.7	12.3	9.4
NIH	56.8	70%	57.9	8.9	11.5	8.7
MedlinePlus	44.0	80%	56.1	8.7	10.4	8.7
MedicineNet	63.0	90%	30.7	13.8	17.6	12.8
Life Extension	62.0	60%	33.7	13.2	15.6	12.1
Medscape Reference	68.8	90%	30.0	14.5	18.3	13.5
insomnia.net	37.0	20%	39.9	14.7	17.3	12.0
LiveScience	47.5	70%	40.3	13.9	16.3	12.4
PyschCentral	37.8	50%	33.1	11.8	15.4	11.1
Everyday Health	45.0	30%	40.0	11.9	15.1	11.4
University of Cambridge	45.3	50%	57.1	11.0	13.8	9.7
American Sleep Association	45.8	40%	52.1	10.3	13.4	10.0
Overall quality and readability	53.3	68%	44.1	11.7	14.6	10.9

FRES, Flesch Reading Ease Score; FKGL, Flesch–Kincaid Grade Level; GFOG, Gunning-Fog index; SMOG, Simple Measure of Gobbledygook.

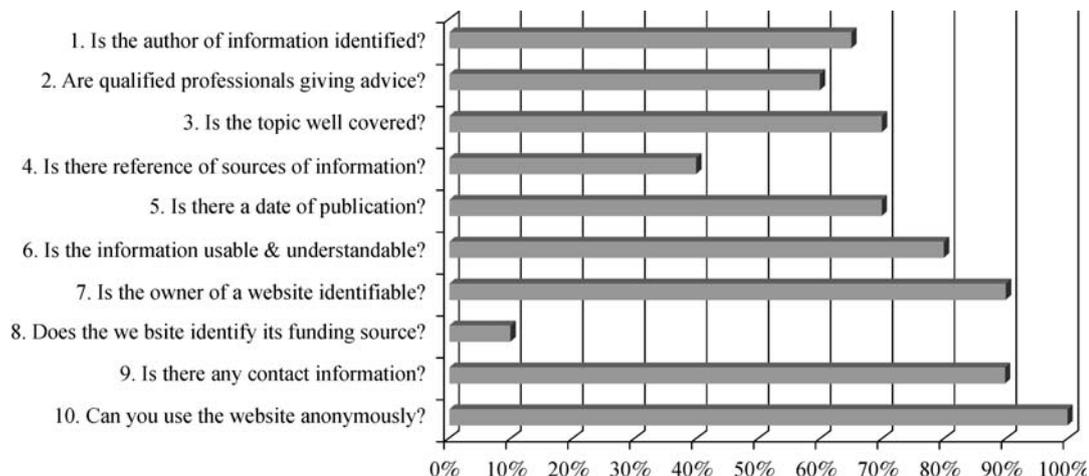


Fig. 1 Quality checklist items for included 20 websites.

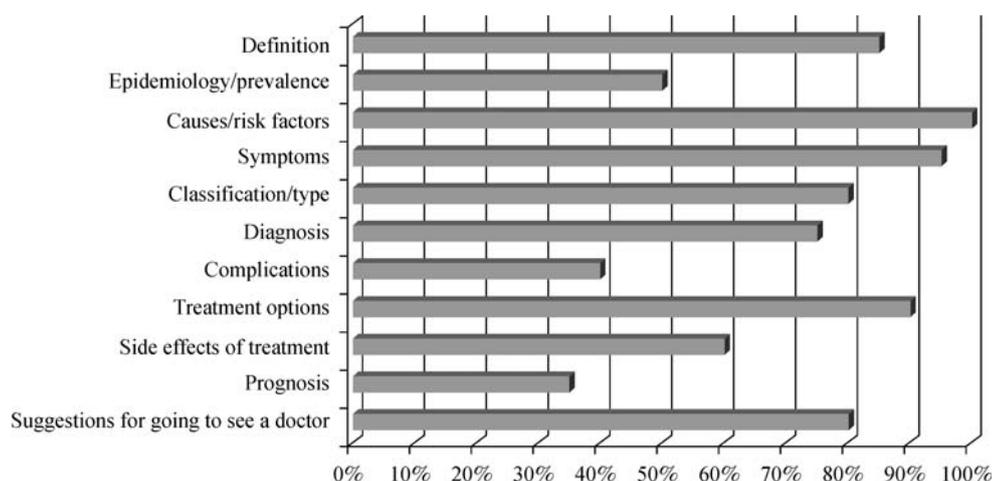


Fig. 2 Content checklist for the top 20 websites.

Quality and content checklists

Quality checklist

As depicted in Fig. 1, all the included websites can be used anonymously, and most of them (70%) comprehensively covered the topic; 13 (65%) provided author information, 14 (70%) specified the date when the resource was written or updated, 8 (40%) referenced the sources of information, and 2 (10%) identified their funding source.

Content checklist

As depicted in Fig. 2, most websites provided definitions (85%), causes and risk factors (100%), symptoms (95%), treatment options (90%), and recommendations for consulting a doctor (80%). Although classifications and

diagnoses were commonly mentioned (80% and 75%, respectively), most websites classified insomnia as acute and chronic. As depicted in Fig. 3, the most commonly suggested treatments were sleep hygiene (80%), over-the-counter supplements or sleep aids (75%), and prescription medications (65%), which were mentioned with or without specifying the side effects. Components of cognitive behavioral therapy for insomnia (CBT-I) were often recommended for insomnia management. Alternative therapies, such as light control, acupuncture, meditation, and traditional exercise (e.g., tai chi, yoga), were mentioned less frequently (15%–25%).

Discussion

Patients typically seek information on their condition before consulting a physician, and health websites strongly

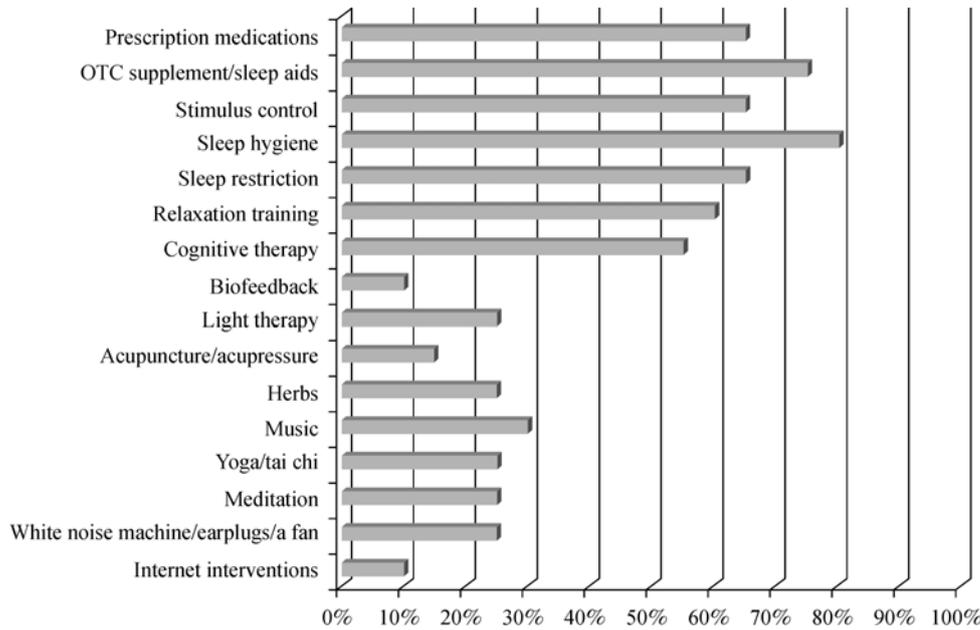


Fig. 3 Recommended therapies by the top 20 websites.

influence the attitude and behavior of consumers [3]. Although people prefer consulting their clinicians, they first search online for health information [32], and most people intend to query their physicians and request clinical resources according to the online information [33]. With increasing number of insomnia patients, the demand for online information has increased; however, the quality of the content on insomnia-related websites has not been investigated much. Our study examined the quality, readability, and content of insomnia information provided by the top websites.

The contents of the majority of the analyzed websites include definitions, causes and risk factors, symptoms, diagnoses, and treatment options for insomnia. Most websites classify insomnia as acute (short-term) and chronic (long-term) or as primary and secondary insomnia. Only four websites (20%) classified insomnia more specifically and detailed each type. For risk factors and causes, the most frequently covered conditions were age, psychiatric disorders (e.g., depression, anxiety), jetlag, and shiftwork syndrome.

Insomnia has been better understood and its treatment options have advanced over the years [7,34–44]. Studies have proven the associations between insomnia and mental disorders [45–47]. The focus of insomnia research has gradually shifted over time from drugs to CBT-I and alternative therapies [48–51]. The analysis of online information for insomnia treatment revealed that sleep hygiene, including healthy sleep habits, is the most commonly mentioned, followed by other CBT-I components, such as sleep restriction and relaxation. Nonphar-

macological therapies, such as light therapy, acupuncture, tai chi and yoga, and other meditation, were not often recommended. Two websites, namely Wikipedia and Helpguide.org, covered internet-based interventions and online CBT-I programs.

Pharmacological treatments, including prescription medications (e.g., benzodiazepines) and over-the-counter supplements (e.g., melatonin, valerian) and sleep aids (e.g., antihistamine), were the second most commonly mentioned modality; however, the indications and side effects of these pharmacological treatments were not adequately described. Several websites did not specify the names of the medicines but suggested that patients first attempt changing their sleep habits, daily routines, and attitude toward sleep and recommended that patients attempt medicine only after consulting a doctor. Approximately 50% of the websites recommended that the patients consult a sleep specialist when necessary. In addition, the websites introduced sleep study and CBT-I as a treatment.

Several websites did not provide adequate metadata on authorship and date of publication or last update. Some websites offered biased information, with little or unreliable references to scientific data. A recent study revealed that few people examined the source and authorship of the websites they seek information from [52]. Citations identify the source of the information, and information from health professionals is more credible because of their expertise in the field. Including author information and any potential conflicts of interest may provide accountability for the presented information. Among the analyzed websites, Medscape had the most appropriate references;

however, because of low readability, it is more appropriate for medical staff than for patients.

Both strong and weak correlations of online health information quality with search ranking have been reported [53,54]. Our results revealed that high-quality websites may not necessarily appear among the top search results or have higher hits; however, higher ranked websites have relatively higher quality, as indicated by the higher DISCERN scores compared with websites on later pages in the Google search results. Although the ranking may vary with time, the websites included in the first two pages of the search results are largely similar. Moreover, these websites were ranked the top in other widely used search engines, such as Bing and Yahoo. Patients can access fairly high-quality insomnia-related information online, even if they review only the first two pages of search results, which is the typical behavior.

Consumer trust in online information does not correlate with such factors as income, education level, and health status but varies with such features as ease of access and comprehension [55]. The layman audience must be educated that online health information may not be regulated or adequately reliable [56]. General search engines are the most widely used tools for accessing health information because of their accessibility; however, websites retrieved by such search engines are not tailored for target patients or medical staff. Our study revealed that most contents on the top insomnia websites are beyond the readability level of patients. If the resources are difficult to comprehend, the readers will lose patience and interest; consequently, they may misinterpret the resource.

Consistent with a few previous reports, we observed an imbalance between patient health literacy and the readability of online information, and the majority of online resources were written at a reading level that is complicated for most adults in developed countries [57–59]. Educational health-related resource are more useful if written by qualified medical staff in plain language; however, healthcare professionals find it difficult to construct text at a basic level [27]. The American Medical Association provided some recommendations [27] in addition to lowering the difficulty of language; for example, formatting is one of the most critical characteristics of reader-friendly patient education resources. Readability can be enhanced when information is presented through or supplemented with bulleted lists and clear illustrations. We found that several websites have unpleasant presentation styles; a few are littered with distracting images and irrelevant links, and a few separate the information into several pages, forcing the readers to click “continue” or “next” for accessing the remaining content.

The requirement for enhanced and customized solutions for disseminating trustworthy information of high-quality reader-friendly health-related resources, which eventually

lead to appropriate decision making, is lacking [8]. Our experience with the limited use of DISCERN for analyzing health-related website content is consistent with a few previous studies. Therefore, a more appropriate quality assessment tool that can be effectively used by healthcare professionals, children, and parents is warranted.

Conclusions

The top results from our Google search for the keyword “insomnia” included websites from nonprofit and commercial institutes and academic organizations. The overall quality of insomnia websites was moderate. Websites that scored high on the DISCERN instrument did not necessarily possess the recommended readability levels for general healthcare consumers, such as insomnia patients; most analyzed websites provided resources that probably were beyond the patients’ capability to comprehend. Concerns that must be addressed to increase the quality and trustworthiness of such information include sharing metadata, such as authorship, time of creation and last update, and conflicts of interest; providing evidence for reliability; and increasing the readability for a layman audience. The most recommended treatment was CBT-I; sleeping pills were mentioned less frequently.

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Compliance with ethics guidelines

Yan Ma, Albert C. Yang, Ying Duan, Ming Dong, and Albert S. Yeung declare that they have no conflict of interest in this paper. This manuscript does not involve a research protocol requiring approval from relevant institutional review board or ethics committee.

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