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Letter to the Editor

LETTER TO THE EDITOR

"Sleep-wake state discrepancy": toward a common understanding and standardized nomenclature

Darah-Bree Bensen-Boakes[1], Nicole Lovato[1], Hailey Meaklim[2], Bei Bei[2] and Hannah Scott[1,*]

[1]Flinders Health and Medical Research Institute: Sleep Health, Flinders University, Adelaide, Australia and [2]Turner Institute for Brain and Mental Health, Monash University, Clayton, Australia

*Corresponding author. Hannah Scott, Flinders Health and Medical Research Institute: Sleep Health, Flinders University, GPO Box 2100, Adelaide 5001, South Australia. Email: hannah.scott@flinders.edu.au.

People with insomnia reporting poorer sleep compared to estimates obtained from objective assessments is common across both research and clinical settings. Typically, individuals report less sleep and more wakefulness across a given sleep opportunity compared to that captured via objective methods (e.g. polysomnography) [1–3]. Many different terms have been used to describe this phenomenon since the 1970s [4], including but not limited to the following: sleep misperception [5], sleep-state misperception [6], sleep-state discrepancy [7], subjective-objective sleep discrepancy [3], sleep misestimation [8], and paradoxical- [9] and pseudo-insomnia [4]. The mechanisms underlying this phenomenon are not yet well understood [2] and require future research to inform developments in the diagnosis and treatment (or management) of the disorder. The aim of this letter is to facilitate such work by highlighting recent findings and proposing a new nomenclature to become standard practice for describing this phenomenon.

Insomnia is regarded as a "subjective" disorder, for which individuals' perceptions of sleep and daytime functioning form the basis of its assessment, diagnosis, and treatment. However, objective measurements of sleep may also hold an important role. Clinicians have anecdotally reported that discussing the discrepancy between perceived and objectively measured sleep can be therapeutic. Preliminary findings [10] support this anecdotal evidence, suggesting that personalized feedback about the discrepancy between self-report (sleep diary) and objectively measured (actigraphy) sleep reduced the discrepancy on subsequent nights in a group of 40 individuals with insomnia when compared to those who received no feedback [10]. However, there is limited knowledge about the mechanisms that underlie this phenomenon and the implications for the diagnosis and management of insomnia.

Emerging evidence suggests that physiologically driven factors, at least to some degree, may underlie this phenomenon. For example, sleep macrostructure looks similar across individuals who demonstrate this phenomenon and those who do not, but sleep microstructure appears to differ [11]. These individuals show reduced electroencephalography power in the delta frequency band, increased power in theta/alpha, sigma, and beta frequency bands, as well as fewer and slower slow waves and more and faster sleep spindles [11]. Regional modulation of sleep [12] (i.e. "local sleep") is also thought to influence individuals' self-reported experience (thus, impacting this phenomenon), as local sleep intrusions may influence attentional lapses and perception of sleep and wakefulness [13]. This phenomenon is also associated with alterations in the salience network in individuals with insomnia [14], further demonstrating the possibility that this phenomenon may have physiologically driven foundations. Relatedly, individuals with insomnia may be more sensitive to sleep fragmentation and need longer continuous bouts of sleep (>30 minutes) to perceive that they had been asleep [15]. This may contribute to shorter perceived sleep duration than measured objectively.

Notably, most studies have been conducted as a single night of polysomnography recording. This is problematic for interpretation as one night is unlikely to accurately represent typical sleep due to the high night-to-night variability [16] that is typical for insomnia. Additional known limitations

of polysomnography (including the loss of information with 30-second scoring into categorical sleep stages and the considerable inter-scorer variability [17]) mean that objectively-obtained sleep estimates cannot be assumed to be "correct." Therefore, suggesting that the individual is inaccurate in their reporting may thus be incorrect. When discussing this phenomenon with individuals with insomnia, a stance that implies their "inaccuracy" of perceived sleep, which individuals with insomnia may interpret as blame or invalidation of their sleep disturbance, is likely to be counter-productive, and at worse harmful, to the individual's sleep.

As we begin to understand the mechanisms underlying this phenomenon, it is perhaps appropriate to re-consider the accuracy of our terminology used to describe it. While terms such as "sleep misperception" or "sleep misestimation" have the benefit of being widely used and recognizable to many, their continued use is likely inappropriate and potentially counter-productive. These terms are used in conjunction with terminology such as "accurate" or "inaccurate," in reference to the individual accurately or inaccurately reporting their sleep compared to polysomnography, placing blame on the individual. Some of the earliest mentions of this phenomenon in 1979 used the term "pseudo-insomnia" [4]. "Paradoxical insomnia" was adopted in the early 2000s to describe the paradoxical relationship (i.e. self-contradictory) between objective and subjective sleep reports [9]. Criticisms of "pseudo-insomnia" and "paradoxical insomnia" are that they both imply the insomnia is "fake" or "false." In recent times, terms such as "Subjective-Objective Sleep Discrepancy (SOSD)" and "Discrepancy between Objectively measures and Self-report Sleep (DOSS)" have been adopted. Using the term "discrepancy" is advantageous, as it accurately describes the difference between the sleep measurement methods but does so in a neutral way. However, the term "subjective" still holds negative connotations in many medical fields as objective measures are often perceived as inherently more correct than subjective measures.

Here, we proffer the term "sleep-wake state discrepancy" for use in future research and clinical practice. This term describes the phenomenon as a neutral discrepancy, thus reflects the state of the evidence about the potential underlying mechanisms of this phenomenon. Also, this term encompasses discrepancies of both sleep and wake, not just sleep. This term should be used in conjunction with directional terminology such as "longer" or "shorter" (e.g. "the individual self-reported shorter total sleep time than polysomnography measures recorded"), rather than 'under-'/"over-estimation" or "accurate"/"inaccurate" as these imply that the individual is incorrect in their perception. The preferred terminology may change over time, as more is understood about the underlying mechanisms. Nonetheless, the standardized use of respectful terminology is desirable to enable productive conversations in clinical care while also remaining true to the state of the evidence.

This common phenomenon for individuals with insomnia potentially holds significant meaning in both clinical and research settings. While the underlying mechanisms of this phenomenon are still under investigation, it is imperative that we conduct research and clinical management in a considerate manner that does not place blame or assumed inaccuracy on the individual for this discrepancy. Overall, we hope to encourage people to acknowledge the phenomenon we suggest be labeled "sleep-wake state discrepancy" with regard for the individual's best interest at the forefront of treatment and research.

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