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A scoping review on non-pharmacological sleep interventions among Asian undergraduate students

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Abstract

This scoping review maps the demographic and methodological landscapes of non-pharmacological sleep interventions for Asian undergraduates. A systematic search of six electronic databases—PubMed/MEDLINE, Scopus, DOAJ, APA PsycNet, ScienceDirect and JSTOR—identified peer-reviewed and open-access studies published between 2015 and 2025. In accordance with the JBI framework and the Arksey and O'Malley (2005) screening guidelines, six studies (n = 6) spanning various RCT and pretest-posttest designs met the inclusion criteria. The evidence demonstrates that structured, multi-week digital protocols—specifically digital Cognitive Behavioral Therapy for Insomnia (dCBT-I) and the Sleep Ambient Music Intervention (SAMI)—show immediate effectiveness for undergraduates experiencing chronic sleep disruptions. In contrast, brief interventions like mindfulness practices are better reserved as an accessible strategy to optimize sleep quality for students who already maintain sufficient sleep duration. Moreover, pronounced geographic asymmetries favoring East Asia, a distinct preference for reactive care, and the exclusion of key academic adjustment stressors constrain the scalability of these interventions. While there is a trend toward experimental designs and home-based digital formats, the omission of granular data tracking leaves the long-term sustainability of these protocols speculative. In conclusion, the reviewed interventions offer university settings practical and scalable tools to improve student well-being. However, implementing these interventions must account for college students' varied demographics (e.g., gender, academic year level, daily commutes, etc.) and incorporate extended follow-up windows, while actively aligning protocols with the 24-hour sleep-wake cycle.

Keywords: Asian undergraduate students, sleep health, sleep interventions, scoping review

A scoping review on non-pharmacological sleep interventions among Asian undergraduate students

1. Introduction

It is well established in the literature that sleep is fundamental to the psychological and physical health of undergraduate students (Henderson & Horan, 2021; Okano et al., 2019). However, sleep disturbances like insomnia and poor daytime functioning remain widespread as academic demands intensify (Babicki et al., 2023). In many Asian contexts, a heavy cultural emphasis on grades often comes at the expense of rest; when paired with systemic hurdles such as long commutes and early-morning schedules, these students face a sleep profile distinct from that of students in Western institutions (Angga & Elminero, 2025; Yeo et al., 2023). This conflict also highlights a physiological variance in which the human circadian rhythm operates as an intrinsic 24-hour timing system that regulates autonomic balance and daytime alertness, meaning that sleep health cannot be evaluated separately from daytime behaviors (Zhu et al., 2025). Navigating strict academic schedules and long commutes (Angga & Elminero, 2025; Yeo et al., 2023) forces students to alter their morning wake times to meet class requirements; because they fail to push their bedtimes earlier, they suffer from chronic sleep restriction (Lu et al., 2024).

Addressing these complex sleep profiles requires effective interventions. Although pharmacological options—ranging from benzodiazepines to dual orexin receptor antagonists—offer immediate relief, they carry significant risks, such as dependence and diurnal dysfunction (De Crescenzo et al., 2022). To mitigate the risks of pharmaceutical options and address safety concerns about sleep deprivation, non-pharmacological sleep interventions, such as the Cognitive Behavioral Therapy for Insomnia (CBT-I), have been widely studied for improving sleep quality (Walker et al., 2022). CBT-I is a structured, six- to eight-session framework that aims to reinforce a natural sleep-wake cycle and improve overall sleep health (Walker et al., 2022).

Newer behavioral strategies are also gaining empirical support. Mindfulness-based therapy for insomnia (MBTI), for instance, focuses on reducing nighttime rumination and autonomic cognitive arousal (Kalmbach et al., 2023), while other approaches, such as light therapy and hypnosis, also aim to reset circadian phases similar to CBT-I (Faulkner et al., 2020; Mamoune et al., 2022). Nevertheless, evidence for these alternative modalities remains highly inconsistent with mixed results and a lack of rigorous, large-scale methodological tracking data. Given the ongoing prevalence of sleep issues among Asian undergraduates (Angga & Elminero, 2025; Babicki et al., 2023; Yeo et al., 2023), , the central research problem our scoping review aims to address is the lack of synthesized evidence regarding non-pharmacological interventions tailored to this distinct population. Moreover, our study aims to evaluate the baseline landscape by mapping the broad characteristics of existing literature, the demographic profiles of the study populations, the prevalence rates of their sleep problems, and the associated risk factors and clinical outcomes linked to their sleep health. Furthermore, our review catalogs the specific non-pharmacological sleep interventions studied to improve sleep health among Asian undergraduate students—both with and without reported sleep-related problems—by analyzing their frequency, geographical distribution across different Asian countries, and the institutional settings (e.g., experimental, school guidance, or psychological clinics) where these applications took place. By synthesizing these data points, our study establishes a consolidated list of actionable, evidence-based recommendations to inform future research methodologies and institutional health practices.

2. Methodology

We conducted our scoping review using the Joanna Briggs Institute methodological framework (Aromataris et al., 2024), which expands upon and specifies the foundational work of Arksey and O'Malley (2005). To manage article volume, we used Rayyan AI v.1.7 (2025), an artificial intelligence application for organizing and screening

journal articles. With this tool, we collaboratively decided whether the records met our inclusion criteria. Lastly, we adhered to the PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews) guidelines (Tricco et al., 2018) to ensure thorough reporting of records.

Inclusion Criteria - We included peer-reviewed empirical studies that examined non-pharmacological sleep interventions for Asian undergraduate students aged 18 years and above published within the last ten years (2015-2025). Studies were eligible if they contained any of the following keywords: "sleep health," "sleep interventions," "sleep hygiene practices," OR "non-pharmacological sleep interventions," AND "undergraduate students," "undergraduates," "college students," "university students," AND a keyword for a specific Asian country or region (e.g., East Asia, Southeast Asia). Eligible studies were required to be published in English, accessible in full text, and available in open-access scholarly journals.

Search Strategy - We conducted a comprehensive literature search for relevant, English-language studies published between 2015 and 2025 across the following electronic databases: PubMed, MEDLINE, Scopus, DOAJ, APA PsycNet (via EBSCOhost), ScienceDirect and JSTOR. The final search query combined the three core concepts of sleep health ("sleep health" OR "sleep interventions" OR "sleep hygiene practices" OR "non-pharmacological sleep interventions"), AND undergraduate students ("undergraduate students" OR "undergraduates" OR "college students" OR "university students"), AND the Asian population (Asia OR Asian OR "Southeast Asia" OR "East Asia" OR "South Asia"). We then imported the retrieved citations into the Rayyan AI application to remove duplicates and began screening.

Source of Evidence Selection - Adhering to the JBI protocol (Aromataris et al., 2024), we conducted the source selection process using Rayyan AI. After we removed duplicates, the research team screened the titles and abstracts for eligibility. To proceed to the full-text review, at least three of the four reviewers had to agree on a study for inclusion. We resolved any discrepancies through team discussion until we reached a consensus. We narratively reported and described the final flow of studies through the selection process.

Data Extraction - Following title screening in Rayyan AI, we used a standardized spreadsheet to systematically extract relevant data across consecutive abstract and full-text review phases (Aromataris et al., 2024; Arksey & O'Malley, 2005). Extracted variables included country/region, sample size, mean age, gender distribution, study design, specific intervention protocols (delivery mode, duration, frequency), baseline sleep problems, data collection instruments, effect sizes, funding sources, and author-reported limitations or recommendations.

Data Analysis - After data extraction, we proceeded with data synthesis and reporting, guided by the principles for scoping reviews (Arksey & O'Malley, 2005) and the PRISMA-ScR guidelines (Tricco et al., 2018). This stage primarily involved a descriptive numerical summary of the extracted data, detailed in our results section. Our analysis also specifically identified trends across different Asian subregions (e.g., East Asia, Southeast Asia, West Asia) to provide a comprehensive overview of the existing literature. By collating and summarizing these findings, we highlight significant knowledge gaps to inform future research and practice, which we expand upon in the discussion section.

3. Results

Database searches initially yielded 15,700 records across six repositories (PubMed/MEDLINE, Scopus, DOAJ, APA PsycNet, ScienceDirect, and JSTOR). Because PubMed fully encompasses MEDLINE content, we merged the search results from both databases. Following duplicate removal (n = 4,682), 11,018 unique citations remained for title screening, as detailed in the PRISMA flow diagram (Figure 1). From this pool, we advanced 304 records to abstract screening and subsequently evaluated 87 studies during the full-text review phase. Of the 81 excluded full-text articles, reasons for omission included geographic location outside of Asia (n = 39), focus on older adult populations (n = 13), and non-English publications (n = 12), among other framework discrepancies (see Figure 1). Only six studies, representing approximately 0.05% of the screened literature, met our inclusion

criteria.

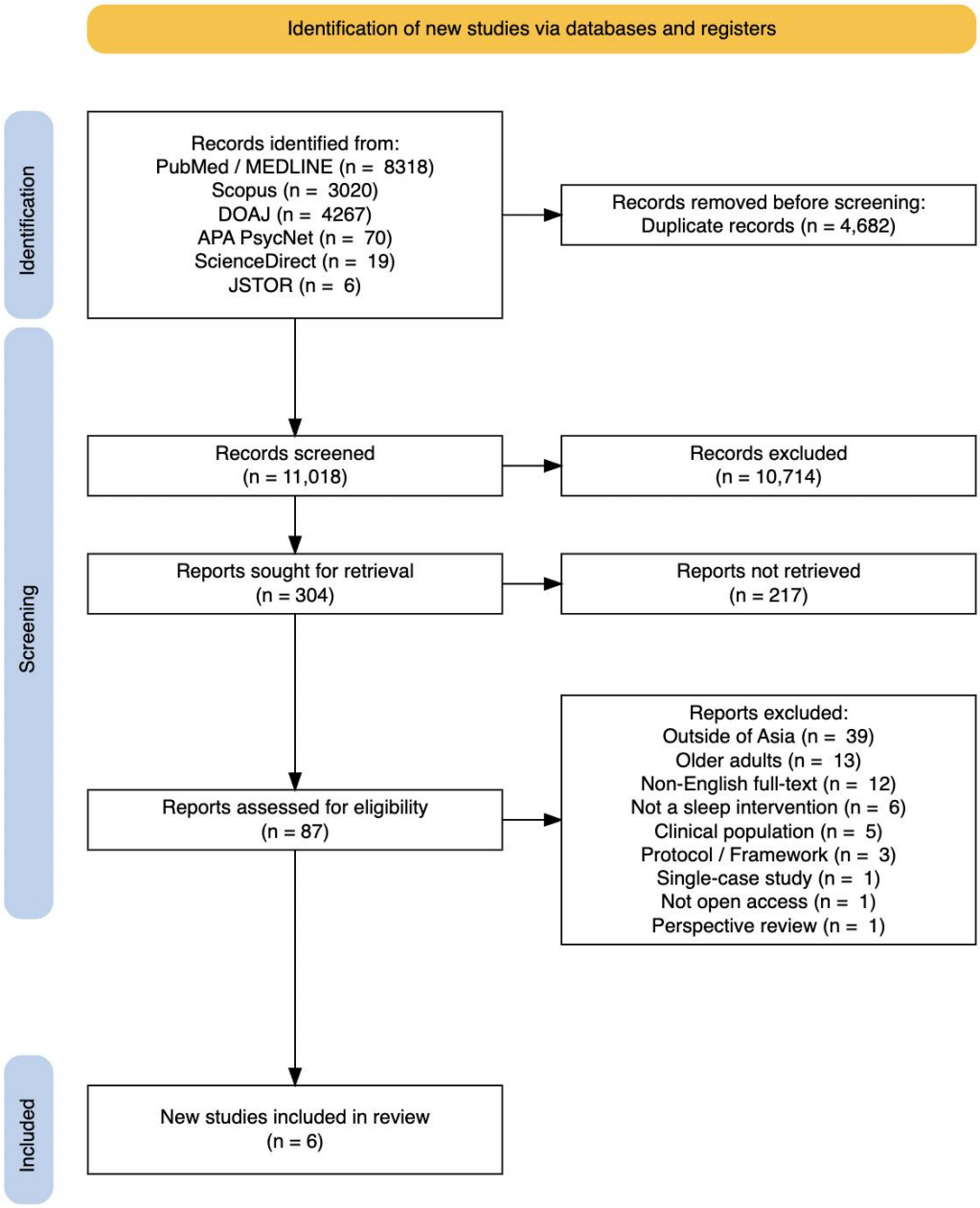


Figure 1. PRISMA Flow Diagram of Selection and Screening Process

General Characteristics of the Included Literature - Table 1 lists the six studies included in this scoping review. Chronologically, the literature reflects a recent surge in interest; only a single study emerged between 2015 and 2020 (Li et al., 2018), whereas the remaining five were all published between 2022 and 2025. In terms of institutional support, universities financially funded half of the included studies (Hu et al., 2023; Li et al., 2018; Sonkaya & Yazgan, 2025), while the remaining authors disclosed no external funding sources (Li et al., 2022; Reza, 2020; Wu et al., 2024). As shown in Figure 2, four studies (67%) originated from East Asia (China and Hong Kong), while Southeast Asia (Indonesia) and West Asia (Turkey) each yielded one study (17%). Hu et al. (2023), Li et al. (2022), and Wu et al. (2024) conducted the three China-based studies in Chongqing, Shenzhen, and Shanghai, respectively.

Table 1

Summary of Study Designs, Participant Characteristics, and Baseline Sleep Metrics Across Reviewed Literature

Author (s)	Country	Design	Phase	Sample	Age	Gender	Baseline Sleep Score	Measures Used	Non-pharmacological
					M (SD)	(M : F)	M (SD)		Sleep Intervention
Hu et al. (2023)	China	Pretest-Posttest	-	138	20.03 (1.26)	73 : 65	8.93 (2.87)	PSQI, STAI, BDI-II, Actigraph, Sleep diary	Sleep Ambient Music Intervention Nightly for four weeks
Li et al. (2018)	Hong Kong	RCT, Pretest-posttest	IG	32	21.16 (1.79)	42:21:00	6.94 (1.39)	PSQI, Pre-sleep Arousal Scale, Sleep diary	Brief Mindfulness Induction
			CG	31			5.65 (1.87)	Nightly for one week	
Li et al. (2022)	China	Cross-Sectional Survey, Pretest-posttest	Study 1	756	-	510 : 246	6.93 (3.17)	PSQI, SWELL, Actigraph,	30-Minute Moderate Exercise
			Study 2 - IG	21	-	00:21	80.00%	Sleep diary	Daily for six days
			Study 2 - CG	8	-	00:08	-		
Reza (2020)	Indonesia	Pretest-Posttest	-	17	-	00:17	High: 3 (18%) Average: 10 (59%) Low: 4 (23%)	Sleep Quality Scale	Wudu-based psychotherapy Two times a day for one week
Sonkaya & Yazgan (2025)	Turkey	RCT, Pretest-posttest	IG	20	19.8	17:03	10.85 (3.44)	PSQI, Digital Addiction Scale, ELISA	Digital Addiction Training Four sessions over an unspecified duration
			CG	20	19.7	16:04	10.30 (3.21)		
Wu et al. (2024)	China	Comparative Case-Control, RCT	Study 1 - IG	52	21 (1.88)	11:41	9 (2.32)	PSQI, Fatigue Severity Scale,	Digital CBT-I
			Study 1 - CG	56	21 (1.68)	09:47	3 (1.27)	Sleep diary	Five times per week for three weeks
			Study 2 - IG	42	21 (1.60)	10:32	5.10 (2.00)		
			Study 2 - CG	25	21 (2.26)	04:21	4.92 (1.00)		

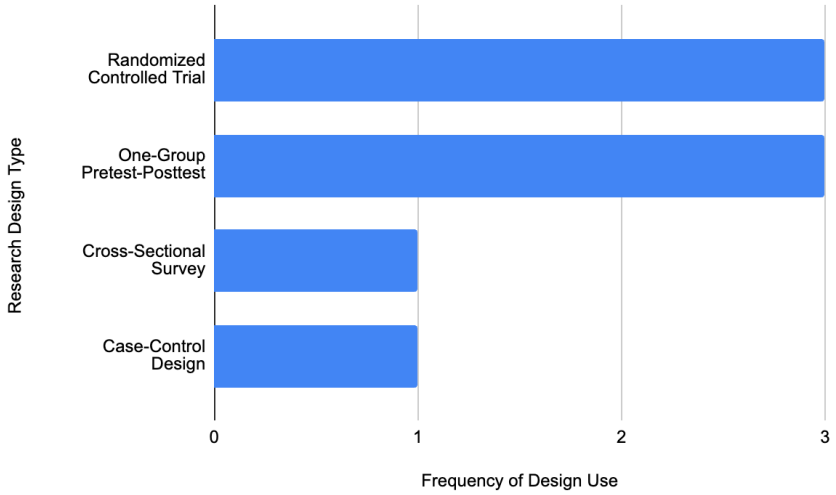
Note. BDI-II = Beck Depression Inventory-II; CBT-I = Cognitive-Behavioral Therapy for Insomnia; CG = control group; ELISA = Enzyme-Linked Immunosorbent Assay; IG = intervention group; PSQI = Pittsburgh Sleep Quality Index; RCT = Randomized Controlled Trial; STAI = State-Trait Anxiety Inventory; SWELL = Smith Wellbeing Questionnaire. Global baseline mean and standard deviation metrics for Reza (2020) were not explicitly reported in the original study. For Li et al. (2022) Study 1, baseline sleep disturbances are reported as a percentage frequency to reflect the high clinical prevalence of poor sleep quality within the surveyed cohort.

Figure 2. Geographical Distribution of the Included Studies

Methodological Trends - As Figure 3 illustrates, experimental frameworks dominate the research landscape, with Randomized Controlled Trials (RCTs) and one-group pretest-posttest formats appearing most frequently. Across the six included studies, the total number of specific research phases and designs is eight, as two papers employed multi-phase research methodologies (Li et al., 2022; Wu et al., 2024). Within this distribution, four studies incorporated control groups (Li et al., 2018; Li et al., 2022; Sonkaya & Yazgan, 2025; Wu et al., 2024),

whereas the standalone pretest-posttest designs lacked a comparative cohort (Hu et al., 2023; Reza, 2020).

Participant Demographics



Reported participant demographics across the studies most commonly included age, gender distribution, and baseline sleep disturbance scores (see Table 1). Gender distributions varied substantially among the six included studies. Males dominated the sample in Sonkaya and Yazgan's (2025) study, comprising 80% to 85% of both the intervention and control groups, followed by Li et al. (2018), with 66.67% males. Conversely, several studies featured predominantly female cohorts. Females comprised 78% to 83% of the treatment groups in Wu et al.'s (2024) first phase, and 76% to 84% in their second phase. Reza (2020) and specific sub-cohorts within Li et al.'s (2022) work focused exclusively on female populations, noting that women disproportionately experience elevated levels of stress, fatigue, and poor sleep quality. Only Hu et al. (2023) evaluated a relatively balanced gender distribution.

While our scoping review targeted university students in Asia, the included samples had unique characteristics, namely, Li et al.'s (2018) university athletes and Wu et al.'s (2024) full-time university students. The remaining studies did not specify whether their samples included part-time students or were part of the collegiate athletic team. Regarding academic year levels, only Hu et al. (2023) reported specific distributions: first-year (n = 41), second-year (n = 86), and third-year (n = 11). Similarly, Li et al. (2022) briefly noted that first-year students comprised the majority of their sample (65.7%). No other demographic variables, such as sexual orientation, college programs, or extracurricular involvement, were reported across the included literature.

In terms of baseline clinical profiles, the reviewed cohorts presented substantial variations. While Hu et al. (2023), Li et al. (2022), and Wu et al. (2024) intentionally sampled undergraduates with elevated baseline sleep disturbances—resulting in mean PSQI scores that exceeded clinical thresholds for poor sleep—Li et al. (2018) focused instead on a healthy cohort already averaging seven to eight hours of sleep.

Data Collection Instruments - Among the subjective measures utilized in the six studies, the PSQI (Buysse et al., 1989) remains the most commonly used measure of sleep quality (see Table 1). Although the authors used localized Chinese and Turkish translations that matched their respective sample populations, the core seven-component scoring structure remained consistent across these variants. Minor procedural discrepancies did emerge, however, regarding item volume and diagnostic thresholds. For example, Sonkaya and Yazgan (2025) appended five non-analyzed bedmate items to their 24-item Turkish version, while across all protocols, the global score threshold used to define "poor sleep" varied from a conservative five (Li et al., 2018; Sonkaya & Yazgan, 2025) to a more stringent seven (Wu et al., 2024) or eight (Hu et al., 2023). Among the reviewed literature, Reza (2020) conducted the only study that did not incorporate the PSQI, opting instead to measure subjective sleep quality with

the Sleep Quality Scale (SQS).

Alongside the PSQI, five studies utilized daily sleep diaries to capture longitudinal, night-by-night variability. However, their specific structural origins, completion timelines, and target variables varied considerably: (1) Hu et al. (2023) adapted the National Sleep Foundation Sleep Diary (NSFSD) to record bedtime, sleep time, body movements, and wake time across twice-daily prompts (pre-bedtime and post-awakening), (2) Li et al. (2018) administered the Sleep Health Research Laboratory's (SHRL) Likert-scale variant post-awakening to isolate subjective sleep quality, duration, and feelings of rest, while Li et al. (2022) focused on tracking bedtime parameters alongside pre- and post-sleep fatigue, and (3) Wu et al. (2024) integrated a daily sleep diary to track routine adherence but left its specific foundational framework or structural derivation unspecified.

To complement these self-reported frameworks, three studies integrated objective physiological metrics. Specifically, Hu et al. (2023) and Li et al. (2022) deployed wrist-worn actigraphy tracking devices (Actigraph wGT3x-BT) to monitor naturalistic home-based sleep efficiency, sleep-onset latency, total sleep time, and awakening time. Tracking intervals varied significantly, spanning five weeks in Hu et al. (2023) but only six days in Li et al. (2022). Sonkaya and Yazgan (2025) further operationalized objective tracking by using enzyme-linked immunosorbent assay (ELISA) kits to quantify participants' serum levels of Orexin-A, a key sleep-regulating neuropeptide.

Researchers also administered various specialized self-report scales to track secondary psychological and behavioral correlates. To evaluate intervention impacts on affective and behavioral health, protocols utilized the Beck Depression Inventory-II (BDI-II) and State-Trait Anxiety Inventory (STAI) for mental health parameters (Hu et al., 2023), the Smith Well-being Questionnaire (SWELL) for academic fatigue (Li et al., 2022), and dedicated digital addiction scales (Sonkaya & Yazgan, 2025). Furthermore, to map acute physiological de-arousal, Li et al. (2018) tracked a 16-item Chinese version of the Pre-sleep Arousal Scale (PSAS) across three time points—immediately following night training, prior to mindfulness induction, and directly post-induction—demonstrating high internal consistency across the three time points ($\alpha = 0.86$ to 0.92).

Typology, Delivery, and Results of Sleep Interventions - As illustrated in Figure 3, the research landscape utilizes a balanced mix of traditional sensory interventions and modern digital health technologies. Across the six included studies, the intervention modalities primarily targeted cognitive-behavioral strategies (50%, $n = 3$), including digital Cognitive-Behavioral Therapy for Insomnia (dCBT-I), digital addiction training, and brief mindfulness induction. Lifestyle mechanisms (i.e., exercise, music) accounted for one-third of the evidence base (33.3%, $n = 2$), while a single study explored spiritual practices (16.7%).

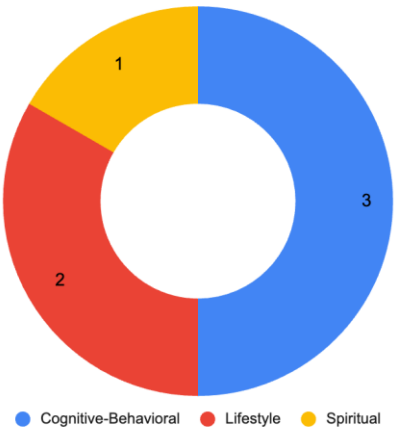


Figure 4. Distribution of Intervention Modalities

Acute, Short-Term Interventions (≤ 1 week) - Half of the literature prioritized rapid-exposure protocols to evaluate the immediate effects of brief sleep hygiene or relaxation techniques. Methodologically, these acute interventions used a mix of localized in-person tracking and independent at-home application delivery. For example, Li et al. (2022) executed a two-phase study, where Phase 1 established that severe academic fatigue was highly prevalent among the student cohort and varied significantly across differing lifestyle choices, coping mechanisms, and academic characteristics, with female students exhibiting disproportionately higher baseline levels of both academic fatigue and poor sleep quality. To address this, Phase 2 deployed an intervention in which participants used highly accessible campus spaces—such as the university gym, fields, playgrounds, and dormitories—to complete daily exercise "punch cards" consisting of any cumulative, 30-minute moderate-intensity physical activity. Participants submitted screenshots of mobile app tracking to a group chat by midnight to verify compliance. Results showed that post-experimental fatigue scores were significantly lower than pre-experimental scores among the female participants. Furthermore, while the six-day intervention yielded no significant improvements in the students' academic concentration metrics, the highly fatigued female students with baseline sleep problems demonstrated profound, statistically significant post-exercise improvements in both sleep latency and sleep efficiency.

The remaining short-term protocols shifted toward sensory and psychological relaxation strategies performed immediately before bed. Li et al. (2018) deployed the only short-term, purely digital protocol, requiring 63 university athletes to stream a six-minute audiovisual mindfulness induction video independently from their homes every night for one week. Although the brief mindfulness induction did not affect objective sleep duration, it significantly improved athletes' subjective sleep quality and subsequent feelings of rest. Mechanistically, the authors noted that while rigorous night training typically spikes athletes' physiological and neural arousal, the brief mindfulness intervention successfully lowered pre-sleep arousal levels, thereby preventing potential sleep disturbances. Similarly, evaluating pre-sleep arousal, Reza (2020) operationalized Wudu—an Islamic ritual ablution involving the systematic washing of specific cutaneous zones—as an individual, home-based psychotherapy. Participants performed this routine twice daily for one week (prior to nocturnal sleep and morning activities) to activate dual somatic hydrotherapy and cognitive-spiritual pathways. Post-intervention results demonstrated that Wudu therapy was highly beneficial for improving sleep profiles in young women, yielding statistically significant increases in overall sleep satisfaction and sleep duration.

Multi-Week and Curriculum-Driven interventions - Longer protocols shifted predominantly toward application-based digital architectures designed to foster sustained habit formation. Both China-based longitudinal trials leveraged the ubiquitous WeChat smartphone platform to embed non-invasive interventions into students' naturalistic home environments. For instance, Wu et al. (2024) executed a two-phase, three-week digital Cognitive-Behavioral Therapy for Insomnia (dCBT-I) program. Phase 1 established that poor sleepers exhibited a profound attentional bias, characterized by heightened attentional vigilance toward sleep-related cues compared to normal sleepers. Whereas, Phase 2 deployed an RCT where poor sleepers (n = 67) accessed 10- to 15-minute digital modules five times per week via WeChat, strictly within a 30-minute pre-bedtime window (8:00 PM to 12:00 AM). This targeted progression integrated stimulus control, sleep restriction, behavioral conditioning, and cognitive-emotional regulation. While both the dCBT-I intervention group and the conventional sleep education control group demonstrated improvements in subjective sleep quality scores, the dCBT-I protocol was uniquely effective in reducing subjective fatigue and in alleviating underlying cognitive, attentional, and vigilance processes related to sleep cues.

Using a parallel digital framework over a relatively longer duration, Hu et al. (2023) evaluated the Sleep Ambient Music Intervention (SAMI). Following a one-week baseline assessment, 138 college students actively streamed a 30-minute nightly loop of slow-tempo, low-frequency soundscapes via Bluetooth headphones for four weeks to mask environmental noise and alleviate nightly cognitive hyperarousal, with researchers rotating musical selections weekly to prevent auditory fatigue. Methodologically, the authors noted that granting participants agency in selecting their personally preferred ambient music tracks was a crucial factor in the protocol's success. The SAMI protocol yielded significant post-intervention improvements in both subjective and objective sleep

metrics, specifically enhancing overall sleep quality on the PSQI and reducing objective sleep-onset latency (SOL). Remarkably, these beneficial sleep effects took hold rapidly, requiring only 2 days to improve subjective PSQI metrics and 3 days to shorten objective SOL. Beyond sleep architecture, the SAMI protocol successfully improved the overall mental health of the cohort by significantly reducing levels of state anxiety, trait anxiety, and depression—outcomes the authors attributed to ambient music's capacity to induce positive neurochemical changes and promote beneficial neuroplasticity.

Breaking away from these remote, application-driven frameworks, Sonkaya and Yazgan (2025) evaluated a custom Digital Addiction Training program through a traditional, in-person classroom format. Their protocol required participants to attend interactive, 45-minute PowerPoint-based group sessions and case discussions focused on cognitive-behavioral strategies for managing screen overconsumption. The training successfully reduced major symptoms of digital addiction, significantly mitigating overuse, dependence, lack of restraint, and associated negative emotional states. However, the program demonstrated limited direct efficacy on physiological sleep parameters, failing to improve subjective sleep quality or Orexin-A levels significantly.

Correlates of Sleep Health: Associated Factors and Outcomes - The six included studies primarily evaluated sleep health and its intersecting variables, with all focusing on sleep quality. Within this domain, researchers investigated specific dimensions, including reduced pre-sleep arousal (Li et al., 2018), insomnia severity (Wu et al., 2024), and sleep satisfaction, encompassing overall quality, sleep tightness, and sleep adequacy (Reza, 2020). Additionally, Hu et al. (2023) examined comprehensive sleep indicators, including sleep latency, persistence, efficiency, disorders, medication use, and daytime dysfunction. Regarding non-sleep variables, half of the studies examined mental health components (n = 3), including constructs such as general mental health (Hu et al., 2023), psychological well-being (Li et al., 2022), and rumination (Wu et al., 2024). Finally, individual studies isolated niche domains, including digital addiction and serum Orexin-A peptide levels (Sonkaya & Yazgan, 2025), academic fatigue (Li et al., 2022), and attentional bias (Wu et al., 2024).

4. Discussion

We find a clear paucity of literature on non-East Asian regions. Additionally, we identified that the majority of these studies spanned 2020 to 2025, with only a single study covering 2015 to 2020. A future systematic review could focus strictly on studies from 2020 onwards. Further, we synthesize the literature below, focusing on non-pharmacological sleep interventions for Asian undergraduates across three main areas: intervention characteristics, sample demographics, methodological trends and outcome assessment approaches, and practical implications for institutional programs.

4.1 Characteristics of Non-Pharmacological Sleep Interventions for Asian Undergraduates

Cognitive-behavioral practices constituted the majority of the scoped interventions. While global literature widely recognizes Cognitive Behavioral Therapy for Insomnia (CBT-I) as the gold standard for non-pharmacological sleep treatment (Walker et al., 2022), we identified only one study that explicitly evaluated a standardized CBT-I protocol—specifically its digital format (Wu et al., 2024). In evaluating this direct clinical protocol, Wu et al. (2024) first established that poor sleepers in China experience heightened cognitive anxiety and a hyper-focus regarding their sleep issues. Both the dCBT-I framework and the control group's conventional sleep education (consisting of basic sleep hygiene tips) improved students' sleep quality. However, only the dCBT-I program successfully targeted and alleviated the underlying cognitive hyperarousal while uniquely mitigating daytime fatigue. Although Walker et al. (2022) emphasize that traditional CBT-I requires a rigorous six- to eight-week framework to dismantle maladaptive thoughts, Wu et al.'s (2024) findings demonstrate that an online adaptation optimized for Chinese undergraduates can effectively deliver these therapeutic mechanisms within a highly compressed three-week timeline. Nevertheless, because Wu et al. (2024) captured only immediate posttests at the conclusion of this three-week progression, the study leaves the long-term maintenance of these behavioral shifts unexamined.

Moreover, instead of relying on pre-existing sleep health protocols like CBT-I, Sonkaya and Yazgan (2025) designed an independent psychoeducational curriculum grounded in a cognitive-behavioral approach and the Health Belief Model for Turkish university students. However, their custom program successfully reduced behavioral digital addiction symptoms; its impact on sleep disappeared when compared directly with a control group (p = .416), failing to affect both subjective sleep scores and students' biological Orexin-A levels (p = .917). This notable discrepancy indicates that while direct clinical sleep protocols like dCBT-I reliably alter the specific cognitive mechanisms and hyperarousal underpinning poor sleep among Chinese college students (Wu et al., 2024), indirect interventions targeting daytime technology habits do not automatically guarantee biological or subjective sleep recovery among their Turkish counterparts (Sonkaya & Yazgan, 2025).

We find that these interventions are not one-size-fits-all; rather, as these differing outcomes suggest, their success hinges entirely on a student's baseline sleep profile. While structured, multi-week protocols like dCBT-I are required to treat students with chronic deficits or insomnia symptoms (Wu et al., 2024), milder or non-clinical sleep disruptions may only require brief, targeted practices. For instance, Li et al. (2018) found that brief mindfulness inductions are highly effective for reducing pre-sleep anxiety and improving subjective rest among students with an optimal baseline sleep duration. These patterns suggest that brief interventions serve best as preventative, “winding-down” tools, while deep-seated sleep disruptions require structured, clinical frameworks (Kalmbach et al., 2023; Okano et al., 2019; Walker et al., 2022).

When looking at the timing of these interventions, we find a heavy reliance on nighttime administration, treating sleep as an isolated bedtime issue rather than a 24-hour cycle. Most protocols focus strictly on the pre-sleep window, utilizing nightly tools such as ambient music, mindfulness videos, or structured app-based tasks immediately before bed (Hu et al., 2023; Li et al., 2018; Wu et al., 2024). This narrow focus, however, overlooks the ways daytime behaviors directly affect sleep quality. The few studies that diverge from this trend demonstrate that targeting daytime habits—whether through scheduled physical activity, classroom sessions, or twice-daily routines—is equally necessary for overall sleep recovery (Li et al., 2022; Reza, 2020; Sonkaya & Yazgan, 2025).

An exclusively nighttime approach runs counter to the circadian rhythm, which operates on a 24-hour cycle to regulate daytime alertness and cognitive performance alongside nocturnal rest (Zhu et al., 2025). Given that rigid academic schedules and social behaviors constantly push undergraduate bedtimes later (Lu et al., 2023), a nighttime-only approach creates a distinct therapeutic mismatch. Integrating both daytime and nighttime practices represents an effective strategy for enhancing sleep quality. Overall, until researchers design these holistic protocols—tailored to students' baseline clinical needs and sustained beyond a month-long duration—interventions will likely offer only temporary relief against the deeply entrenched structural realities of university life.

4.2 Geographic and Demographic Profiles of the Student Samples

Our scoped data reveals a pronounced regional data gap, with non-pharmacological sleep trials heavily concentrated in localized East Asian metropolitan hubs, leaving student populations across South, Central, North, and West Asia unrepresented. Even within Southeast and Western Asia, data remains sparse (Reza, 2020; Sonkaya & Yazgan, 2025). This uneven distribution matters because it means the current literature largely overlooks localized environmental factors that shape how students actually sleep, such as the daily commute. In regions like Southeast Asia, students frequently face grueling morning transits and rigid commute windows that act as an uncontrollable tax on their sleep schedules (Angga & Elminero, 2025; Yeo et al., 2023). Because the heavily represented East Asian intervention models omit commuting habits as a tracking variable, their real-world generalizability remains unclear. We cannot yet determine if these sleep protocols can successfully scale to a broader, diverse population of regional students whose transit infrastructure heavily restricts their sleep.

Additionally, a clear trend in recruitment skews current sleep research toward reactive rather than preventive care. Most available literature explicitly targets symptomatic student cohorts—such as those already experiencing poor sleep quality, digital addiction, or insomnia—to demonstrate short-term therapeutic efficacy. While this

targeting proves that behavioral interventions can treat existing pathologies, it systematically overlooks preventive sleep hygiene. Furthermore, the field lacks data on how these interventions perform when applied to healthy college students who are not involved in athletics. Thus, we also cannot yet determine whether these same behavioral modalities can actively prevent the onset of clinical sleep disorders in the broader student population.

Compounding these geographic disparities, a distinct gender asymmetry runs through the literature, suggesting that research teams may unconsciously align specific intervention types with one gender over the other. Trials focusing on psychotherapy, digital CBT-I, and general wellness heavily over-recruit female participants, whereas interventions focusing on performance optimization or behavioral restraint—such as mindfulness for athletes or digital addiction training—predominantly feature male samples. This asymmetrical recruitment obscures how different genders actually respond to sleep protocols. For instance, even when studies achieve an equitable gender balance, baseline differences can mask critical behavioral shifts; male participants may enter a trial with significantly lower baseline sleep efficiency, skewing the post-intervention analysis (Hu et al., 2023). Neglecting these balances also leads to structural blind spots in the results. High-male cohorts in digital addiction training can fail to improve overall sleep quality because they overlook the higher global vulnerability to insomnia that female students carry (Babicki et al., 2023). Similarly, while female students often struggle with long-term semester-long schedule consistency (Okano et al., 2019), brief, female-dominated protocols fail to assess whether these lifestyle changes persist beyond the immediate posttest window.

Lastly, the available literature overlooks demographic variation across academic years, obscuring the evolving stressors that characterize different stages of a student's university career. A rare exception in the data reveals that first- and second-year students exhibit significantly more severe sleep disruptions than upper-level students, likely reflecting the unique psychological burdens of domestic displacement and adaptation to higher education (Hu et al., 2023). Because unstructured behavioral interventions require students to manage their sleep routines autonomously, these protocols benefit juniors and seniors who already possess established self-regulation skills and stable schedules. Consequently, younger cohorts require more structured institutional scaffolding, yet the current literature fails to tailor sleep interventions to these distinct developmental stages. Ultimately, until future trials consciously account for external transit infrastructure, prioritize preventive care, balance gender-specific sleep vulnerabilities, and scaffold interventions for incoming first-year students, these behavioral modalities will remain limited in their real-world utility across the broader, diverse regional student population.

4.3 Methodological Trends and Outcome Assessment Approaches

Methodologically, the literature trends heavily toward rigorous experimental frameworks—such as randomized controlled trials and pre-post designs—over simpler correlational approaches. Interestingly, financial funding does not entirely bottleneck these technological capabilities. While resource-intensive protocols like biomarker monitoring (Sonkaya & Yazgan, 2025) or extensive actigraphy tracking (Hu et al., 2023) align with funded initiatives, teams can still deploy objective actigraphy in entirely unfunded settings (Li et al., 2022). This overlap demonstrates that acquiring objective data is financially feasible even without substantial grant support, likely through departmental resources or existing institutional equipment. Ultimately, when specialized equipment or heavy financing is unavailable, subjective instruments like the widely favored Pittsburgh Sleep Quality Index (PSQI) and daily or weekly sleep diary entries remain highly effective, resource-efficient alternatives—provided researchers analyze and report the resulting data adequately.

Regrettably, most of the current literature misses this opportunity by flattening its data into single, global scores that hide the true value of these subjective tools. Most studies favor the PSQI but consistently omit its component subscores in favor of a single, global rating. Because the instrument encompasses distinct dimensions—such as sleep latency, duration, and nocturnal disturbances—relying solely on an aggregated score hides the exact mechanisms of improvement and fails to pinpoint which specific facets of sleep architecture these interventions actually modify. At the same time, researchers frequently require participants to maintain sleep diaries, but they routinely omit these continuous metrics from their final analyses in favor of basic pre- and post-

test scores. Omitting diary data limits the analytical scope of the literature; broad global shifts may indicate overall improvement, but they completely fail to illustrate whether an intervention actually stabilized a student's routine over time or merely extended sleep duration on an otherwise erratic timeline (Okano et al., 2019). Hu et al. (2023) stand alone in the literature as the only team to fully utilize and report their diary metrics alongside PSQI component scores, revealing that sleep-onset latency, efficiency, total sleep time, and awakening times actually improve at completely different, independent rates across the active intervention timeline. Therefore, by failing to disaggregate data and triangulate subjective diaries with objective metrics, the broader literature obscures vital behavioral patterns and leaves the exact mechanisms of student sleep stabilization unexamined.

Regarding data collection procedures, researchers generally choose between two distinct environments: structured, classroom-based settings or flexible, at-home formats. While the shift toward fully remote protocols was accelerated by the necessities of the COVID-19 pandemic (Wu et al., 2024), the preference for online delivery actually predated the global health crisis (Li et al., 2018). Although transitioning protocols from a controlled laboratory to a naturalistic home environment forces researchers to trade strict environmental control for greater reliance on student compliance, it simultaneously reveals a core methodological strength. These remote frameworks demonstrate that behavioral sleep tools do not require artificial laboratory settings to be effective; instead, they can seamlessly integrate into the daily lives of busy college students. Synthesizing these trends reveals that, regardless of whether they deploy advanced actigraphy or subjective diaries, investigators testing sleep interventions in college student populations must analyze their data with much closer detail to capture the real impact on students' lives.

4.4 Practical Implications for Institutional Programs

Synthesizing the empirical trends mentioned above for real-world applications enables university stakeholders, student affairs offices, and campus mental health clinics to develop immediate, actionable frameworks. Rather than relying on rigid, resource-intensive operations, institutions can leverage localized, low-cost behavioral tools proven effective in the literature to support distinct student populations. Campus counseling centers and guidance offices could provide structured psychoeducation on sleep management through multi-week digital or hybrid frameworks tailored for students experiencing severe, chronic sleep deficits. Based on the successful deployment of digital Cognitive Behavioral Therapy for Insomnia (dCBT-I) and the Sleep Architecture Modification Intervention (SAMI) (Hu et al., 2023; Wu et al., 2024), universities can host asynchronous, web-based platforms, institutional learning management systems (e.g., Canvas discussion boards and chat features), or regional smartphone-embedded modules (such as localized Viber or WeChat support networks, and semester-based Google Chat cohorts tied to university emails). These digital channels allow students to access cognitive restructuring exercises and sleep restriction strategies flexibly around their demanding academic and commuting schedules.

Moreover, institutional psychoeducation programs can maximize engagement by validating and integrating localized psychospiritual and religious practices already embedded in students' daily routines. For example, in Muslim-majority student populations (such as in Indonesia or specific regional cohorts), campus wellness campaigns can explicitly emphasize the inherent physiological and psychological “wind-down” benefits of Wudu (ritual ablution before prayer) as an immediate, low-barrier tool for lowering autonomic cognitive arousal before bed (Reza, 2020). Similarly, in contexts shaped by South Asian Ayurvedic traditions or regional Buddhist and Jewish mindfulness practices, institutional counselors can scaffold sleep-hygiene education around existing cultural frameworks rather than completely introducing new alternatives. By connecting clinical sleep hygiene to these deeply entrenched spiritual practices, institutions can foster culturally responsive, high-compliance habits that naturally fit into the diverse student identities.

In contrast to targeted services for clinical populations, institutions should design broad sleep-focused mental health literacy programs to cultivate preventive sleep hygiene habits among asymptomatic or subclinical student cohorts. Administered through university health offices or student affairs, these literacy campaigns can offer low-barrier, actionable wellness education that strips away the clinical stigma of seeking help—such as partnering with

physical education departments to integrate brief daytime mindfulness inductions for student-athletes (Li et al., 2018), or introducing campus-wide moderate exercise protocols and morning "physical activity punch cards" (Li et al., 2022) to naturally anchor delayed circadian phases. Furthermore, because tracking tools like the National Sleep Foundation Sleep Diary (NSFSD) are highly resource-efficient and financially feasible to execute without grant funding, university clinics and wellness centers can readily adopt them as standard self-monitoring protocols within these literacy campaigns. By training the broader student body to use these meticulous subjective instruments to monitor night-to-night volatility, institutions can empower non-clinical undergraduates to identify their own environmental stressors and autonomously cultivate sustainable sleep health in highly competitive academic environments.

5. Conclusion

Our scoping review systematically mapped the landscape of non-pharmacological sleep interventions among Asian undergraduate students from 2015 to 2025. Our findings confirm that non-pharmacological modalities offer a highly effective and safe pathway for alleviating widespread sleep-related problems in this population, as demonstrated by the documented success of localized clinical protocols, psychoeducational frameworks, and active lifestyle modifications (Hu et al., 2023; Li et al., 2022; Reza, 2020; Wu et al., 2024). However, while these individual trials provide clear evidence of therapeutic efficacy, the broader synthesized evidence evaluating behavioral interventions across the continent remains fragmented and inconsistent. Specifically, these literature contradictions stem from four distinct mismatches: (1) a methodological mismatch, where studies compare vastly different timelines and modalities, such as comparing brief, one-day mindfulness sessions against rigorous, multi-week clinical applications; (2) an analytical mismatch, where researchers routinely flatten rich subjective data into single, global scores, masking whether an intervention truly stabilized a student's routine or merely altered a single metric; (3) a geographic and environmental mismatch, where successful interventions built around the stable schedules of East Asian metropolitan campuses frequently produce conflicting results when researchers attempt to scale them to regional student cohorts who face uncontrollable, sleep-restricting morning transit infrastructures; and (4) a clinical and demographic mismatch, where the literature incorrectly evaluates short-term preventive tools tested on healthy cohorts against identical modalities tested on entrenched, chronic insomnia populations, while simultaneously neglecting gender-specific vulnerabilities and first-year adaptation stressors.

The underlying nuances driving these contradictions do not signal a failure of the interventions themselves but rather point to a profound therapeutic mismatch when investigators apply generic, standardized Western clinical protocols without accounting for the complex socio-cultural, environmental, structural, and psychospiritual realities of Asian undergraduates. To bridge this gap, regardless of whether researchers use advanced actigraphy or zero-cost sleep diaries, they must analyze and report their data in much closer, granular detail to capture the exact mechanisms underlying student sleep stabilization. In conclusion, this empirical shift provides a clear operational roadmap for higher education, demonstrating that universities do not need rigid, resource-intensive, or expensive grant-funded operations to solve the campus sleep epidemic. By abandoning homogeneous frameworks in favor of holistic, localized, and low-cost behavioral frameworks—such as leveraging existing institutional learning management systems, digital chat networks, and entrenched psychospiritual traditions—campus wellness centers and stakeholders can immediately deploy sustainable solutions tailored precisely to the specific clinical, cultural, and preventive needs of their diverse student populations.

Recommendations - Rather than relying on a "one-size-fits-all" approach, future interventions must prioritize gender- and age-specific tracking. Because the evaluated clinical protocols relied heavily on female-dominated samples (Li et al., 2022; Reza, 2020; Wu et al., 2024), the lack of menstrual cycle tracking remains a major barrier to external validity. Fluctuating progesterone and estrogen levels fundamentally alter core body temperature, melatonin secretion, and sleep efficiency; therefore, tracking these cycles is essential to isolate true protocol efficacy from underlying endocrine shifts (Beroukhim & Seifer, 2022). Moreover, researchers should deliberately alternate gender recruitment and test modalities to decouple biological mechanisms from socio-cultural compliance assumptions. Beyond biological markers, protocols must also evaluate academic-year differences, as

an undergraduate's progression from first-year student to senior status dictates shifting self-regulation capacities and environmental stressors (Hu et al., 2023).

Future studies should transition from isolated behavioral tracking toward multimodal, stratified designs. Specifically, protocols should evaluate combining daytime physical exercise (Li et al., 2022) with nighttime mindfulness inductions (Li et al., 2018) to provide a low-intensity lifestyle strategy for undergraduates, providing trial control for baseline caffeine, nicotine, and dietary habits. Future designs could also integrate localized psychospiritual practices to accommodate regional nuances across Asia. For instance, intervention models in Muslim-majority Southeast Asian contexts (e.g., Indonesia) should account for the psychological and physiological grounding of Wudu (ritual ablution before prayer) and expand on Reza's (2020) study, while South Asian trials could evaluate alignment with traditional Ayurvedic circadian lifestyle rhythms. Similarly, researchers testing cognitive and meditative therapies must explore how seamlessly these modalities integrate with local Buddhist traditions in East Asia or Jewish frameworks in West Asian nations such as Israel. Furthermore, researchers must implement severity-based screening by pairing DSM-5 diagnostic criteria with the PSQI during recruitment to map a clear continuum across healthy, subclinical, and chronic clinical populations (Wu et al., 2024). While shorter interventions are ideal for maintaining baseline sleep hygiene in asymptomatic cohorts, structured multi-week frameworks like dCBT-I (Wu et al., 2024) and SAMI (Hu et al., 2023) remain necessary for severe, entrenched insomnia. Finally, trials must incorporate multi-month follow-up intervals to determine whether these behavioral modifications yield sustainable health trajectories or merely transient, short-term relief.

To further elevate empirical rigor, future PSQI-based studies should report all seven individual component subscores alongside the global score, while fully integrating structured daily sleep diaries to capture night-by-night volatility. While objective metrics such as actigraphy or polysomnography are ideal for validating improvements in sleep architecture (Li et al., 2018; Li et al., 2022; Sonkaya & Yazgan, 2025), meticulous subjective instruments can suffice in resource-constrained environments lacking specialized university equipment. Additionally, as non-pharmacological interventions shift to remote settings, researchers must design direct empirical trials contrasting digital delivery modes with traditional, face-to-face standards to validate whether unmonitored applications can successfully correct the deep-seated maladaptive behaviors associated with chronic insomnia (Wu et al., 2024).

Methodologically, a clear funding split reveals a systemic vulnerability: resource-intensive tracking tools remain tied almost exclusively to funded initiatives. Because sleep deprivation has escalated into a campus epidemic (Hu et al., 2023; Okano et al., 2019), public health sectors and government bodies must realign funding portfolios to subsidize large-scale, campus-wide interventions directly, shifting the financial burden away from isolated university laboratories.

Limitations - We acknowledge several structural constraints that limit the generalizability of our findings. Geographically, despite using expansive Boolean strings covering the Asian continent, our final literature pool was heavily polarized toward East Asian contexts—yielding only a single representation from Southeast Asia and none from West Asia, and completely lacking data from Central, North, and South Asia. Consequently, we cannot fully capture the heterogeneous socio-cultural and educational environments across the entire continent. Moreover, we compounded this spatial bias by restricting our inclusion criteria to English-language publications and unblended populations. We excluded potentially relevant datasets (n = 12) published in regional Asian languages and disqualified mixed-enrollment studies that combined undergraduate and graduate cohorts without disaggregating their datasets. These choices introduced language bias and forced us to omit valuable undergraduate sleep data embedded within broader university literature. Additionally, our search query architecture may have inadvertently narrowed our initial retrieval volume. We prioritized generalized, high-level terms related to non-pharmacological and digital sleep frameworks rather than highly specific procedural-intervention keywords (e.g., exercise, mindfulness, music therapy). By omitting these specialized modal terms, we may have bypassed relevant interventions that did not explicitly identify as falling under broad psychoeducational or behavioral labels. Furthermore, because we focused on major academic databases, we omitted localized, institutional, or grey literature repositories, potentially overlooking geographically diverse datasets outside mainstream indexing

networks.

Lastly, although we followed the Joanna Briggs Institute (JBI) framework, we did not execute a full three-step search strategy. Specifically, we bypassed a secondary systematic search employing expanded index terms derived from our preliminary abstract reviews, and we omitted a manual ancestral search of the bibliographies and reference lists of our included reports. Relying solely on our initial database queries increases the probability that we missed obscure or non-indexed publications. Temporally, our formal search window—initiated in December 2025 and finalized in May 2026—establishes a firm boundary; we excluded "in-press," "ahead-of-print," or forthcoming articles undergoing peer review during this timeframe, thereby missing nascent datasets that would otherwise have been eligible.

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We conducted this study in strict accordance with institutional ethical guidelines. Because we utilized a scoping review framework limited entirely to the synthesis of publicly available, previously published secondary data, the De La Salle University Research Ethics Office (REO) formally evaluated the project. It granted an official exemption from full ethical review. No public, commercial, or not-for-profit entities funded this study, and we conducted all research activities independently outside of standard administrative hours.

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