Received: 18 January 2024 | Revised: 15 March 2024 | Accepted: 21 March 2024

DOI: 10.1111/jsr.14206

REVIEW ARTICLE

Sleep effort and its measurement: A scoping review

Daniel Ruivo Marques[1,2] | Luís Pires[2,3] | Niall M. Broomfield[4] | Colin A. Espie[5]

[1]Department of Education and Psychology, University of Aveiro, Aveiro, Portugal

[2]CINEICC – Center for Research in Neuropsychology and Cognitive Behavioral Intervention, Faculty of Psychology and Educational Sciences, University of Coimbra, Coimbra, Portugal

[3]Faculty of Psychology and Educational Sciences, University of Coimbra, Coimbra, Portugal

[4]Department of Clinical Psychology and Psychological Therapies, Norwich Medical School, University of East Anglia, Norwich, UK

[5]Nuffield Department of Clinical Neurosciences, Sleep and Circadian Neuroscience Institute, University of Oxford, Oxford, UK

Correspondence
Daniel Ruivo Marques, Department of Education and Psychology, University of Aveiro, Campus Universitário de Santiago, 3810-193 Aveiro, Portugal.
Email: drmarques@ua.pt

Summary

Insomnia disorder is characterized by disruption in sleep continuity and an overall dissatisfaction with sleep. A relevant feature of insomnia is sleep effort, which refers to both cognitive and behavioural conscious attempts to initiate sleep. The Glasgow Sleep Effort Scale is a self-report tool developed to assess this construct. The objective of the current scoping review was to map how sleep effort has been discussed in the literature and operationalized through its respective measure. Medline/PubMed, Scopus, Web of Science and PsycInfo databases were used to search for potential studies. The search query used in databases was the specific name of the self-reported tool itself (Glasgow Sleep Effort Scale) and "sleep effort" term. This scoping review followed JBI guidelines. To be included, records pertaining to any type of study that mentioned the Glasgow Sleep Effort Scale were considered. No language constraint was used. At the end, 166 initial records were retrieved. From those, 46 records met eligibility criteria and were analysed. Among the main findings, it was observed that the Glasgow Sleep Effort Scale has been increasingly used in recent years, with a notable observed upward trend, especially in the last 2 years. In addition to the original measure, only three published adapted versions of the instrument were identified. This suggests that there is limited research on adapting the scale for different populations or contexts. Sleep effort has been increasingly studied in the last few years. Nonetheless, more research on the Glasgow Sleep Effort Scale tool is recommended, including cross-cultural adaptations.

KEYWORDS
Glasgow Sleep Effort Scale, insomnia, scoping review, sleep, sleep effort

1 | INTRODUCTION

Insomnia disorder is the most prevalent sleep disorder worldwide constituting a clear public health problem (Morin & Jarrin, 2022). It pertains to sleep continuity dysfunction and an overall dissatisfaction with sleep (Perlis, Posner, et al., 2022). It may comprise difficulty initiating sleep, difficulty maintaining sleep, or waking up too early (AASM, 2023).

Over the last decades, several comprehensive models of insomnia have been suggested. One of the most well-known is the Psychobiological Inhibition Model (PIM) (Espie, 2002; Espie, 2023; Espie et al., 2006). Within the PIM lies the sleep effort construct, which assumes a pivotal importance for insomnia research and clinical practice. According to Perlis, Vargas, et al. (2022), this refers to any mental or behavioural activity carried out to induce sleep. These latter authors point out that sleep effort can involve various rituals and the

application of self-help techniques, such as thought stopping, imagery and relaxation. The underlying idea is that the act of "trying" (i.e. making an effort) is inherently incompatible with sleeping.

Sleep effort was operationalized through a self-report measure called the "Glasgow Sleep Effort Scale (GSES)" published originally by Broomfield and Espie (2004a, 2004b, 2005). The GSES is a brief and easy-to-use tool comprising seven items, scored 0 ("very much") to 3 ("not at all"), aimed at examining levels of sleep effort over the previous week (Broomfield & Espie, 2005). This initial version of the instrument showed good psychometric properties in terms of reliability (internal consistency) and validity (concurrent, discriminant and operative properties; Broomfield & Espie, 2005). A principal component was found to account for 62.6% of total variance. This one-dimensional structure has been replicated in other studies where the GSES was translated into other languages (Dias et al., 2023; Meia-Via et al., 2016). According to recent literature on insomnia disorder and cognitive-behavioural therapy for insomnia (CBT-I), the GSES may be considered a supplementary sleep-related instrument with utility for assessment and clinical intervention (Ellis et al., 2022; Espie & Kyle, 2012; Ong et al., 2022; Perlis, Posner, et al., 2022). Given its characteristics, it may well have clinical utility for application in primary health care settings, as arguably it may be considered somehow pathognomonic of insomnia (e.g. historically, the International Classification of Sleep Disorders referred to "striving" to sleep). The GSES can adequately discriminate between patients with insomnia and good sleepers (Broomfield & Espie, 2005). Moreover, it is worth mentioning that paradoxical intention is a psychological intervention technique to tackle sleep effort, which on systematic review appears to do so, and improves sleep (Jansson-Fröjmark et al., 2022). For more details, see the paper by Espie (2023) on revisiting the PIM of insomnia.

Scoping reviews (ScR) address comprehensive research inquiries while upholding the same level of methodological rigour as systematic reviews (Munn et al., 2018). The main objective of a ScR is to explore the breadth of research (Munn et al., 2022).

Given the relevance of sleep effort to insomnia, it is timely to explore how the construct has evolved since its inception to offer new avenues of research for the future. At least to our knowledge, there are no review studies on the topic. The recent paper by Espie (2023) although not being specifically a review on sleep effort is a contemporary call to action pertaining to this field. To rule out this possibility, a preliminary search for existing ScR (and systematic reviews) on the topic was conducted on 6 November 2023 in JBI Evidence Synthesis, Cochrane Database of Systematic Reviews, OSF, Medline/PubMed, Scopus, Web of Science, and Google Scholar databases.

Thus, the current study aimed to perform a ScR on sleep effort, operationalized with the GSES, synthesizing existing knowledge and exploring possible gaps in research.

Specifically, we aimed to examine the following: How often has the GSES been used in research (i.e. volume and general trend); in what types of studies (e.g. intervention) and publications (e.g. research papers, review papers); with which populations (e.g. sleep-disordered patients, psychiatric groups, community samples); and how reliability has been reported.

2 | MATERIALS AND METHODS

To conduct the present review, we built upon JBI ScR guidelines (Peters et al., 2017; Peters et al., 2021) and PRISMA Extension for Scoping Reviews (PRISMA-ScR) for reporting (Tricco et al., 2018). For a detailed description, see Supplementary Material Data S1.

As our aim was to develop a comprehensive overview of the evidence, we formulated a broad research question: "*How has the GSES been addressed/used/reported in the literature?*"

The objectives, inclusion/exclusion criteria and methods for this ScR were specified in advance and documented in a protocol publicly available (https://osf.io/jyb3m) placed in OSF, a free and open platform devoted to Open Science. The project has the following doi: 10.17605/OSF.IO/JYB3M.

2.1 | Inclusion criteria

Given the broad research question, any published literature on the GSES was considered as a source of evidence. Only publications that explicitly reported or mentioned the GSES were included.

2.2 | Search strategy

Medline/PubMed, Scopus, Web of Science and PsycInfo databases were considered the main sources of information from their inception up to 10 November 2023. As search string, the name of the scale, that is, "Glasgow Sleep Effort Scale" and "sleep effort" were used considering title and abstract fields (and keywords if applicable; for a detailed search query for each database, see Table 1). There was no language restriction in the search. If any included record was written in a language not mastered by any of the authors of the research team, support from external translators was relied upon. Grey literature was not considered for the current study purposes.

A pilot test was performed to check whether the data extraction sheet was functioning adequately. This test was carried out on five randomly selected records.

2.2.1 | Source of evidence screening and selection

Initially, the files extracted from the databases were imported into Rayyan (https://www.rayyan.ai; Ouzzani et al., 2016). In the first phase, duplicates were identified and deleted by the first author (DRM).

In the second step, two authors (DRM and LP) selected and reviewed the records based on title and abstract examination. Disagreements were solved by discussion to reach consensus.

TABLE 1 Search strategies in databases.

Database	Number of records	Search string
Medline/PubMed	*#31*	("Glasgow Sleep Effort Scale"[Title/Abstract]) OR ("sleep effort"[Title/Abstract])
Web of Science	*#38*	TS = ("Glasgow Sleep Effort Scale" OR "sleep effort")
Scopus	*#57*	(TITLE-ABS-KEY ("Glasgow Sleep Effort Scale") OR TITLE-ABS-KEY ("sleep effort"))
PsycInfo	*#40*	("sleep effort" or "Glasgow Sleep Effort Scale").ab,kw,ti.

2.3 | Data extraction

The information extracted for each record included: author(s); year of publication; country of origin; aims/purpose of the study; population; type of study; use of the GSES; type of source; and reliability report. Details are described below.

- ***Author(s)*:** Author or authors who conducted the study;
- ***Year of publication*:** Year in which the document/record was published;
- ***Country*:** Country associated with the corresponding author of the publication;
- ***Aim(s) of the study*:** Overall aim(s) of the publication;
- ***Population*:** Type of sample recruited for the study and respective sample size;
- ***Study design*:** Cross-sectional, longitudinal, intervention, psychometric or review;
- ***Use of the GSES*:** Paper-and-pencil or online administration;
- ***Type of publication*:** Journal article, conference proceeding, chapter, editorial, etc;
- ***Reliability report*:** Checking if an adequate internal consistency indicator is reported. In empirical papers, when there is no mention of an own internal consistency indicator of the study such as the Cronbach's alpha, then the study meets the criteria for "reliability induction" problem. Specifically, if the authors omit the reliability for a study, then it is called "*reliability induction by omission*"; if the authors only present reliability values of the original study of the GSES (or any other publication other than their one), then it is called "*reliability induction by report*" (Sánchez-Meca et al., 2021).

2.4 | Analysis and presentation of results

A data charting form was developed to extract the necessary information from included records. Data charting was done independently by the first author (DRM) and validated by a second author (LP). Absolute and relative frequencies calculations and figures generation were performed with MS Excel 2019.

3 | RESULTS

3.1 | Search strategy

Figure 1 provides the flowchart of the present study. A comprehensive web-based literature search yielded 166 records (i.e. PubMed [$n = 31$]; Scopus [$n = 57$]; Web of Science [$n = 38$]; PsycInfo [$n = 40$]). For the final analysis, 46 records remained. Three reports were not retrieved. These were scientific meeting abstracts to which our team did not have access. Corresponding authors of these studies were contacted by e-mail. Regarding two, the authors advised that they were not available, and one author did not respond to our email request.

3.1.1 | Inclusion of sources of evidence

A detailed source of evidence framework is presented in Table 2.

3.1.2 | Review findings

The overwhelming bulk of studies were published in specialized journals (in full-text modality; $n = 43$; 93%). Most publications were from the UK ($n = 9$; 19%), USA ($n = 9$; 19%) and South Korea ($n = 7$; 15%). Italy ($n = 1$; 2%) and Iran ($n = 1$; 2%) had lower levels of production among the countries with studies about sleep effort or GSES (Figure 2).

As to date and publication type, a significant increasing trend in publications over the last 2 years was observed (i.e. 2022 and 2023). Moreover, the most common type of study in which the GSES was used was cross-sectional (Figure 2).

In terms of administration, and considering only the empirical research using the GSES, over half of studies deployed a traditional "paper-and-pencil" format for GSES completion ($n = 27$; 64.3%). Additionally, a trend over recent years to use GSES in online research protocols was also observed.

Regarding samples, 24 out of 43 empirical studies focused on clinical samples, with participants identified as having insomnia disorder based in a clinical diagnosis or insomnia symptoms typically identified using self-reports. The detailed list of sample types and sample sizes considering all records is displayed in Figure 3.

Finally, it was notable that most of the publications did not report their own reliability indicators such as internal consistency, with the number of studies reporting an own internal consistency measure equal to those who showed reliability induction by omission ($n = 16$; Figure 4).

4 | DISCUSSION

The present study aimed to map the use of GSES by analysing scientific publications using a ScR methodology. The ScR methodology is

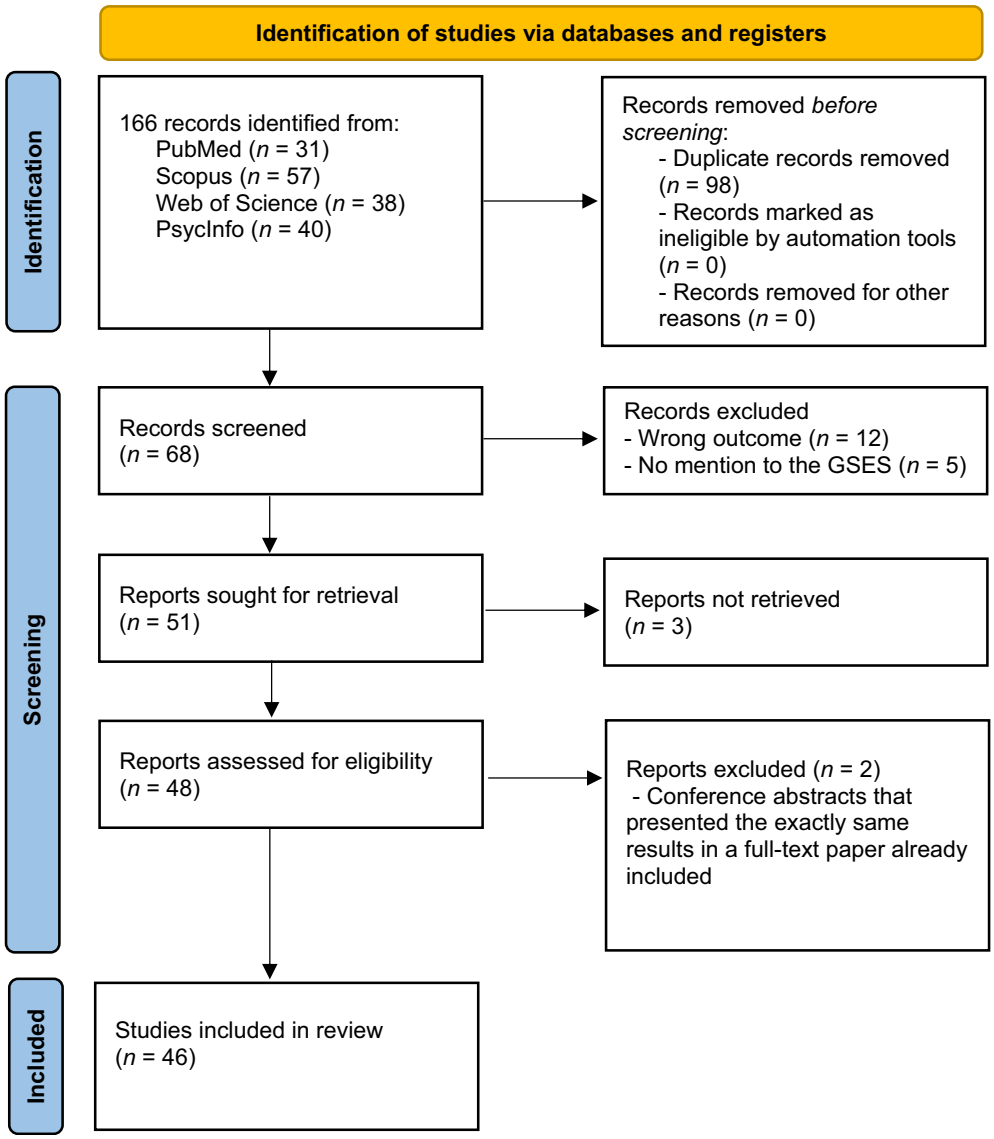

FIGURE 1 PRISMA flowchart (scoping reviews [ScR]) applied to the current study.

particularly suitable for addressing wide-ranging research questions, as per here (Munn et al., 2022).

An interesting observed finding is the significant and increasing trend of sleep effort research publications in the past 2 years (i.e. 2022 and 2023). While we cannot definitively identify the cause(s) for it, this appears to be a significant indicator of the construct's relevance. Attempting to better understand this scenario, we investigated whether the observed increase in articles using the GSES in 2022 and 2023 is also coincident with an increase in published papers on "insomnia". We did a quick search on Medline/PubMed, Scopus, Web of Science and PsycInfo, and confirmed that this is the case. This trend may be partly explained by the growing number of publications on insomnia. However, it is also possible that the measure is becoming more widely used due to its clinical utility and citation in important reviews in the field (Ellis et al., 2022; Perlis, Posner, et al., 2022).

The studies included in this review focused mostly on patients with insomnia while studying sleep effort. Sleep effort has been studied among the factors that can influence the severity of insomnia (Lee et al., 2022) and to identify insomnia subtypes (Sforza et al., 2021). The assessment of sleep effort seems to be relevant in all disorders of initiating and maintaining sleep, regardless of their association with other sleep disorders (e.g. obstructive sleep apnea), mood disorders (e.g. major depression) or other clinical conditions (e.g. dementia associated to Alzheimer's disease). Moreover, sleep effort seems to be a better discriminator of insomnia from good sleepers than most other constructs (Kohn & Espie, 2005).

Concerning the type of studies in which sleep effort has been investigated, we found several works looking at changes in sleep effort after a specific intervention (Lau & Carney, 2019; Ong et al., 2008).

Among the 11 intervention studies in this review, sleep effort has been reduced with treatments targeting insomnia symptoms and/or depressive symptoms (e.g. CBT-I), with moderate to large effect sizes (Bei et al., 2018, Kyle et al., 2011; Lau & Carney, 2019; Marway et al., 2023; Ong et al., 2008; Ong et al., 2009; Ong et al., 2018; Sforza

TABLE 2 Summary of included studies.

Author (s) and year	Country	Aims of the study	Population	Study design	Use of the GSES	Type of publication	Reliability report
Broomfield and Espie (2004a)	UK	This is a preliminary presentation of the data that will be reported in the original GSES paper by Broomfield and Espie (2005)	89 insomnia patients and 102 good sleepers	Psychometric	Paper-and-pencil	Proceeding	–
Broomfield and Espie (2004b)	UK	This is a preliminary presentation of the data that will be reported in the original GSES paper by Broomfield and Espie (2005)	65 insomniacs and 110 good sleepers	Psychometric	Paper-and-pencil	Proceeding	–
Broomfield et al. (2005)	UK	To discuss cognitive processes in insomnia Sleep effort is presented as a relevant process for insomnia disorder	–	Review	–	Journal article	–
Kohn and Espie (2005)	UK	To investigate possible explanatory mechanisms in psychophysiological insomnia by investigating the sensitivity and specificity of commonly used insomnia research tools, including sleep effort, in discriminating insomnia types and good sleepers	18 patients with psychophysiological insomnia, 18 patients with insomnia associated with mental disorder and 18 good sleepers	Cross-sectional	Paper-and-pencil	Journal article	No Reliability induction by report
Broomfield and Espie (2005)	UK	To present psychometric data on the original GSES	89 insomnia patients and 102 good sleepers	Psychometric	Paper-and-pencil	Journal article	Yes
Ong et al. (2008)	USA	To assess the efficacy of an intervention for psychophysiological insomnia that combines mindfulness meditation with CBT-I Among other measures, change on sleep effort is investigated	30 adults with psychophysiological insomnia	Intervention	Paper-and-pencil	Journal article	No Reliability induction by omission
Ong et al. (2009)	USA	To examine effects of an intervention combining mindfulness meditation with CBT-I on measures of sleep and sleep-related distress in an attempt to characterize the natural course of insomnia following this treatment and to identify predictors of poor long-term outcome	21 patients with psychophysiological insomnia	Intervention	Paper-and-pencil	Journal article	No Reliability induction by report
Kyle et al. (2011)	UK	Assess SRT for insomnia, looking at possible side-effects, challenges to adherence and implementation, and perceptions of benefit/impact	18 patients with primary insomnia	Intervention	Paper-and-pencil	Journal article	No Reliability induction by report

(Continues)

TABLE 2 (Continued)

Author (s) and year	Country	Aims of the study	Population	Study design	Use of the GSES	Type of publication	Reliability report
Espie et al. (2012)	UK	To investigate psychological characteristics and treatment preferences of people with idiopathic insomnia relative to the ones with psychophysiological insomnia	20 patients with primary insomnia and 20 with idiopathic insomnia	Cross-sectional	Paper-and-pencil	Journal article	No Reliability induction by report
Fairholme and Manber (2014)	USA	To examine whether dysfunctional beliefs about sleep interact with both sleep-related safety behaviours and sleep effort, such that safety behaviours and sleep effort would have a more deleterious effect on insomnia and fatigue severity to the extent that individuals endorsed dysfunctional beliefs more strongly	63 outpatients with a current anxiety or mood disorder	Cross-sectional	Paper-and-pencil	Journal article	No Reliability induction by omission
Ebert et al. (2015)	USA	To evaluate the efficacy of an Internet-based intervention, which aimed to improve recovery from work-related strain in teachers with sleeping problems and work-related rumination	128 teachers with elevated symptoms of insomnia and work-related rumination	Intervention	Online	Journal article	Yes
Hiller et al. (2015)	UK	To present evidence on Harvey's cognitive model of insomnia (2002) The GSES is indicated as a relevant measure in cognitive domain of insomnia	–	Review	–	Journal article	–
Hertenstein et al. (2015)	Germany	To investigate to what extent three major components of insomnia models, that is, sleep effort, dysfunctional beliefs and attitudes about sleep, and pre-sleep arousal, are associated with subjective insomnia severity and polysomnogram-determined sleep	47 patients with primary insomnia and 52 good sleepers	Cross-sectional	Paper-and-pencil	Journal article	No Reliability induction by omission
Meia-Via et al. (2016)	Portugal	To examine the psychometric properties of the European Portuguese version of the GSES	2995 higher education students	Psychometric	Online	Journal article	Yes

TABLE 2 (Continued)

Author (s) and year	Country	Aims of the study	Population	Study design	Use of the GSES	Type of publication	Reliability report
Herbert et al. (2017)	UK	To examine predictors of subjective/objective sleep discrepancy in poor sleepers [Sleep effort was assessed using an item adapted from the GSES ("How much effort did you put into sleeping last night?", with anchors "No effort" at 0 mm and "A lot of effort" at 100 mm)]	42 individuals with insomnia symptoms	Longitudinal	Paper-and-pencil	Journal article	No Reliability induction by omission
Crawford et al. (2017)	USA	To examine empirically derived symptom cluster profiles among patients who present with insomnia using clinical data and polysomnography	175 patients with insomnia disorder	Cross-sectional	Paper-and-pencil	Journal article	No Reliability induction by report
Bei et al. (2018)	Australia	To explore the heterogeneity in long-term depression change trajectories, and to examine their correlates, particularly insomnia-related characteristics	148 adults with insomnia and major depressive disorder	Intervention	Paper-and-pencil	Journal article	Yes
Best et al. (2018)	Germany	To study subjective sleep-related parameters in adults with autism spectrum disorders	29 adults with autism spectrum disorder and 50 healthy controls	Cross-sectional	Paper-and-pencil	Journal article	No Reliability induction by omission
Gomes et al. (2018)	Portugal	To examine the psychometric properties of the Pittsburgh Sleep Quality Index The GSES was used to construct validity purposes	564 participants recruited in several settings (e.g. university campuses; work place; home; sleep consultations)	Cross-sectional	Paper-and-pencil	Journal article	Yes
Ong et al. (2018)	USA	To examine the treatment effects for adults with chronic insomnia disorder who were randomized to mindfulness-based stress reduction, mindfulness-based therapy for insomnia, or a delayed-treatment control condition consisting of sleep diary self-monitoring followed by behaviour therapy	162 insomnia patients: 54 were allocated to each condition and only a total of 44 completed the intervention	Intervention	Paper-and-pencil	Journal article	No Reliability induction by omission
Lau and Carney (2019)	Canada	To examine sleep effort as a predictor of treatment outcome and relapse in CBT-I	312 insomnia patients	Intervention	Paper-and-pencil	Proceeding	No Reliability induction by omission

(Continues)

TABLE 2 (Continued)

Author (s) and year	Country	Aims of the study	Population	Study design	Use of the GSES	Type of publication	Reliability report
Doos Ali Vand et al. (2020)	Iran	To examine the psychometric properties of the Persion version of the GSES	A clinical sample of 120 patients with insomnia disorder and 110 good sleepers	Psychometric	Paper-and-pencil	Journal article	Yes
Benz et al. (2020)	Germany	To investigate the link between physiological REM parameters and mentation characteristics in REM sleep, including the analysis of GSES scores	22 patients with insomnia and 23 good sleepers	Cross-sectional	Paper-and-pencil	Journal article	No Reliability induction by omission
Varma et al. (2020)	Australia	To examine sleep and mood associations in parents of children with sleep disturbances across a sample of typically developing children and children with neurodevelopmental disorders	293 parents of children aged 2–12 years	Cross-sectional	Online	Journal article	No Reliability induction by report
Sforza et al. (2021)	Italy	To identity insomnia subtypes according with baseline scores of insomnia severity and features, anxiety, depression, stress and sleepiness symptoms, sleep effort, circadian rhythm, and treatment effectiveness	123 insomnia patients	Intervention	Paper-and-pencil	Journal article	Yes
Fernandez-Mendoza et al. (2021)	USA	To explore the psychometric properties of the Hypersomnia Severity Index in clinical samples of patients with sleep disorders GSES as a measure of sleep effort was included to contribute for construct validity	73 patients with chronic insomnia disorder; 46 patients with other sleep disorder; and 39 patients with central disorders of hypersomnolence	Cross-sectional	Paper-and-pencil	Journal article	No Reliability induction by report
Dias and Marques (2021)	Portugal	In this editorial, the authors cite the GSES as a relevant self-report instrument in which advanced psychometric techniques should be used	–	Editorial	–	Journal article	–
Kang et al. (2021)	South Korea	To evaluate the relationship between Aβ deposition and sleep effort, sleep efficiency, and circadian rhythm patterns in a group of clinically diagnosed Alzheimer's disease patients	21 patients healthy-normal participants; 49 amnestic mild cognitive impairment; and 26 with Alzheimer's disease	Cross-sectional	Paper-and-pencil	Journal article	No Reliability induction by omission
Lee et al. (2022)	South Korea	To explore the factors that can influence the severity of insomnia	387 participants from the general population	Cross-sectional	Online	Journal article	Yes

TABLE 2 (Continued)

Author (s) and year	Country	Aims of the study	Population	Study design	Use of the GSES	Type of publication	Reliability report
Quin et al. (2022)	Australia	To distinguish between insomnia disorder and perinatal sleep disruption and their sleep and mental health correlates, including sleep effort	163 nulliparous females	Longitudinal	Paper-and-pencil	Journal article	No Reliability induction by omission
Jang and Kim (2022)	South Korea	To explore the determinants of sleep disturbance (insomnia and daytime sleepiness) and its potential consequence (depression, somatization, fatigue and cognitive failure) on jet-lagged employee	120 jet-lagged employees	Cross-sectional	Online	Journal article	No Reliability induction by omission
Chung (2022)	South Korea	To explore whether the discrepancy between a patient's desired time in bed and desired total sleep time (DBST index) can predict the severity of insomnia	374 participants from the general population	Cross-sectional	Online	Journal article	Yes
Bang et al. (2022)	South Korea	To explore the reliability and validity of the Korean version of the Positive and Negative Sleep Appraisal Measure scale using pre-existing sleep-related questionnaires, like the GSES	400 participants from the general population	Cross-sectional	Online	Journal article	Yes
Uygur et al. (2022)	Turkey	To examine the psychometric properties of the Turkish version of the GSES	747 university students	Psychometric	Online	Journal article	Yes
Meaklim, Junge, et al. (2023)	Australia	To determine which modifiable factors, beyond stress, were associated with acute insomnia during a major crisis, the COVID-19 pandemic	1319 participants (578 with acute insomnia, 731 good sleepers)	Cross-sectional	Online	Journal article	No Reliability induction by report
Borges et al. (2023)	Portugal	To investigate the role of sleep effort as a mediating variable between anxiety and depression and vice versa	1927 higher education students	Cross-sectional	Online	Journal article	Yes
Bzeih et al. (2023)	South Korea	To explore whether the DBST index can be used as a tool to assess insomnia severity	366 shift-working nursing professionals	Cross-sectional	Online	Journal article	No Reliability induction by omission
Uygur and Bahar (2023)	Turkey	To investigate the mediating role of bedtime procrastination in the relationship between sleep effort and insomnia severity	497 university students	Cross-sectional	Paper-and-pencil	Journal article	Yes

(Continues)

TABLE 2 (Continued)

Author (s) and year	Country	Aims of the study	Population	Study design	Use of the GSES	Type of publication	Reliability report
Kalmbach, Cheng, Reffi, Ong, Swanson, Espie, et al. (2023)	USA	To examine nocturnal cognitive arousal and sleep effort as potential treatment mechanisms for alleviating insomnia and depression via a mindfulness sleep program for pregnant women	12 pregnant women with insomnia disorder	Intervention	Paper-and-pencil	Journal article	No Reliability induction by omission
Dias et al. (2023)	Portugal	To evaluate the psychometric properties of the European Portuguese version of the GSES through classical test theory, item response theory, and network analysis	227 adults from the general population	Cross-sectional	Paper-and-pencil	Journal article	Yes
Uygur et al. (2023)	Turkey	To investigate the mediating role of sleep reactivity, sleep hygiene and sleep effort in the relationship between Type D personality (combination of two stable traits, negative affectivity and social inhibition) and insomnia	474 university students	Cross-sectional	Online	Journal article	Yes
Kalmbach, Cheng, Reffi, Ong, Swanson, Fresco, et al. (2023)	USA	To evaluate Perinatal Understanding of Mindful Awareness for Sleep (PUMAS, which combines mindfulness with behavioural sleep strategies) on insomnia, depression and cognitive arousal	12 pregnant women with insomnia disorder	Intervention	Online	Journal article	No Reliability induction by omission
Marway et al. (2023)	Canada	To study the factors that drive insomnia severity perception and the psychometric properties of the Insomnia Severity Index post-CBT-I	147 insomnia patients	Intervention	Paper-and-pencil	Journal article	No Reliability induction by report
Meaklim, Saunders, et al. (2023)	Australia	To examine whether individuals with insomnia symptoms early in the pandemic, either pre-existing or new-onset, were more vulnerable to anxiety and depressive symptoms over time than those who maintained normal sleep	2069 participants (617 with pre-existing insomnia, 761 with new-onset insomnia, or 691 with no insomnia symptoms)	Longitudinal	Online	Journal article	No Reliability induction by omission

TABLE 2 (Continued)

Author (s) and year	Country	Aims of the study	Population	Study design	Use of the GSES	Type of publication	Reliability report
Johann et al. (2023)	Germany	To examine whether multidimensional perfectionism is related to dysfunctional beliefs about sleep, sleep-effort, pre-sleep arousal and polysomnography-determined markers of sleep among individuals with insomnia	43 insomnia patients	Intervention	Paper-and-pencil	Journal article	Yes
Hwang et al. (2023)	South Korea	To investigate whether sleep reactivity and sleep effort differ among late-night shift-workers, non-late-night shift-workers and non-shift-workers	3339 late-night shift-workers, 1071 non-late-night shift-workers and 1613 non-shift-workers	Cross-sectional	Online	Journal article	No Reliability induction by omission

Abbreviations: Aβ, amyloid-beta; CBT-I, cognitive-behavioural therapy for insomnia; DBST, discrepancy between desired time in bed and desired total sleep time; GSES, Glasgow Sleep Effort Scale; REM, rapid eye movement; SRT, sleep restriction therapy.

et al., 2021). Sleep effort was suggested as a predictor of insomnia problems relapse (i.e. an increase of 1 point in GSES predicted 1.32 times increase in the likelihood of insomnia; Lau & Carney, 2019; Ong et al., 2009). Finally, sleep effort was suggested as a mechanism for alleviating insomnia and depression following a mindfulness-based sleep program (Kalmbach, Cheng, Reffi, Ong, Swanson, Espie, et al., 2023).

Considering intervention, cross-sectional and longitudinal studies, higher sleep effort has been associated with higher insomnia severity symptoms (Bang et al., 2022; Bzeih et al., 2023; Ebert et al., 2015; Hertenstein et al., 2015; Jang & Kim, 2022; Johann et al., 2023; Lee et al., 2022; Marway et al., 2023; Meaklim, Saunders, et al., 2023; Quin et al., 2022; Uygur & Bahar, 2023; Uygur et al., 2023), higher pre-sleep arousal (Johann et al., 2023; Meaklim, Saunders, et al., 2023), more dysfunctional beliefs and attitudes about sleep (Bang et al., 2022; Johann et al., 2023; Lee et al., 2022), presence of positive and negative appraisals of sleeping (Bang et al., 2022), higher DBST index (i.e. discrepancy between a patient's desired time in bed and desired total sleep time; Bang et al., 2022; Chung, 2022; Lee et al., 2022), higher levels of bedtime procrastination (Uygur & Bahar, 2023), lower sleep quality (Fairholme & Manber, 2014; Hwang et al., 2023; Varma et al., 2020), more sleepiness symptoms (Hwang et al., 2023), higher subjective/objective sleep discrepancy (Herbert et al., 2017), lower sleep hygiene (Uygur et al., 2023), more anxiety symptoms (Borges et al., 2023; Marway et al., 2023; Meaklim, Junge, et al., 2023; Uygur & Bahar, 2023), more stress symptoms (Marway et al., 2023; Uygur & Bahar, 2023), more depressive symptoms (Bei et al., 2018; Borges et al., 2023; Hwang et al., 2023; Uygur & Bahar, 2023), higher fatigue severity (Marway et al., 2023), higher traits of type D or "distressed" personality (Uygur et al., 2023) and higher levels of perfectionism (Johann et al., 2023).

Recently, sleep effort has been studied in contexts of possible circadian disruption, particularly focusing on the effects of jet lag and shift-working schedules on sleep (Hwang et al., 2023; Jang & Kim, 2022).

With respect to psychometric studies, GSES has been used to validate other sleep-related measures, for example, the Pittsburgh Sleep Quality Index (Gomes et al., 2018), the Positive and Negative Sleep Appraisal Measure scale (Bang et al., 2022), and the Hypersomnia Severity Index (Fernandez-Mendoza et al., 2021).

Another finding that stands out pertains to the GSES adaptations into other languages and cultures. Related to this is the small number of studies concerning psychometric properties of the instrument beyond the UK original version (i.e. European Portuguese, Turkish and Persian) as happens in other sleep or insomnia-related measures such as the Insomnia Severity Index (Morin et al., 2011). However, it is important to note that there are studies where the GSES is used in countries for which we did not find any psychometric papers published (e.g. Germany, Italy). An eventual explanation for this may be that these psychometric studies are grey literature that was not considered for this review (e.g. theses, dissertations).

The UK and USA are the countries with a higher volume of production. This is expected as the measure was developed in the UK,

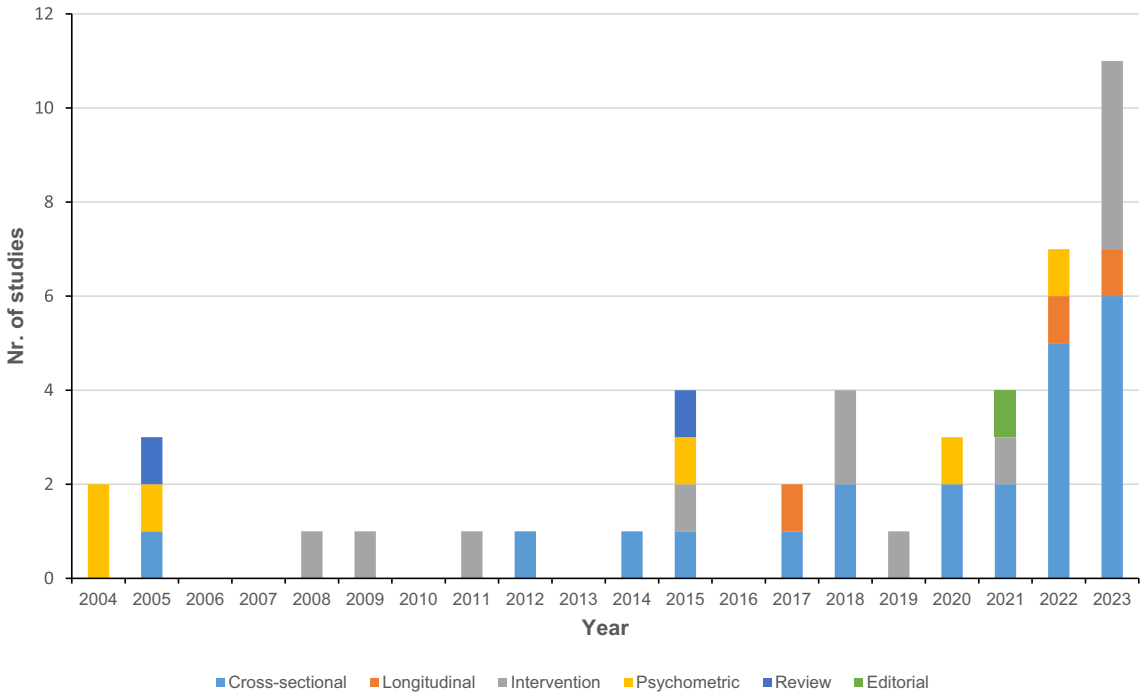

FIGURE 2 Number of records by type of study over the years.

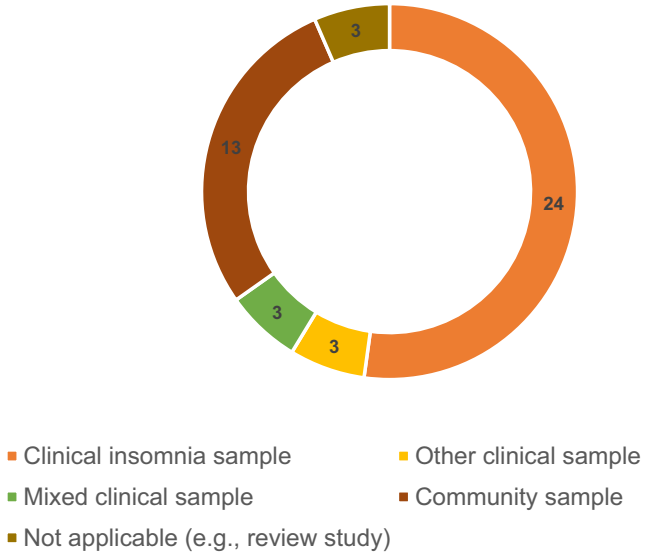

FIGURE 3 Number of community and clinical samples included in the review. *Clinical insomnia sample* (studies using insomnia groups exclusively or using insomnia groups compared with control groups); *community sample* (studies using community or general population samples); *other clinical sample* (studies using other clinical samples such as major depression or dementia); *mixed clinical sample* (studies using insomnia disorder and other clinical samples); and *not applicable* (records used in the current scoping review [ScR] but that they are not empirical studies).

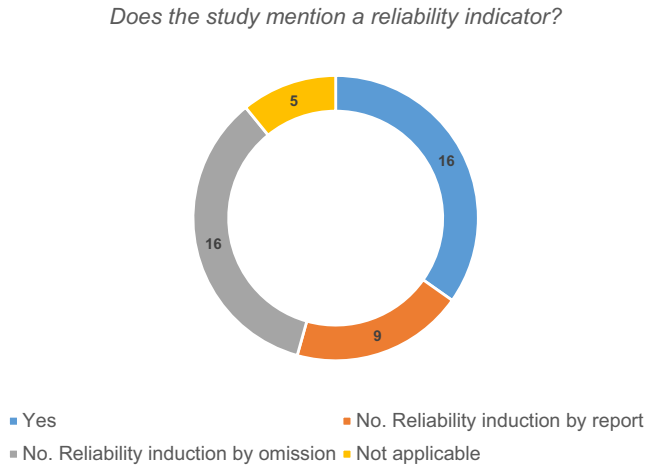

FIGURE 4 Report of reliability indicators by study.

specifically in Scotland. And besides, one of the authors who initially worked with the instrument in research settings has strong connections with researchers in the USA and Canada.

One of the interesting observed conclusions of this review is that in a significant bulk of studies the authors do not report any GSES reliability measure for their samples. In psychometric literature, this is the so-called "reliability induction" problem that is commonly reported in meta-analyses (Sánchez-Meca et al., 2021). This is an important issue that, going forward, researchers of GSES should give attention to. It is important to mention that this problem is common to other self-report measures.

One should note that the GSES has been considered one of the most useful measures in insomnia (Ellis et al., 2022; Riemann et al., 2023). The GSES is a relevant clinical tool with high potential in primary care to spot insomnia disorder (Dias et al., 2023). One

hypothetical explanation for the relatively less volume of research using the GSES in the first years after its development may be a more expressive use of the tool in clinical/applied settings and not so much in research. However, particularly in the previous 2 years (2022 and 2023, respectively), the GSES has been used in several research protocols. Additionally, the full-paper that presents the tool and its psychometric properties in detail dates to 2005 (Broomfield & Espie, 2005), thus it is important to reflect on why the measure only recently has known a generalized use.

Despite our results, some limitations pertaining to this review should be outlined. First, though we resorted to the main databases, there are some of them that were not searched and that may have enabled us to find more records with the potential to be included in this review. Moreover, grey literature, that is academic theses and dissertations whose data are (many times) not published in journal articles, were not included. Finally, in this study, we included records belonging to the same study and/or dataset. Though it is acceptable to reach this decision within an ScR methodology, this finding should not be overlooked as it enacts the overestimation of the results. In a future systematic review, when there are more studies, this issue should be considered in the analysis.

Future research should invest more in psychometric studies across cultures. In addition, researchers should report a reliability indicator each time they use the measure in a non-psychometric study. This will allow for a future reliability generalization meta-analysis, similar to that performed with other self-report scales in sleep medicine, such as the Insomnia Severity Index (Cerri et al., 2023), the Athens Insomnia Scale (Jahrami et al., 2023) or the Epworth Sleepiness Scale (Gonçalves et al., 2023). Moreover, given the GSES potential for primary health care contexts (Espie & Kyle, 2012), its use is advised as it will foster the conduction of future systematic reviews. Besides, it would be important to check how often the GSES is being used in clinical practice. It is worth mentioning that the GSES has shown potential in clinical settings as well, discriminating patients with insomnia from good sleepers and helping to determine the efficacy of interventions developed to target insomnia problems. One interesting use of the measure is to administer the tool to the patient in an initial stage of an intervention and then ask the patient to respond to the same scale as if he/she was a known "good sleeper" person. This decentration technique fosters the application of restructuring techniques, for example (Espie & Kyle, 2012).

The current ScR is the first approximation to the field. In the future, it would be important to proceed to quality appraisal of the studies and risk of bias assessment with adequate tools (which is not mandatory in a ScR). This will be possible through a systematic review, which within a few years may be possible to perform.

5 | CONCLUSIONS

Sleep effort, and particularly its operationalization through the GSES, has gained prominence in the last few years. Given its importance to insomnia disorder, both in clinical and research settings, and its ease of use and brevity, the GSES seems to be an ideal measure to be included in clinical and research protocols.

AUTHOR CONTRIBUTIONS

Daniel Ruivo Marques: Conceptualization; methodology; formal analysis; investigation; data curation; writing – original draft. **Luís Pires:** Formal analysis; writing – original draft; data curation; validation. **Niall M. Broomfield:** Writing – review and editing. **Colin A. Espie:** Writing – review and editing.

FUNDING INFORMATION

The authors declare that no specific funding was received in support the research.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interests.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

ORCID

Daniel Ruivo Marques https://orcid.org/0000-0003-3729-0120
Luís Pires https://orcid.org/0000-0003-3774-6036
Niall M. Broomfield https://orcid.org/0000-0003-2599-3435
Colin A. Espie https://orcid.org/0000-0002-1294-8734

REFERENCES

American Academy of Sleep Medicine. (2023). *International classification of sleep disorders: Diagnostic and coding manual – ICSD-3-TR* (3rd ed.). American Academy of Sleep Medicine.

Bang, Y. R., Cho, E., Ahmed, O., Lee, J., Pearson, L., Ahn, J., & Chung, S. (2022). Validation of the Korean version of the positive and negative sleep appraisal measure (PANSAM) as a tool for evaluating dysfunctional beliefs about sleep among the general population. *Journal of Clinical Medicine*, *11*(16), 4672. https://doi.org/10.3390/jcm11164672

Bei, B., Asarnow, L. D., Krystal, A., Edinger, J. D., Buysse, D. J., & Manber, R. (2018). Treating insomnia in depression: Insomnia related factors predict long-term depression trajectories. *Journal of Consulting and Clinical Psychology*, *86*(3), 282–293. https://doi.org/10.1037/ccp0000282

Benz, F., Riemann, D., & Feige, B. (2020). Dreaming and insomnia: Link between physiological REM parameters and mentation characteristics. *Brain Sciences*, *10*(6), 378. https://doi.org/10.3390/brainsci10060378

Best, V., Riedel, A., Feige, B., van Elst, L., Riemann, D., & Spiegelhalder, K. (2018). Subjektive schlafbezogene Parameter bei Patienten mit Autismus-Spektrum-Störung. *Somnologie*, *22*, 262–266. https://doi.org/10.1007/s11818-018-0156-6

Borges, C., Ellis, J. G., & Ruivo Marques, D. (2023). The role of sleep effort as a mediator between anxiety and depression. *Psychological Reports*, 332941221149181. Advance online publication. https://doi.org/10.1177/00332941221149181

Broomfield, N. M., & Espie, C. A. (2004a). Development and validation of the Glasgow Sleep Effort Scale. *Sleep*, *27*, A254.

Broomfield, N. M., & Espie, C. A. (2004b). Toward a valid, reliable measure of sleep effort. *Journal of Sleep Research*, *13*(Suppl. 1), 1.

Broomfield, N. M., & Espie, C. A. (2005). Towards a valid, reliable measure of sleep effort. *Journal of Sleep Research*, *14*(4), 401–407. https://doi.org/10.1111/j.1365-2869.2005.00481.x

Broomfield, N. M., Gumley, A. I., & Espie, C. A. (2005). Candidate cognitive processes in psychophysiologic insomnia. *Journal of Cognitive Psychotherapy*, *19*(1), 5–17. https://doi.org/10.1891/jcop.19.1.5.66328

Bzeih, W., Kim, S., Yi, K., & Chung, S. (2023). No association between insomnia severity, and discrepancy between desired time in bed and desired total sleep time among shift-working nursing professionals. *Sleep Medicine Research*, *14*(3), 155–160. https://doi.org/10.17241/smr.2023.01704

Cerri, L. Q., Justo, M. C., Clemente, V., Gomes, A. A., Pereira, A. S., & Marques, D. R. (2023). Insomnia severity index: A reliability generalisation meta-analysis. *Journal of Sleep Research*, *32*(4), e13835. https://doi.org/10.1111/jsr.13835

Chung, S. (2022). The DBST index, the discrepancy between desired time in bed and desired total sleep time: The possible new sleep index predicting severity of insomnia. *Sleep Medicine Research*, *13*(2), 85–93. https://doi.org/10.17241/smr.2022.01368

Crawford, M. R., Chirinos, D. A., Iurcotta, T., Edinger, J. D., Wyatt, J. K., Manber, R., & Ong, J. C. (2017). Characterization of patients who present with insomnia: Is there room for a symptom cluster-based approach? *Journal of Clinical Sleep Medicine*, *13*(7), 911–921. https://doi.org/10.5664/jcsm.6666

Dias, S., Gomes, F., A. A, Espie, C., & Marques, D. R. (2023). Analysis of the psychometric properties of the Glasgow Sleep Effort Scale through classical test theory, item response theory and network analysis. *Sleep and Vigilance*, *7*, 65–77. https://doi.org/10.1007/s41782-023-00229-4

Dias, S. F., & Marques, D. R. (2021). "Life" beyond classical test theory: Some considerations on using complementary psychometric approaches in sleep medicine. *Sleep Medicine*, *79*, 225–226. https://doi.org/10.1016/j.sleep.2020.11.012

Doos Ali Vand, H., Ahmadian Vargahan, F., Charkhabi, M., Sadeghniiat Haghighi, K., Dutheil, F., & Habibi, M. (2020). Glasgow Sleep Effort Scale: Translation, test, and evaluation of psychometric properties of the Persian version. *Nature and Science of Sleep*, *12*, 843–854. https://doi.org/10.2147/NSS.S258471

Ebert, D. D., Berking, M., Thiart, H., Riper, H., Laferton, J. A. C., Cuijpers, P., Sieland, B., & Lehr, D. (2015). Restoring depleted resources: Efficacy and mechanisms of change of an internet-based unguided recovery training for better sleep and psychological detachment from work. *Health Psychology*, *34*, 1240–1251. https://doi.org/10.1037/hea0000277

Ellis, J., Alfonso-Miller, P., & Santhi, N. (2022). CBT-I assessment instruments. In C. Baglioni, C. A. Espie, & D. Riemann (Eds.), *Cognitive-behavioural therapy for insomnia (CBT-I) across the life span: Guidelines and clinical protocols for health professionals* (pp. 62–74). John Wiley & Sons Ltd..

Espie, C., & Kyle, S. (2012). Cognitive behavioral and psychological therapies for chronic insomnia. In T. Barkoukis, J. Matheson, R. Ferber, & K. Doghrami (Eds.), *Therapy in sleep medicine* (pp. 161–171). Saunders. https://doi.org/10.1016/C2009-0-40426-4

Espie, C. A. (2002). Insomnia: Conceptual issues in the development, persistence, and treatment of sleep disorder in adults. *Annual Review of Psychology*, *53*, 215–243. https://doi.org/10.1146/annurev.psych.53.100901.135243

Espie, C. A. (2023). Revisiting the psychobiological inhibition model: A conceptual framework for understanding and treating insomnia using cognitive and behavioural therapeutics (CBTx). *Journal of Sleep Research*, *32*, e13841. https://doi.org/10.1111/jsr.13841

Espie, C. A., Barrie, L. M., & Forgan, G. S. (2012). Comparative investigation of the psychophysiologic and idiopathic insomnia disorder phenotypes: Psychologic characteristics, patients' perspectives, and implications for clinical management. *Sleep*, *35*(3), 385–393. https://doi.org/10.5665/sleep.1702

Espie, C. A., Broomfield, N. M., MacMahon, K. M., Macphee, L. M., & Taylor, L. M. (2006). The attention-intention-effort pathway in the development of psychophysiologic insomnia: A theoretical review. *Sleep Medicine Reviews*, *10*(4), 215–245. https://doi.org/10.1016/j.smrv.2006.03.002

Fairholme, C. P., & Manber, R. (2014). Safety behaviors and sleep effort predict sleep disturbance and fatigue in an outpatient sample with anxiety and depressive disorders. *Journal of Psychosomatic Research*, *76*(3), 233–236. https://doi.org/10.1016/j.jpsychores.2014.01.001

Fernandez-Mendoza, J., Puzino, K., Amatrudo, G., Bourchtein, E., Calhoun, S. L., Plante, D. T., & Kaplan, K. (2021). The hypersomnia severity index: Reliability, construct, and criterion validity in a clinical sample of patients with sleep disorders. *Journal of Clinical Sleep Medicine*, *17*(11), 2249–2256. https://doi.org/10.5664/jcsm.9426

Gomes, A. A., Marques, D. R., Meia-Via, A., Cunha, F., & Clemente, V. (2018). Psychometric properties and accuracy of the European Portuguese version of the Pittsburgh Sleep Quality Index in clinical and non-clinical samples. *Sleep and Biological Rhythms*, *16*(4), 413–422. https://doi.org/10.1007/s41105-018-0171-9

Gonçalves, M. T., Malafaia, S., Moutinho Dos Santos, J., Roth, T., & Marques, D. R. (2023). Epworth sleepiness scale: A meta-analytic study on the internal consistency. *Sleep Medicine*, *109*, 261–269. https://doi.org/10.1016/j.sleep.2023.07.008

Herbert, V., Pratt, D., Emsley, R., & Kyle, S. D. (2017). Predictors of nightly subjective-objective sleep discrepancy in poor sleepers over a seven-day period. *Brain Sciences*, *7*(3), 29. https://doi.org/10.3390/brainsci7030029

Hertenstein, E., Nissen, C., Riemann, D., Feige, B., Baglioni, C., & Spiegelhalder, K. (2015). The exploratory power of sleep effort, dysfunctional beliefs and arousal for insomnia severity and polysomnography-determined sleep. *Journal of Sleep Research*, *24*(4), 399–406. https://doi.org/10.1111/jsr.12293

Hiller, R. M., Johnston, A., Dohnt, H., Lovato, N., & Gradisar, M. (2015). Assessing cognitive processes related to insomnia: A review and measurement guide for Harvey's cognitive model for the maintenance of insomnia. *Sleep Medicine Reviews*, *23*, 46–53. https://doi.org/10.1016/j.smrv.2014.11.006

Hwang, Y., Jang, H., Lee, J., Jeon, S., Kim, J., Lee, S., & Kim, S. J. (2023). Sleep reactivity and sleep efforts in shift workers. *Psychiatry Investigation*, *20*(9), 880–887. https://doi.org/10.30773/pi.2023.0098

Jahrami, H., Trabelsi, K., Saif, Z., Manzar, M. D., BaHammam, A. S., & Vitiello, M. V. (2023). Reliability generalization meta-analysis of the Athens Insomnia Scale and its translations: Examining internal consistency and test-retest validity. *Sleep Medicine*, *111*, 133–145. https://doi.org/10.1016/j.sleep.2023.09.015

Jang, H., & Kim, S. (2022). Factor associated with sleep disturbance and its consequence in jet-lagged employee. *Chronobiology in Medicine*, *4*(2), 69–74. https://doi.org/10.33069/cim.2022.0015

Jansson-Fröjmark, M., Alfonsson, S., Bohman, B., Rozental, A., & Norell-Clarke, A. (2022). Paradoxical intention for insomnia: A systematic review and meta-analysis. *Journal of Sleep Research*, *31*(2), e13464. https://doi.org/10.1111/jsr.13464

Johann, A. F., Feige, B., Hertenstein, E., Nissen, C., Benz, F., Steinmetz, L., Baglioni, C., Riemann, D., Spiegelhalder, K., & Akram, U. (2023). The effects of cognitive behavioral therapy for insomnia on multidimensional perfectionism. *Behavior Therapy*, *54*(2), 386–399. https://doi.org/10.1016/j.beth.2022.10.001

Kalmbach, D. A., Cheng, P., Reffi, A. N., Ong, J. C., Swanson, L. M., Espie, C. A., Seymour, G. M., Hirata, M., Walch, O., Pitts, D. S., Roth, T., & Drake, C. L. (2023). Reducing cognitive arousal and sleep effort alleviates insomnia and depression in pregnant women with DSM-5 insomnia disorder treated with a mindfulness sleep program.

Sleep Advances, *4*(1), zpad031. https://doi.org/10.1093/sleepadvances/zpad031

Kalmbach, D. A., Cheng, P., Reffi, A. N., Ong, J. C., Swanson, L. M., Fresco, D. M., Walch, O., Seymour, G. M., Fellman-Couture, C., Bayoneto, A. D., Roth, T., & Drake, C. L. (2023). Perinatal understanding of mindful awareness for sleep (PUMAS): A single-arm proof-of-concept clinical trial of a mindfulness-based intervention for DSM-5 insomnia disorder during pregnancy. *Sleep Medicine*, *108*, 79–89. https://doi.org/10.1016/j.sleep.2023.05.026

Kang, J., Choi, H. J., Isaacs, G. D., Sung, W., & Kim, H. J. (2021). Amyloid burden in Alzheimer's disease patients is associated with alterations in circadian rhythm. *Dementia and Neurocognitive Disorders*, *20*(4), 99–107. https://doi.org/10.12779/dnd.2021.20.4.99

Kohn, L., & Espie, C. A. (2005). Sensitivity and specificity of measures of the insomnia experience: A comparative study of psychophysiologic insomnia, insomnia associated with mental disorder and good sleepers. *Sleep*, *28*(1), 104–112. https://doi.org/10.1093/sleep/28.1.104

Kyle, S. D., Morgan, K., Spiegelhalder, K., & Espie, C. A. (2011). No pain, no gain: An exploratory within-subjects mixed-methods evaluation of the patient experience of sleep restriction therapy (SRT) for insomnia. *Sleep Medicine*, *12*(8), 735–747. https://doi.org/10.1016/j.sleep.2011.03.016

Lau, P., & Carney, C. (2019). Sleep effort as a predictor of treatment outcome and relapse in cognitive behavioural insomnia therapy. *Sleep Medicine*, *S1*, S212–S213. https://doi.org/10.1016/j.sleep.2019.11.593

Lee, J., Cho, I. K., Kim, K., Kim, C., Park, C. H. K., Yi, K., & Chung, S. (2022). Discrepancy between desired time in bed and desired total sleep time, insomnia, depression, and dysfunctional beliefs about sleep among the general population. *Psychiatry Investigation*, *19*(4), 281–288. https://doi.org/10.30773/pi.2021.0373

Marway, O. S., Lau, P. H., Carmona, N. E., & Carney, C. E. (2023). What are patients completing Cognitive Behavioral Insomnia Therapy telling us with their post-treatment Insomnia Severity Index scores?. *Sleep Medicine*, *103*, 187–194. https://doi.org/10.1016/j.sleep.2023.02.008

Meaklim, H., Junge, M. F., Varma, P., Finck, W. A., & Jackson, M. L. (2023). Beyond stress: Altered sleep-wake patterns are a key behavioral risk factor for acute insomnia during times of crisis. *Behavioral Sleep Medicine*, *21*(2), 208–225. https://doi.org/10.1080/15402002.2022.2074996

Meaklim, H., Saunders, W. J., Byrne, M. L., Junge, M. F., Varma, P., Finck, W. A., & Jackson, M. L. (2023). Insomnia is a key risk factor for persistent anxiety and depressive symptoms: A 12-month longitudinal cohort study during the COVID-19 pandemic. *Journal of Affective Disorders*, *322*, 52–62. https://doi.org/10.1016/j.jad.2022.11.021

Meia-Via, M. S., Marques, D. R., Espie, C. A., da Silva, C. F., & Allen Gomes, A. (2016). Psychometric properties of Glasgow Sleep Effort Scale in Portuguese language. *Psychological Assessment*, *28*(3), e12–e18. https://doi.org/10.1037/pas0000178

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

Morin, C. M., & Jarrin, D. C. (2022). Epidemiology of insomnia: Prevalence, course, risk factors, and public health burden. *Sleep Medicine Clinics*, *17*(2), 173–191. https://doi.org/10.1016/j.jsmc.2022.03.003

Munn, Z., Peters, M. D. J., Stern, C., Tufanaru, C., McArthur, A., & Aromataris, E. (2018). Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. *BMC Medical Research Methodology*, *18*(1), 143. https://doi.org/10.1186/s12874-018-0611-x

Munn, Z., Pollock, D., Khalil, H., Alexander, L., Mclnerney, P., Godfrey, C. M., Peters, M., & Tricco, A. C. (2022). What are scoping reviews? Providing a formal definition of scoping reviews as a type of evidence synthesis. *JBI Evidence Synthesis*, *20*(4), 950–952. https://doi.org/10.11124/JBIES-21-00483

Ong, J., Arnedt, J., Grandner, M., Kalmbach, D., Smith, M., & Spielman, A. (2022). Insomnia: Diagnosis, assessment, and evaluation. In M. Kryger, T. Roth, & C. Goldstein (Eds.), *Principles and practice of sleep medicine* (7th ed., pp. 858–866). Elsevier.

Ong, J. C., Shapiro, S. L., & Manber, R. (2008). Combining mindfulness meditation with cognitive-behavior therapy for insomnia: A treatment-development study. *Behavior Therapy*, *39*(2), 171–182. https://doi.org/10.1016/j.beth.2007.07.002

Ong, J. C., Shapiro, S. L., & Manber, R. (2009). Mindfulness meditation and cognitive behavioral therapy for insomnia: A naturalistic 12-month follow-up. *Explore*, *5*(1), 30–36. https://doi.org/10.1016/j.explore.2008.10.004

Ouzzani, M., Hammady, H., Fedorowicz, Z., & Elmagarmid, A. (2016). Rayyan – A web and mobile app for systematic reviews. *Systematic Reviews*, *5*, 210. https://doi.org/10.1186/s13643-016-0384-4

Perlis, M., Vargas, I., Grandner, M., Bastien, C., Posner, D., & Spielman, A. (2022). The assessment of insomnia. In M. Kryger, T. Roth, & C. Goldstein (Eds.), *Principles and practice of sleep medicine* (7th ed., pp. 1951–1965). Elsevier.

Perlis, M. L., Posner, D., Riemann, D., Bastien, C. H., Teel, J., & Thase, M. (2022). Insomnia. *Lancet*, *400*(10357), 1047–1060. https://doi.org/10.1016/S0140-6736(22)00879-0

Peters, M. D., Godfrey, C., McInerney, P., Baldini Soares, C., Khalil, H., & Parker, D. (2017). Chapter 11: Scoping reviews. In E. Aromataris & Z. Munn (Eds.), *Joanna Briggs institute Reviewer's manual (JBI)*. Joanna Briggs institute.

Peters, M. D., Marnie, C., Colquhoun, H., Garritty, C. M., Hempel, S., Horsley, T., Langlois, E. V., Lillie, E., O'Brien, K. K., Tunçalp, Ö., Wilson, M. G., Zarin, W., & Tricco, A. C. (2021). Scoping reviews: Reinforcing and advancing the methodology and application. *Systematic Reviews*, *10*(1), 263. https://doi.org/10.1186/s13643-021-01821-3

Quin, N., Lee, J. J., Pinnington, D. M., Newman, L., Manber, R., & Bei, B. (2022). Differentiating perinatal insomnia disorder and sleep disruption: A longitudinal study from pregnancy to 2 years postpartum. *Sleep*, *45*(2), zsab293. https://doi.org/10.1093/sleep/zsab293

Riemann, D., Espie, C. A., Altena, E., Arnardottir, E. S., Baglioni, C., Bassetti, C. L. A., Bastien, C., Berzina, N., Bjorvatn, B., Dikeos, D., Dolenc Groselj, L., Ellis, J. G., Garcia-Borreguero, D., Geoffroy, P. A., Gjerstad, M., Gonçalves, M., Hertenstein, E., Hoedlmoser, K., Hion, T., … Spiegelhalder, K. (2023). The European Insomnia Guideline: An update on the diagnosis and treatment of insomnia 2023. *Journal of Sleep Research*, *32*(6), e14035. https://doi.org/10.1111/jsr.14035

Sánchez-Meca, J., Marín-Martínez, F., López-López, J. A., Núñez-Núñez, R. M., Rubio-Aparicio, M., López-García, J. J., López-Pina, J. A., Blázquez-Rincón, D. M., López-Ibáñez, C., & López-Nicolás, R. (2021). Improving the reporting quality of reliability generalization meta-analyses: The REGEMA checklist. *Research Synthesis Methods*, *12*(4), 516–536. https://doi.org/10.1002/jrsm.1487

Sforza, M., Galbiati, A., Zucconi, M., Casoni, F., Hensley, M., Ferini-Strambi, L., & Castronovo, V. (2021). Depressive and stress symptoms in insomnia patients predict group cognitive-behavioral therapy for insomnia long-term effectiveness: A data-driven analysis. *Journal of Affective Disorders*, *289*, 117–124. https://doi.org/10.1016/j.jad.2021.04.021

Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K. K., Colquhoun, H., Levac, D., Moher, D., Peters, M. D. J., Horsley, T., Weeks, L., Hempel, S., Akl, E. A., Chang, C., McGowan, J., Stewart, L., Hartling, L., Aldcroft, A., Wilson, M. G., Garritty, C., … Straus, S. E. (2018). PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. *Annals of Internal Medicine*, *169*(7), 467–473. https://doi.org/10.7326/M18-0850

Uygur, O., & Bahar, A. (2023). Sleep effort and insomnia severity: The role of bedtime procrastination. *Sleep Medicine Research*, *14*(1), 18–24. https://doi.org/10.17241/smr.2023.01655

Uygur, O. F., Ahmed, O., Uygur, H., Bahar, A., Hursitoglu, O., Chung, S., & Drake, C. L. (2023). Type D personality to insomnia: Sleep reactivity, sleep effort, and sleep hygiene as mediators. *Frontiers in Psychiatry*, *14*, 1160772. https://doi.org/10.3389/fpsyt.2023.1160772

Uygur, O. F., Uygur, H., Chung, S., Ahmed, O., Demiroz, D., Aydin, E. F., & Hursitoglu, O. (2022). Validity and reliability of the Turkish version of the Glasgow sleep effort scale. *Sleep Medicine*, *98*, 144–151. https://doi.org/10.1016/j.sleep.2022.06.022

Varma, P., Conduit, R., Junge, M., & Jackson, M. L. (2020). Examining sleep and mood in parents of children with sleep disturbances. *Nature and Science of Sleep*, *12*, 865–874. https://doi.org/10.2147/NSS.S271140

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: Marques, D. R., Pires, L., Broomfield, N. M., & Espie, C. A. (2024). Sleep effort and its measurement: A scoping review. *Journal of Sleep Research*, *33*(6), e14206. https://doi.org/10.1111/jsr.14206