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Unwind the Mind: A Pilot Sequential-Explanatory Study on Sleep Hygiene Practices Among Filipino Undergraduate Students

Jao, Trisha Marie D.[1] Ceñidoza, Christine D.[2], Reveldez, Miriam Abigail L.[3], and Pili, Veniz Airylle M.[4]

[1]Case Manager in Counseling and Psychological Services (CPS), De La Salle University, Manila - Philippines

[2,3,4]Master of Science in Clinical Psychology Graduate student, De La Salle University, Manila - Philippines

Abstract— This pilot sequential-explanatory study explored the effectiveness of a four-week sleep hygiene program for Filipino undergraduate students. Grounded in Beck's Cognitive Behavioral Therapy (2020), Deci and Ryan's Self-Determination Theory (2000), and Brehm's Reactance Theory (1981), the intervention aimed to address cognitive distortions, foster intrinsic motivation, and overcome resistance to change. Voluntary participants engaged in weekly psychoeducation on sleep hygiene practices and Cognitive Behavioral Therapy for Insomnia (CBT-I). The Pittsburgh Sleep Quality Index (PSQI), administered pre- and post-intervention, showed a statistically significant improvement in sleep latency, reflecting a significant difference in means (p = 0.049). Participants' experiences were further illuminated by a sleep diary (adapted from the American Academy of Sleep Medicine, 2021) and subsequent thematic analysis of group discussions and in-depth interviews. This qualitative data yielded themes of collaborative and experiential learning, along with perceived benefits and challenges in joining a group-based sleep intervention. These findings offer a nuanced understanding of behavioral interventions for college student sleep, combining quantitative evidence of improved sleep latency with qualitative insights into the program's broader impact.

Keywords— Sleep hygiene, sleep quality, sleep intervention, Filipino undergraduate students.

I. INTRODUCTION

Achieving restorative nighttime sleep and maintaining optimal daytime alertness are fundamental to overall health and well-being (Bani et al., 2023). In the Philippines, poor sleep quality is a significant concern, with studies showing Filipinos are less likely to obtain adequate sleep (≥ 7 hours) compared to Whites and Chinese. Specifically, 38.4% of Filipinos report insufficient sleep duration versus 29.2% of non-Hispanic Whites (Inam et al., 2023; Wang et al., 2023). This prevalence of poor sleep extends to college students, often impacting their academic performance, mental health, and overall well-being (Arbinaga et al., 2020; Wang & Bíró, 2020). It has been recognized that biological and psychological factors interact in a reciprocal manner, consistent with integrative models such as Barlow et al.'s (2018), which illustrates how biological vulnerability (e.g., genetic predispositions, circadian rhythm disruptions) can interact with psychological factors like sleep stress and maladaptive reactions (e.g., cognitive distortions, poor sleep hygiene) to exacerbate and maintain sleep problems.

Against this backdrop, we explored the interrelated factors that affect sleep hygiene among Filipino undergraduate students and promoted their sleep hygiene practices through psychoeducation and cognitive-behavioral

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techniques. Unlike much of the existing literature that predominantly focuses on productivity metrics or pharmacological interventions (Albqoor & Shaheen, 202; Narmandakh et al., 2021; Pagel, 2013), our study primarily explored the efficacy of Cognitive Behavioral Therapy for Insomnia (CBT-I). CBT-I is a nonpharmacological treatment for sleep-related concerns, often recommended as a first-line approach before medication use (Rossman, 2019; Walker et al., 2022). In our four-week program, we conducted weekly psychoeducation sessions focused on sleep hygiene practices and incorporated the following CBT-I components: stimulus control, sleep restriction, cognitive restructuring, and relaxation training. The efficacy of CBT-I is well-established in the literature; college students who have undergone this treatment have been found to report a striking decrease in symptoms of insomnia anxiety and depression (Tadros et al., 2024; Yang & Jun, 2022), and exhibit improvements on sleep onset and sleep efficiency (Chang et al., 2021). In line with these observed benefits, our program yielded significant improvements in sleep latency among participants, further underscoring the contributory roles of peer support and in the in-person group discussions.

Theoretical Framework

Beck's Cognitive Behavioral Theory (CBT) (Beck, 2020), Deci and Ryan's Self-Determination Theory (SDT) (Deci & Ryan, 2000), and Brehm's Reactance Theory (Brehm & Brehm, 1981) informed the design and approach of our four-week program. Originally formulated for depression, Beck's CBT principles have been extensively adapted and applied to various conditions, including chronic insomnia, forming the basis of CBT-I (Walker et al., 2022). Thus, CBT provides the foundation for addressing cognitive distortions and maladaptive behaviors that contribute to poor sleep (Beck, 2020). Additionally, SDT highlights the importance of intrinsic motivation, emphasizing the role of autonomy, competence, and relatedness in fostering lasting behavior change (Deci & Ryan, 2000). The satisfaction-checking component of the intervention supported this by enhancing participants' sense of autonomy and self-regulation. Brehm's Reactance Theory addresses participants' initial resistance to the intervention (Brehm & Brehm, 1981), and guided our strategies to mitigate potential participant resistance. By integrating these theories, our program was designed to foster motivation, engagement, and the adoption of effective sleep strategies.

Statement of the Problem

Sleep hygiene refers to a set of practices that promote healthy sleep patterns and daytime alertness (Bani et al., 2023). Among college students, insufficient sleep has become a significant concern, as it is closely linked to increased psychological distress and diminished academic performance (Narmandakh et al., 2021). While there has been a growing awareness of the importance of sleep (Walker et al., 2022), the impact of targeted sleep hygiene interventions on improving sleep quality among specific student populations remains insufficiently explored. This gap underscores the need for further research to investigate sleep hygiene practices within various student cohorts and to evaluate the effectiveness of intervention programs in enhancing sleep quality and mental health outcomes. By examining the efficacy of a sleep hygiene program that incorporates psychoeducation and behavioral interventions among Filipino undergraduate students, we aimed to deepen the understanding of how sleep influences student behavior and well-being, and to provide evidence guiding future interventions for healthy sleep habits.

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Objectives of the Study

Our main aim is to explore the effectiveness of psychoeducation and CBT-I in improving sleep quality among undergraduate students in the Philippines. Moving beyond commonly explored areas (e.g., academic performance and substance use), we directly investigate the impact of behavioral interventions on sleep hygiene and overall sleep quality. More specifically, we aim to:

- Evaluate the immediate impact of the four-week program on improving sleep hygiene among Filipino undergraduate students.
- Assess pre- to post-intervention changes in participants' overall sleep quality, including sleep latency, sleep duration, and sleep disturbances.
- Explore the relationship between participants' motivation, engagement, and program adherence with changes in their sleep quality.
- Identify participants' perceived changes in sleep quality and the factors they report as contributing to these changes.

Significance of the study

Much of the existing literature on sleep quality, particularly research employing the Pittsburgh Sleep Quality Index (PSQI), has largely investigated its associations with academic performance, productivity, substance use, and the effects of psychopharmacological interventions (Arbinaga et al., 2020; Choi et al., 2017; Narmandakh et al., 2021; Pagel, 2013). However, these studies have consistently overlooked the potential of targeted behavioral interventions for improving sleep quality itself. Thus, we aim to fill this significant gap by examining the efficacy of evidence-based psychoeducation and CBT-I in promoting the adoption and maintenance of healthy sleep habits among undergraduate students in the Philippines. By focusing on sleep hygiene interventions, we contribute to a growing body of literature that emphasizes the role of behavioral strategies in addressing sleep disturbances. We aim to provide valuable insights into the practice applications of psychoeducation and CBT-I within the university setting, a context in which sleep-related issues are highly prevalent (Wang & Bíró, 2020). We have the potential to inform future public health initiatives aimed at improving student well-being and to contribute to the creation of more supportive academic environments that prioritize overall health.

II. LITERATURE REVIEW

Psychoeducation on Sleep Hygiene

Sleep hygiene involves behavioral and environmental practices that promote good sleep, for instance, establishing a consistent sleep-wake cycle, obtaining seven to nine hours of sleep per night, maintaining a restful sleep environment, and participating in regular daytime physical activity (Baranwal et al., 2023; Ellis & Allen, 2019; McAlpine et al., 2024). Moreover, it is advised to limit or avoid the consumption of heavy meals, liquids (e.g., water, juice, milk), and sleep-disrupting substances (e.g., caffeine, nicotine, alcohol) in the hours leading up to bedtime (Albqoor & Shaheen, 2021; Choi et al., 2017; Claydon et al., 2023; Duan et al., 2021; Goodhines et al., 2017; Rossman, 2019; Wang & Bíró, 2020). These sleep hygiene practices often serve as the first-line strategy against

sleep disturbances (Ellis & Allen, 2019), and are fundamental for promoting optimal sleep quality among undergraduate students (Tadros et al., 2024; Thabit & Alsulami, 2023; Yang & Jun, 2022).

Effective dissemination of sleep hygiene principles often occurs through psychoeducational programs, which equip individuals with the knowledge and skills to adopt healthier sleep behaviors. Such programs have shown promise in improving sleep outcomes among college students. For example, Bani et al. (2023) conducted a quasi-experimental study that found significant improvements in sleep quality and a reduction in psychological worry among first-year university students following a four-week sleep education program, delivered through lectures, WhatsApp, and Blackboard. Similarly, Schmickler et al. (2024) reported that their brief online "Sleep 101" program significantly improved sleep behaviors and increased sleep duration in college students, with participants experiencing better sleep quality and reduced detrimental bedtime activities. These online and blended modalities demonstrate valuable efficacy and scalability; nevertheless, our study explores the application of these evidence-based interventions in an onsite, group-based setting, offering distinct insights into factors comprising direct interaction and peer support. Consistent with the established understanding of sleep hygiene among undergraduate students, our findings highlight Filipino undergraduate students' strong appreciation of the psychoeducation's essential role in promoting restorative sleep.

Cognitive Behavioral Therapy for Insomnia (CBT-I)

Insomnia, as defined by the DSM-5-TR (2022), involves persistent difficulty with sleep initiation, maintenance, or early awakening despite adequate opportunity, leading to substantial daytime impairment across various functional domains. Consequently, this poor sleep quality or quantity results in daytime issues such as difficulty concentrating, irritability, fatigue, and anxiety, stressing the need for early intervention (Ellis & Allen, 2019). Notwithstsanding the appeal of rapid relief offered by sleeping pills (i.e., benzodiazepines, nonbenzodiazepines), their use carries a considerable risk of memory deficits (Chang et al., 2024; Dokkedal-Silva et al., 2021). This emphasizes the need for prioritizing non-pharmacological alternatives in treating sleep disturbances, specifically CBT-I which promotes natural and restorative sleep (Pagel, 2013; Walker et al., 2022).

CBT-I addresses both cognitive and behavioral aspects of sleep disturbances and has become the widely known first-line and gold-standard treatment for insomnia and sleep problems. Typically spanning four to eight weeks, CBT-I aims to re-establish the body's natural sleeping functions by promoting sleep onset and prolonging sleep duration. This is achieved through CBT-I's core components: psychoeducation on sleep hygiene practices, cognitive restructuring aimed at identifying and challenging maladaptive thoughts, and behavioral interventions, e.g., stimulus control, sleep restriction, and relaxation techniques (Rossman, 2019; Walker et al., 2022; Verreault et al., 2023). Given the sustained expenditures and significant risks associated with sleep medications, CBT-I emerges as a more cost-effective and sustainable sleep intervention, particularly for student populations.

Stimulus Control

Stimulus control is a behavioral therapy technique based on the principle that repeated associations between a specific environment and certain behaviors can influence future responses in that environment. This technique is widely applied across various contexts, including the treatment of insomnia (Bootzin, 1972; Bootzin & Perlis,

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2010). Bootzin (1972) observed that individuals with insomnia often exhibit a misalignment between sleep cues and their sleep environment, frequently engaging in wakeful activities in bed (e.g., watching movies, using electronic devices, reading, and daydreaming). To counteract these maladaptive associations and facilitate rapid sleep onset, practicing stimulus control emphasizes the exclusive use of the bed for sleep and intimacy. Consistent implementation of the following recommendations can contribute to the establishment of a healthy sleep-wake cycle and enhance sleep quality: (a) use the bed solely for sleep and coitus, (b) only lie down or go to bed when feeling sleepy, (c) leave the bed if unable to sleep within 15 to 20 minutes and only return to bed when feeling sleepy, (d) repeat the process as needed throughout the night, (e) wake up and get out of bed at the same time each morning, and (f) avoid daytime napping (Walker et al., 2022; Rossman, 2019; Verreault et al., 2023).

Sleep Restriction

Individuals with sleep difficulties often spend excessive time in bed, ruminating on their inability to fall asleep or maintain sleep throughout the night. This anxiety frequently drives an increase in time-in-bed (TIB) as individuals attempt to 'catch up' on sleep by going to bed earlier and staying there longer. Rossman (2019) emphasizes that this prolonged TIB can paradoxically worsen sleep problems and impede the re-establishment of a healthy sleep-wake cycle. The foundation of sleep restriction lies in restoring normal homeostatic sleep drive (the physiological pressure for sleep, mainly regulated by adenosine) by progressively limiting TIB and promoting a consistent sleep-wake schedule that enhances this pressure, stabilizes circadian rhythm, and minimizes pre-sleep arousal. Central to this approach is the utilization of a sleep diary to monitor sleep patterns and identify sleep-wake windows, which serves as the groundwork for developing an individualized sleep schedule that promotes efficient sleep and meets the individual's nuanced sleep needs (Kyle et al., 2015). Gradual adjustments to an individual's sleep window are typically done on a weekly basis. By restricting TIB, sleep drive is naturally amplified, facilitating quicker sleep onset and improved sleep maintenance throughout the night (Walker et al., 2022). Notably, despite its potential benefits in addressing some aspects of insomnia, it is generally most effective when implemented as part of a comprehensive CBT-I program that incorporates other behavioral and cognitive techniques (Maurer et al., 2020).

Cognitive Restructuring

In the cognitive domain, chronic sleep problems frequently foster a cycle of negative thoughts, beliefs, and emotional responses toward sleep (Rossman, 2019). These cognitive distortions—among them rumination, distorted perceptions, and an excessive focus on sleep-related threats—can promote a self-fulfilling prophecy, increasing the likelihood of experiencing further sleep disturbances (Walker et al., 2022). Within CBT-I, cognitive restructuring techniques are designed to identify, re-evaluate, and modify these negative and inaccurate beliefs about sleep by helping individuals acknowledge and reframe them into more logical and realistic perspectives, ultimately fostering more positive sleep expectations (Morin, 1993; as cited in Walker et al., 2022).

For example, when a college student persistently believes that they will be unable to function the next day without falling asleep quickly, their facilitator can guide them in restructuring this belief by exploring alternative scenarios, such as acknowledging they may still function adequately even with some sleep disruption.

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Relaxation Training

Relaxation training also constitutes a core component of CBT-I, principally aimed at reducing the psychosomatic tension that often interferes with sleep onset. This reduction in tension is pivotal, as a calm mind and relaxed body cultivate an optimal physiological state for sleep initiation (Rossman, 2019). Common relaxation methods used to foster sleep include deep breathing exercises, biofeedback, progressive muscle relaxation (PMR), autogenic training, and mindfulness meditation. Deep breathing exercises help reduce mental and physical tension, regulate stress, mood, and pain for individuals with chronic sleep problems (Russo et al., 2017). Biofeedback, conversely, is a technique that enables individuals to gain greater perception and control over physiological processes, for instance, muscle tension, heart rate, blood pressure, breathing, and brainwave activity, thereby promoting relaxation (Wang et al., 2023). Another widely used technique, PMR, involves the systematic tensing and gradual release of different muscle groups, which helps release muscle tension and fosters a state of physiological relaxation (Simon et al., 2022). Furthermore, autogenic training is a self-relaxation technique that uses meditative exercises to align the mind with a steady heartbeat, regulated breathing, feelings of warmth and heaviness in the limbs, and a general sense of calmness (Garcia et al., 2023). Finally, mindfulness meditation practices (e.g., yoga) can enhance sleepiness by reducing stress and anxiety (Sharpe et al., 2021).

Pittsburgh Sleep Quality Index (PSQI)

Sleep quality encompasses an individual's subjective satisfaction with their sleep, encompassing its duration, continuity, and post-awakening feelings (Kline, 2020). Even so, poor sleep quality is prevalent among college students, significantly influenced by a complex interplay of lifestyle, mental health, social, and physical factors (Wang & Bíró, 2020). In evaluating sleep quality, the PSQI assesses seven major components of sleep quality: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, sleeping medication use, and daytime dysfunction. These components align with standardized areas typically evaluated during clinical assessments of individuals experiencing sleep-difficulties (Buysse et al., 1989). The PSQI's global score differentiates between "good" and "poor" sleepers by evaluating patterns of various sleep disturbances. Moreover, the PSQI is a valuable tool for assessing sleep quality in college students, as evidenced by its frequent application in studies investigating their sleep patterns and difficulties (Bani et al., 2023; Wang & Bíró, 2020).

Studies employing the PSQI have consistently shown that behaviors such as smoking, excessive screen time, and a sedentary lifestyle adversely affect the sleep quality of college students (Wang & Bíró, 2020). These negative impacts often manifest as task avoidance and class absenteeism (Arbinaga et al., 2020), and they increase the risk of developing or exacerbating mental health problems (Milojevich & Lukowski, 2016; Zhang et al., 2017; Zou et al., 2020). In contrast, positive social relationships (e.g., with family, friends, and classmates) can significantly enhance the sleep quality of college students (Wang & Bíró, 2020). Integrating these findings, we explored sleep quality among Filipino undergraduate students with the administration of the PSQI and the exploration of sleep-related behaviors.

The literature reviewed underscores the significant prevalence and impact of sleep disturbances among undergraduate students, pointing to the benefits of promoting healthy sleep hygiene practices and CBT-I. While these concepts are well-established in international research, a need remains for studies dedicated to examining

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the nuances of sleep hygiene practices and their relationship with sleep quality among Filipino undergraduate students. We sought to address this gap by exploring the sleep quality of Filipino undergraduate students through a mixed-methods approach, with findings revealing a significant improvement in sleep latency—implying that the program positively impacted the time it took them to fall asleep.

III. METHOD

Research Participants

We gathered eight Filipino undergraduate psychology students from a private university, aligning with recommendations for pilot studies in mixed-methods research that suggest a range of 6 to 10 participants for establishing feasibility and gathering preliminary data (Mason, 2010). The participant group consisted of two male and six female students. In terms of academic standing, five participants were graduating students; the remaining three, however, were still finishing their coursework.

All participants were full-time students, with four reporting involvement in at least one student organization and one engaged in freelance work for approximately 10 hours per week outside of school. Following Teresi et al.'s (2022) guidelines, we initially aimed for at least 70% program adherence; and notably, we achieved 100% program adherence, with all eight participants completing both the pre- and post-test assessments and attending all weekly sessions. In recruitment, we employed a non-probability purposive sampling, a method characterized by the intentional selection of participants based on predefined criteria (Campbell et al., 2020). We reached participants through flyers posted on a student support services Facebook page and via word of mouth. Eligibility required participants to score between 4.0 and 5.0 and at least three to five items on a willingness to participate scale; the final participants averaged 4.44, pointing to high initial commitment.

Inclusion Criteria

Second-year or higher undergraduate students majoring in Psychology or other programs within the College of Arts and Sciences (e.g., Communication Arts, Political Science, History, International Studies, and Literature) were eligible to participate. They were also required to be non-working or employed part-time for no more than 10 hours per week and involved in a maximum of one student organization. We implemented this inclusion criteria to minimize potential confounding factors, namely, excessive workload, competing time commitments, and potential distractions that could interfere with study participation.

Exclusion Criteria

First-year undergraduate students, graduate students, and undergraduate students from other colleges within the university (e.g., College of Information Technology, Business, Education, etc.) or those pursuing a double major outside the College of Arts and Sciences were excluded. Participants were also deemed ineligible if they were involved in more than one extracurricular activity, worked over 10 hours per week, or were undergoing treatment for medical or psychiatric conditions that could interfere with the study's focus on sleep and behavior change (e.g., severe sleep-wake disorders, conditions affecting sleep patterns or motivation to engage in interventions). We implemented these exclusions to control for potential confounding factors.

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Withdrawal Criteria

In compliance with RA 10029 (the Philippine Psychology Act), RA 10173 (the Data Privacy Act), and the ethical guidelines of the private university where this study was conducted, participants could withdraw from the study at any time without penalty. They also maintained the right to access and withdraw their data even after study completion, ensuring respect for their autonomy and privacy.

Research Design

Our pilot mixed-methods investigation was designed to assess the feasibility, acceptability, and initial impact of a sleep hygiene program for Filipino undergraduate students. Such preliminary studies are essential for refining research protocols, identifying potential challenges, and building researcher confidence and skills (Williams-McBean, 2019). We employed a sequential explanatory mixed-methods design, consisting of two phases: initial collection of quantitative data followed by qualitative data to explain the quantitative findings (Creswell & Clark, 2017)—thereby enriching the overall findings (see Figure 1). Quantitative data were collected using the PSQI, administered both at baseline (pre-intervention) and post-intervention, and were analyzed using descriptive statistics (i.e., mean, median, standard deviation, and interquartile range) and inferential statistics (i.e., Wilcoxon Signed-Rank, Cohen's d). Given the sample size inherent to this pilot study (n = 8), we interpreted inferential results with caution, acknowledging the potential for over-reporting and inflated effect sizes as noted by Teresi et al. (2022). In addition to quantitative outcomes, we closely monitored process variables, including attendance, retention, and completion rates, to assess program implementation and adherence. Subsequently, we conducted in-depth interviews with all participants, and analyzed the transcripts using thematic analysis (DeJonckheere et al., 2024). Consistent with our sequential explanatory mixed-methods design, the qualitative findings were used to contextualize and explain the observed changes in the pre- and post-intervention PSQI scores, specifically exploring the participants' experiences, their perceptions of the program's effectiveness, and any barriers they faced in adhering to sleep hygiene practices.

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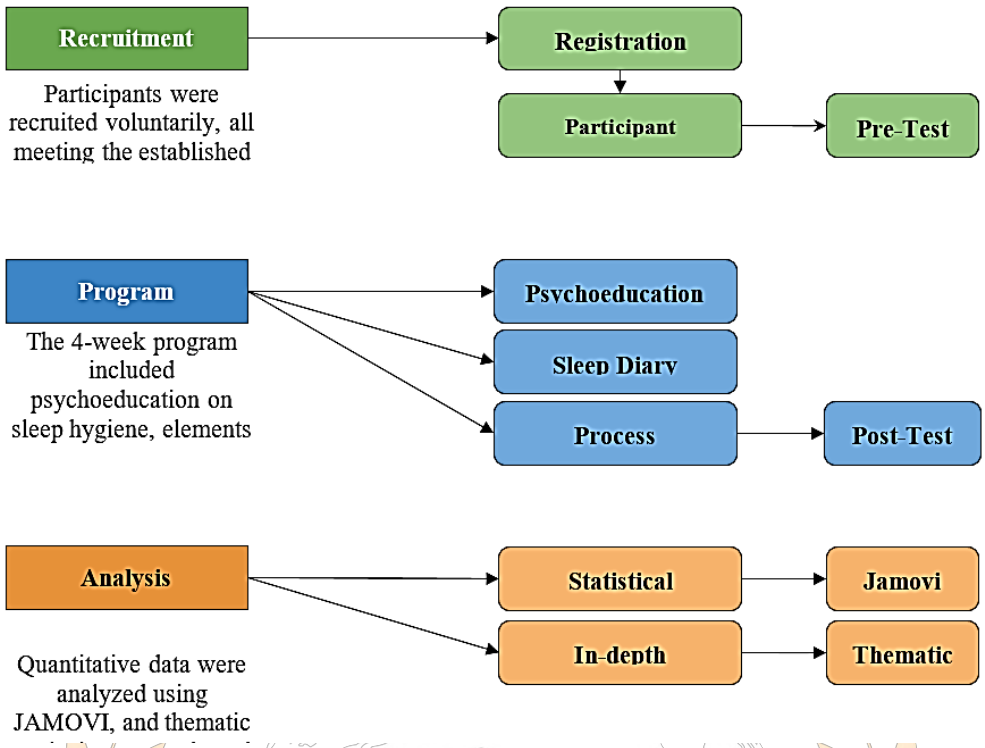

Figure 01: Program Flow

Figure 1 illustrates the study's three sequential phases: Recruitment, Program, and Analysis. The Recruitment phase involved participant selection based on inclusion criteria and a pre-test using the PSQI. The four-week Program phase delivered weekly sleep hygiene psychoeducation and CBT-I techniques, utilizing sleep diaries for tracking and discussion, culminating in a post-test (PSQI). The Analysis phase combined statistical analysis of PSQI scores (using JAMOVI) with thematic analysis of in-depth interview transcripts to integrate quantitative and qualitative findings.

Materials

We utilized several key materials for data collection and program implementation. These included sleep diaries, psychoeducational materials focusing on sleep hygiene and CBT-I techniques, and an in-depth interview guide used to gather qualitative insights.

Willingness to Participate Scale

Participants' readiness and commitment to the program was consequential in the inclusion criteria. Thus, we developed a 5-item self-report scale to identify participants who displayed sufficient motivation to engage in our activities. Items were rated on a 5-point Likert scale from 1 (Strongly Disagree) to 5 (Strongly Agree). The items included:

- I am motivated to improve my sleep habits by participating in this study.
- I am willing to participate in brief study activities, including the psychoeducation sessions.
- I feel confident that I can follow the sleep hygiene practices suggested in the study.

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- I am willing to dedicate time to complete the pre- and post-study assessments.
- I am generally committed to following through with the study's requirements.

Scores from this scale were used solely for screening purposes to ensure participant engagement and were not subjected to statistical analyses.

Pittsburgh Sleep Quality Index (PSQI)

The PSQI is a 19-item self-report questionnaire designed to assess global sleep quality and disturbance over a one-month period (Buysse et al., 1989). It comprises seven component scores: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. Each component is scored from 0 to 3 using a four-point Likert scale, with higher scores denoting greater sleep difficulty. These component scores are summed to yield a global PSQI score ranging from 0 to 21, where a score ≥ 5 typically indicates poor sleep quality. The original study by Buysse et al. (1989) reported high internal consistency (Cronbach's α = 0.83), good test-retest reliability (r = 0.85), and good validity, with a sensitivity of 89.6% and a specificity of 86.5%. Their validity analysis also involved comparing PSQI scores with polysomnographic data over two to three nights, corroborating that the PSQI scores generally reflected the participants' reported sleep experience over the previous month. Subsequent research has continued to support the PSQI's reliability and validity in various populations, including undergraduate students (Aloba et al., 2007; Manzar et al., 2016). These studies have generally confirmed the PSQI's acceptable internal consistency (Cronbach's α typically ranging from 0.70 to 0.80 in various samples), and its ability to differentiate between good and poor sleepers. Although the PSQI includes five additional items for a bed partner or roommate, we did not consistently collect this supplementary data due to the diverse living situations of our participants, and thus this was not included in our primary analysis or global PSQI score calculation.

Educational Resources

We developed presentations, infographics, and posters to convey key concepts of sleep hygiene and CBT-I. The content of these materials included an introduction to sleep health and establishing evidence-based bedtime routines: maintaining consistent wake-up times, engaging in daytime exercise, and minimizing caffeine, nicotine, and heavy meals before bedtime

Sleep Diary

We adapted a daily sleep diary, based on the guidelines of the American Academy of Sleep Medicine (2021), for our participants. This self-assessment tool prompted them to track daily information such as wake time, bedtime, sleep duration, and instances of sleep disruption, as well as potential influencing factors like the timing and frequency of substance use and activities preceding bedtime (e.g., school, work, exercise, etc.). In addition, participants rated their satisfaction (on a scale of 1 to 100 with each CBT-I technique (Stimulus Control, Sleep Restriction, Cognitive Restructuring, and Relaxation Training) they practiced. Strategies with an average score of ≤ 4 were categorized as least effective, whereas those with an average score of ≥ 6 were considered most effective.

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Interview Guide

We designed a semi-structured interview guide to gather information on: (1) changes observed between pre- and post-intervention PSQI scores; (2) key themes in their experiences in the program and suggestions for program improvement; (3) reflections on their engagement with the AASM-adapted sleep diary; (4) insights from their initial willingness to participate, factors influencing their motivation, and the feasibility of CBT-I techniques within the context of university life; and (5) experiences and outcomes related to the study's theoretical framework, including their sense of autonomy and competence (Self-Determination Theory), their engagement and motivation (Reactance Theory), and their reflections and satisfaction on the behavioral and cognitive aspects of the intervention (Cognitive Behavior Theory).

Procedures

We used an online registration form to gather demographic information from all ten registrants (e.g., name, email address, etc.). To ensure a relatively consistent baseline sleep health among participants and maximize their attendance, we also inquired about current treatments for sleep-wake disorders, severe mental health conditions, or chronic illnesses that might interfere with sleep, and their preferred times for the weekly sessions (i.e., morning or afternoon) through the form. We also incorporated a five-item Willingness to Participate Scale detailed above into the form to assess participants' initial motivation and commitment to the four-week program. Based on the data provided in this form, and the predefined inclusion and exclusion criteria, eight participants were selected and subsequently included in our study. The remaining two individuals were excluded primarily due to scheduling conflicts that indicated an inability to consistently attend the weekly sessions. Although we considered residence, mode of transportation, and travel time to campus as potential factors influencing sleep quality, we did not collect these information in the registration form.

After selecting the eight participants, we administered the PSQI at baseline and again as a post-test following the completion of the four-week program to track changes in sleep quality. The psychoeducation component of the program was delivered through weekly sessions and a dedicated online group space (i.e., Google Space). During these sessions, we presented key concepts of sleep hygiene and CBT-I techniques using visual aids, such as presentations. To reinforce these concepts and provide easily accessible information outside of the sessions, we also shared the developed infographics and posters within the online group space. Throughout the program, participants utilized a sleep diary. Introduced in the first week, this self-assessment tool facilitated their cognizance of sleep patterns and active engagement with sleep hygiene and CBT-I techniques.

Thereafter, we conducted semi-structured interviews lasting approximately 30 minutes to an hour. In these interviews, we explored how the quantitative PSQI results could illuminate the quality and outcomes of the study (Creswell & Clark, 2017), concurrently ensuring consistency across interviews (Thille et al., 2021).

All collected data, including interview transcripts, were handled according to ethical guidelines to ensure anonymity and protect participant confidentiality, with identifying information kept separate from the research data and access limited to the research team.

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Data Analysis

We employed a sequential-explanatory mixed-methods design (Creswell & Clark, 2017). This two-phase approach first involved the collection and analysis of quantitative data to evaluate the sleep hygiene program's effectiveness for Filipino undergraduate students. Subsequently, qualitative data were collected and analyzed to help explain and interpret these quantitative findings. Statistical analysis assessed changes in sleep quality, utilizing descriptive statistics for summarization and inferential statistics for significance and effect size. Acknowledging the limitations of our small sample data (n = 8) of our pilot study yet aiming for a robust examination of preliminary trends of a sleep hygiene program, we conducted both parametric (paired samples t-test) and non-parametric (Wilcoxon signed-rank test) analyses. Thematic analysis then complemented these quantitative findings by exploring participants' experiences and perceptions of the program, providing deeper insights into its effectiveness. This integrated approach allowed for a more holistic understanding of the intervention's impact, combining numerical trends with rich, contextual information.

Statistical Analysis

All statistical analyses were conducted using JAMOVI, a statistical software package. Given the nature of pilot studies with small sample sizes, all statistical results were interpreted with deliberation, acknowledging the potential for inflated effect sizes and the over-reporting of inferential statistics (Teresi et al., 2022). As measured by the PSQI, we reported the descriptive statistics including mean and median. We reported the median, particularly for components where data were observed to be skewed or contained outliers (e.g., Subjective Sleep Quality and Sleep Efficiency pre-test), consistent with guidelines for robust reporting in such cases (Vetter, 2017). To assess the variation or dispersion of the data, demonstrating how spread out the values are around the mean, the Standard Deviation (SD) was calculated. Additionally, the Interquartile Range (IQR), representing the range between the 25th percentile (Q1) and the 75th percentile (Q3), provided a stable measure of variability of the overall distribution (Flannelly et al., 2015; Vetter, 2017). Together, these descriptive measures, along with the results of the inferential results, provided a comprehensive overview of the changes in sleep quality before and after the intervention (see Table 1 in Results section).

Next, we conducted inferential analyses to examine the statistical significance and effect size of the observed changes. Paired-samples t-test was used to evaluate changes in sleep quality from pre- to post-test intervention. However, given the small sample size inherent in pilot studies and the common deviation from normal distribution in sleep data, we primarily relied on the Wilcoxon signed-rank test to determine whether the changes in sleep quality were statistically significant. This non-parametric test is commonly employed in pilot studies, particularly when data do not follow a normal distribution, and is ideal for analyzing paired pre- and post-assessment scores (Ahad et al., 2014). We then calculated Cohen's d to assess the effect size of the observed changes in sleep quality. Given the emphasis on quantitative data in the initial phase of sequential-explanatory designs, calculating effect sizes such as Cohen's d is crucial for understanding intervention impacts and guiding subsequent qualitative analyses (Hedges, 2024). Cohen's d is also widely used to report effect sizes in pilot studies (e.g., Campisi et al., 2024; McGuire et al., 2023). While these quantitative results were analyzed with caution, they proved instrumental

in informing our subsequent thematic analysis, such as guiding the exploration of specific areas of interest (e.g., sleep latency).

Thematic Analysis

Our primary qualitative data consisted of in-depth interview transcripts. These verbatim transcriptions preserved the nuances, details, and emotional tones of participants' responses (Nevedal et al., 2021), which captured the richness of their experiences with the program. We then analyzed these data using thematic analysis, a qualitative method for identifying and reporting patterns within data, providing contextual insights that enrich the interpretation of quantitative findings (DeJonckheere et al., 2024). Following Kiger & Varpio's (2020) process, we familiarized ourselves with the data, generated initial codes, identified potential themes, reviewed and refined themes, and defined and named themes.

Ethical Considerations

Our study underwent review and received approval from the relevant ethics board and institutional authorities, ensuring adherence to ethical guidelines and compliance with their standards for research involving human participants. We prioritized our participants' well-being, implementing measures to minimize distress and provide support if needed (e.g., referral to the guidance center or clinic). Additionally, transparent communication of the study's purpose was essential, especially given its pilot nature. Consistent with ethical guidelines for pilot studies (Khan et al., 2020), the term 'pilot' was explicitly included in the study title to manage participant expectations regarding the research's scope.

Adhering to RA 10029 (the Philippine Psychology Act) and RA 10173 (the Data Privacy Act), participants were informed through online Informed Consent Forms (ICFs) and verbal reiteration during the first session of their right to withdraw from the study at any time without penalty. These ICFs outlined the study's objectives, purpose, scope, participant rights, the nature of participation, and data protection measures, which further clarified that we aimed to test feasibility rather than produce conclusive results, ensuring participants' accurate understanding of their involvement.

All data, including PSQI scores, audio recordings from interviews, and notes from sessions, were treated with utmost confidentiality through anonymization and secure storage in a dedicated online Google Drive folder, accessible only to authorized research personnel. As the PSQI is publicly available for academic use, no formal permission was needed from the authors (Buysse et al., 1989). Google Drive, being a third-party service, has its own privacy policies and security measures, which were considered in our data management strategy. Data processed within JAMOVI software also adhered to strict confidentiality guidelines, protecting all personal information from improper disclosure, use, or unauthorized processing. In accordance with institutional data retention policies, all data will only be retained until July 2026–a year after data analysis completion.

Limitations

Despite offering valuable insights into the potential of CBT-I for addressing sleep-related issues among Filipino undergraduate students, we acknowledge several limitations that warrant consideration for future research. The

limited sample size (n = 8) inherently restricted statistical power and thus the generalizability of our findings. Our focus on undergraduate psychology students in their second year or higher in a private university significantly limits the generalizability of our results. This restricted scope applies both to the entire student population within this university (including students from other colleges, those in their first year, and those with double majors) and to students in public universities, scholarship recipients (who may face unique stressors), or working students (who balance academic and employment demands), as their experiences and responses to the intervention may differ.

As a pilot study focused on feasibility, our findings should be interpreted as preliminary and not conclusive. Our reliance on self-report measures (i.e., PSQI, sleep diary) makes our findings susceptible to inaccurate recall and potential social desirability bias (e.g., underreporting caffeine and alcohol consumption). Additionally, due to the lack of a validated local language translation of the PSQI, the applicability of our findings is restricted to English-speaking Filipino undergraduate students. Furthermore, our focus on a specific university context meant that other relevant factors such as personality traits, sociocultural norms, and environmental variables within and outside the academic setting were not directly examined, potentially limiting the scope of our understanding.

III. RESULTS

As with all pilot research, we present our findings with caution due to several limitations, including our relatively small sample size (n = 8), which limits the statistical power and generalizability of our results (Teresi et al., 2022). We explored the feasibility of our four-week program and gathered initial data on the impact of psychoeducation on sleep quality, rather than establishing definitive efficacy of the intervention (i.e., CBT-I). Changes in PSQI components as detailed in Table 1 were assessed using both paired samples t-tests and Wilcoxon signed-rank tests, to garner both parametric and non-parametric preliminary results of our program. Therefore, we consider these findings indicative, with their contextualization provided by qualitative data from participant interviews.

Given our small sample size and the potential for non-normal distribution, both mean and median are reported for descriptive statistics. During the pre-test, the average global PSQI score (M = 8.63, SD = 2.13, Mdn = 8.5, IQR = 2.25) was slightly higher compared to the average global PSQI score in the post-test (M = 8.38, SD = 1.85, Mdn = 8, IQR = 3), implying a slight improvement in overall perceived sleep quality following the CBT-I implementation. Nevertheless, a paired sample t-test revealed no statistically significant difference between these scores ($t(7)$ = 0.30, p = 0.775), with a very small effect size (d = 0.11). Even though the Global PSQI score only showed a small, non-significant improvement at the group level, the decrease in the 'Subjective Sleep Quality' component (as detailed in Table 1) connotes that the perception of improvement might be more pronounced for some individuals than the overall statistical change reflects. Notably, pre-test scores for this component exhibited a positive skew.

The mean component scores that decreased from pre-test to post-test were Subjective Sleep Quality, Sleep Latency, Sleep Disturbance, and Daytime Dysfunction, indicating an improvement in these aspects of sleep. Moreover, average component scores that increased were Sleep Duration and Sleep Efficiency, meaning participants on average, reported sleeping for a slightly shorter duration and spending a slightly smaller proportion of their TIB actually sleeping after the intervention. Pre-test data for both Sleep Duration and Sleep

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Efficiency also showed some positive skewness. In contrast, a Wilcoxon signed-rank test showed no statistically significant changes for Sleep Duration (W = 7, p = 0.484, $r$rb = -0.33) or Sleep Efficiency (W = 7, p = 0.242, $r$rb = -0.57). Although some individual variations were observed, these trends did not show a consistent group-level change in our study.

Interestingly, a paired sample t-test for Sleep Latency revealed a statistically significant decrease from pre-test and post-test ($t(7)$ = 2.38, p = 0.049), leading to a conclusion of an improvement in this area. Yet, a Wilcoxon signed-rank test for Sleep Latency showed a trend towards a decrease that did not reach statistical significance (W = 24, p = 0.073, $r$rb = 0.71). This indicates that despite the mean reduction in Sleep Latency being statistically significant based on the t-test, the median reduction (as assessed by the Wilcoxon test) showed a strong positive trend but did not meet the conventional threshold for statistical significance.

Table 1: PSQUI Results

Component	M (SD)	MdN (IQR)	*t* (df)	*p*-value (t-test)	*d*	*W*	*p*-value (Wilcoxon)	*r*rb
Global PSQI Score								
Pre-Test	8.63 (2.13)	8.5 (2.25)	0.30 (7)	0.775	0.11	14	1.000	0.00
Post-Test	8.38 (1.85)	8 (3)						
Subjective Sleep Quality								
Pre-Test	1.5 (0.76)	1 (1)	0.55 (7)	0.598	0.20	4	0.773	0.33
Post-Test	1.38 (0.92)	1 (1)						
Sleep Latency								
Pre-Test	2 (1.07)	2 (1.25)	2.38 (7)	0.049*	0.84	24	0.073	0.71
Post-Test	1.38 (0.74)	1.5 (1)						
Sleep Duration								
Pre-Test	1.38 (1.06)	1.5 (1.25)	-0.80 (7)	0.451	-0.28	7	0.484	-0.33
Post-Test	1.63 (0.74)	1.5 (1)						
Sleep Efficiency								
Pre-Test	0.38 (0.74)	0 (0.25)	-1.43 (7)	0.197	-0.50	4	0.242	-0.57
Post-Test	1.13 (1.25)	1 (1.5)						
Sleep Disturbance								
Pre-Test	1.38 (0.52)	1 (1)	2.05 (7)	0.080	0.73	6	0.149	1.00
Post-Test	1 (0.54)	1 (0)						
Daytime Dysfunction								
Pre-Test	2 (0.54)	2 (0)	0.42 (7)	0.685	0.15	2	1.000	0.33
Post-Test	1.88 (0.35)	2 (0)						

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Note. The "Sleep Medication" component of the PSQI was omitted from this table as none of the participants reported using sleep medication, consistent with the eligibility criteria.

Subjective Sleep Quality

While the overall improvement in global PSQI score was not statistically significant, the Subjective Sleep Quality scores showed a marginal reduction from the pre-test (M = 1.50, SD = 0.76, Mdn = 1, IQR = 1) to the post-test (M = 1.38, SD = 0.92, Mdn = 1, IQR = 1). For the pre-test scores, the mean (M = 1.50) being notably higher than the median (Mdn = 1) evinces a positive skew in the data—highlighting that the majority of the participants (62.5%, or 5 of 8) reported optimal or near-optimal subjective sleep quality (a score of 1), with the remaining participants having higher scores (2s and a 3). In the post-test, the distribution remained positively skewed (M = 1.38, Mdn = 1), though with a slightly lower mean (M =1.38). The proportion of participants reporting optimal or near-optimal sleep quality (scoring 0 and 1 respectively) remained 62.5% (5 of 8) in the post-test; however, this now included one participant achieving an optimal score of 0, and four participants scoring 1. However, the continued presence of higher scores (2s and a 3) suggests that while some individual improvement occurred, challenges persisted for a segment of the sample Moreover, our paired sample t-test revealed no significant difference in this component between the two time points, $t(7) = 0.55$, $p = 0.598$, with a small effect size ($d = 0.20$). Similarly, our Wilcoxon signed rank test indicated no significant difference in the central tendency of these scores across the two time points, $W = 4.00$, $p = 0.773$, implying a small effect size ($rrb = 0.33$). This non-significant change in 'Subjective Sleep Quality' underscores that while some individuals may have perceived improvement, this was not a consistent, statistically significant change for the entire sample.

Sleep Latency

Sleep latency scores showed a notable decrease from the pre-test (M = 2.00, SD = 1.07, Mdn = 2, IQR = 1.25) to the post-test (M = 1.38, SD = 0.74, Mdn = 1.5, IQR = 1). Our paired sample t-test revealed a statistically significant reduction in sleep latency from pre-test to post-test, $t(7) = 2.38$, $p = 0.049$, with a large effect size ($d = 0.84$). However, our Wilcoxon signed rank test, while also revealing a substantial decrease in the central tendency, did not reach statistical significance ($W = 24.00$, $p = 0.073$), despite a large effect size ($rrb = 0.71$). This observed trend towards faster sleep onset could be attributed to several factors highlighted in the program and the self-monitoring process.

The psychoeducation coupled with the clear presentation of techniques through various mediums like infographics, likely equipped participants with practical strategies to fall asleep more quickly. Furthermore, the consistent self-monitoring via sleep diaries may have empowered individuals to identify and subsequently modify behaviors that were previously delaying their sleep onset.

The ease with which techniques specifically targeting sleep onset were understood and implemented, might also explain the more pronounced improvement in this particular sleep parameter. The effective learning and self-monitoring facilitated by the program, therefore, likely played an influential role in the adoption and application of these sleep-promoting behaviors.

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Sleep Duration

Sleep duration scores showed a slight increase from the pre-test (M = 1.38, SD = 1.06, Mdn = 1.5, IQR = 1.25) to the post-test (M = 1.63, SD = 0.74, Mdn = 1.5, IQR = 1), reflecting a trend towards participants reporting slightly shorter sleep duration following the intervention. Our paired sample t-test revealed no significant difference in sleep duration scores between the two time points, $t(7) = -0.80$, $p = 0.451$, with a small negative effect size ($d = -0.28$). Similarly, our Wilcoxon signed rank test showed no significant difference in the central tendency of sleep duration scores across the two time points, $W = 7.00$, $p = 0.484$, implying a small negative effect size ($rrb = 0.33$). This non-significant change, with a slight trend towards shorter sleep, could be attributed to several interconnected factors, such as a perception of reduced TIB due to sleep restriction techniques, the timing of the post-test administration during a period of high academic stress (e.g., finals week or submission deadlines), or continued sleep fragmentation from pre-existing issues like nighttime awakenings. While a majority of participants reported more consistent schedules and longer sleep in the interviews, the PSQI results imply this improvement was not universal or substantial enough to significantly impact the group average.

Sleep Efficiency

Sleep efficiency scores showed a notable increase from the pre-test (M = 0.38, SD = 0.74, Mdn = 0, IQR = 0.25) to the post-test (M = 1.13, SD = 1.25, Mdn = 1, IQR = 1.5). For the pre-test scores, the mean (M = 0.38) being notably higher than the median (Mdn = 0) also implies a positive skew in the data or the presence of outliers for this component, similar to Subjective Sleep Quality. This strong pre-test skew meant that 75% (6 of 8) of participants scored the optimal 0 for this component. In the post-test, however, while still positively skewed, only 37.5% (3 of 8) of participants maintained this optimal score, with the emergence of higher scores (e.g., two participants scoring 3) revealing a broader distribution of sleep efficiency and a worsening for a segment of the sample. Our paired t-test revealed no significant difference in sleep efficiency scores between the two time points, $t(7) = -1.43$, $p = 0.197$, with a medium negative effect size ($d = -0.50$), reflecting a moderate tendency for sleep efficiency to increase from pre-test to post-test (the negative t and d reflects that the higher post-test mean is being subtracted from the lower pre-test mean in the calculation). Similarly, our Wilcoxon signed rank test showed no significant difference in the central tendency of this component cross the two time points ($W = 4{,}00$, $p = 0.242$), implying a medium negative effect size ($rrb = -0.57$). This moderate trend toward improved sleep efficiency, despite not reaching statistical significance, could be influenced by the stimulus control techniques taught in the program—strengthening the association between bed and sleep. However, the limited overall improvement at the group level implies that other factors not directly targeted by stimulus control (e.g., nighttime awakenings due to various reasons), and the period of high academic stress during post-test administration (i.e., finals week), might have constrained a more substantial increase in sleep efficiency across all participants.

Sleep Disturbance

Sleep disturbance scores showed a decrease from the pre-test (M = 1.38, SD = 0.52, Mdn = 1, IQR = 1) to the post-test (M = 1.00, SD = 0.54, Mdn = 1, IQR = 0). Our paired samples t-test revealed a trend towards a significant reduction in sleep disturbance scores between the two time points, $t(7) = 2.05$, $p = 0.080$, with a large effect size ($d = 0.73$), indicating a substantial tendency for sleep disturbance to decrease from pre- to post-test (the positive

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t and d reflect the pre-test mean being higher than the post-test mean). Similarly, our Wilcoxon signed rank test showed a non-significant trend in the central tendency of sleep disturbance scores across the two time points (W = 6.00, p = 0.149), implying a perfect positive effect ($r$rb = 1.00), also pointing towards a very strong decrease. This trend towards reduced sleep disturbance suggests that some participants may have successfully implemented strategies learned in the program to minimize nighttime awakenings. However, the fact that this reduction did not reach statistical significance at the conventional level (p = 0.05) could be attributed to several factors highlighted in the qualitative data: the persistent 'commitment and responsibilities' reported by participants of the intervention on sleep maintenance; and the variations between individual experiences with the CBT-I techniques. Furthermore, these scores align with participants' reports of no overall change in sleep continuity, with awakenings often attributed to factors like recurring bad dreams, late-night activities (which may fall outside the direct scope of some CBT-I techniques), and physiological needs.

Daytime Dysfunction

Daytime dysfunction scores showed a slight decrease from the pre-test (M = 2.00, SD = 0.54, Mdn = 2, IQR = 0) to the post-test (M = 1.88, SD = 0.35, Mdn = 2, IQR = 0). Our paired samples t-test revealed no significant difference in daytime dysfunction scores between the two time points, $t(7) = 0.42$, p = 0.685, with a small positive effect size (d = 0.15), indicating a slight tendency for daytime dysfunction to decrease from pre-test and post-test. Similarly, our Wilcoxon signed rank test showed no significant difference in the central tendency of daytime dysfunction across the two time points (W = 2.00, p = 1.00), implying a small positive effect ($r$rb = 0.33), aligning with the observed slight decrease. The minimal improvement in daytime dysfunction could be linked to the challenges participants faced in consistently improving their nighttime sleep due to their commitments, as discussed earlier. The mention of sleep restriction being difficult for some, leading to non-optimal afternoon napping, further complicates daytime functioning. The combination of these varied experiences and challenges likely resulted in the non-significant observed changes in this component. However, the potential realization of the link between sleep and overall health and well-being (even without drastic improvements in daytime functioning in PSQI results) might have contributed to a greater sense of control or understanding, which this tool might not fully capture.

In summary, our analysis revealed a statistically significant improvement in sleep latency based on the paired samples t-test, although this trend did not reach significance with the Wilcoxon signed rank test. While other PSQI components (i.e., subjective sleep quality and sleep disturbance) showed trends toward improvement, these changes were not statistically significant at the group level. Sleep duration and sleep efficiency, however, showed slight and non-significant trends in the opposite direction.

These preliminary findings, derived from our small pilot sample, should be interpreted with caution as they suggest potential avenues for further investigation rather than definitive conclusions. To provide a more comprehensive understanding of these quantitative outcomes, the subsequent Discussion section integrates data gathered from participant interviews, exploring the underlying mechanisms and individual experiences related to these observed trends.

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IV. DISCUSSION

Our study aimed to evaluate the impact of a sleep hygiene program on Filipino undergraduate students, revealing several interconnected factors contributing to observed improvements in sleep. We organized this section into distinct themes, specifically detailing the pivotal role of psychoeducation in fostering sleep valuation and autonomy, the mechanisms through which consistent routines and CBT-I interventions improved sleep latency, the pervasive influence of external factors on sleep quality, and the profound impact of peer support on program adherence within a culturally relevant context.

Psychoeducation Linked to Sleep Satisfaction

Psychoeducation on sleep health equips individuals with essential knowledge on the effects of sleep deprivation and the importance of sleep hygiene practices (Rossman, 2019), which in turn lays the foundation for behavioral and cognitive adaptation (Morin, 1993; as cited in Verreault et al., 2023). Our findings align with the growing body of literature that demonstrates the effectiveness of sleep education programs as an impactful intervention strategy for undergraduate students (Schmickler et al., 2024; Levenson et al., 2016; Hershner & Chervin, 2014). In our sleep hygiene program, psychoeducation was delivered through a weekly series of lectures, group discussions, and infographics. Despite the mixed quantitative outcomes from the PSQI components, the information provided through these sessions appeared to contribute to participants' increased satisfaction with their sleep. They initially reported limited understanding of sleep's importance and CBT-I principles; however, as the program progressed, they gained a deeper appreciation for how their daily activities (e.g., meal intake, gadget use, study hours) could contribute to their sleep difficulties. This led to prioritizing their sleep quality as they reported a heightened sense of control over the impact of their daytime activities on their sleep-wake cycles. Moreover, this increased insight appears to have played a significant role in fostering greater overall satisfaction with their sleep, reinforcing the notion that comprehension of therapeutic rationale enhances treatment engagement and self-efficacy, both essential for behavioral change (Ong et al., 2012). However, it is important to note that while psychoeducation is a critical component of CBT-I, meaningful improvement eventually depends on active engagement with the behavioral and cognitive strategies that follow (Rossman, 2019).

In addition, participants consistently valued the semi-structured approach of the program, which gave them liberty to explore which CBT-I techniques best suited their individual needs, significantly cultivating a sense of autonomy. This observation strongly aligns with Self-Determination Theory (SDT), which posits that the satisfaction of basic psychological needs (i.e., autonomy, competence, relatedness) is crucial for fostering intrinsic motivation and lasting behavior change (Deci & Ryan, 2000). By empowering Filipino undergraduates to personalize their sleep strategies, the program likely enhanced their self-efficacy and sustained engagement, reflecting SDT's emphasis on volitional participation in therapeutic processes. Another key aspect in promoting sleep satisfaction was the quality of group discussion. This amplified the comprehension and reinforcement of the CBT-I concepts among the participants. One participant, who reported a demanding extracurricular involvement, mentioned feeling a slight pressure from other participants' progress with the techniques. However, this appeared to be an isolated incident, and overall, the group setting was perceived as highly beneficial for shared learning and motivation.

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Indeed, participants' experiences with specific CBT-I interventions varied: some expressed a strong preference for stimulus control, making deliberate efforts to limit working in bed and re-associating their bed with sleep; on the other hand, some preferred sleep restriction as it aligned with their existing academic schedule (e.g., similar class times in a week). We also observed that a majority (7 of 8) reported positive experiences with relaxation training, suggesting its widespread acceptability and perceived effectiveness akin to studies by Russo et al. (2017) and Sharpe et al. (2021). For instance, some found PMR particularly effective and continued to apply it before bedtime as part of their winding down routine. This receptiveness might be attributed to their academic background; as psychology majors, they may have been previously introduced to meditation and similar techniques in their coursework. Consequently, their familiarity could have fostered greater ease in implementing these relaxation techniques. Collectively, these findings underscore the importance of providing a range of strategies within a flexible framework. This approach, which emphasizes providing psychoeducation while simultaneously allowing individuals to discover and adopt techniques best suited for their unique circumstances and preferences, affirms SDT's tenets regarding autonomy and volitional participation. All in all, these findings reinforce the principle that comprehension of therapeutic rationale enhances treatment engagement, self-efficacy, and leads to lasting behavioral change (Ong et al., 2012). This comprehensive outcome also further supports the recommendation for interactive psychoeducation that integrates complementary personalized components, as highlighted by Bani et al. (2023).

Improved Sleep Latency through Building a Routine

Despite the limitations inherent in pilot studies, we observed a statistically significant improvement in participants' Sleep Latency PSQI component. This outcome is particularly striking given that Filipinos report higher rates of trouble falling asleep compared to other populations (Wang et al., 2023). Based on our in-depth interviews, the common recurring theme explaining this improved sleep onset was the establishment of a consistent bedtime routine. This finding parallels McAlpine et al.'s (2024) finding that sleep-promoting behaviors (i.e., going to bed, waking up at the same time) predict sleep quality. The sleep diary played a crucial role in facilitating this change by enhancing participants' understanding of their current sleep-wake schedules and daily habits. This heightened awareness provided an important foundation for identifying areas of improvement, aligning with CBT's activity scheduling principles which emphasize planning and observation of behaviors to promote desired outcomes. For instance, many participants noted that bedtime phone usage and afternoon naps significantly hindered their sleep quality.

The sleep diary's pivotal role stemmed from participants' active engagement; many approached its use enthusiastically rather than with resistance (e.g., viewing it as a mandatory homework assignment). This monitoring process also led participants to grasp their own optimal sleep duration, which often varied from general recommendations—with some feeling more rested after 5 to 7 hours of sleep, rather than the recommended 7 to 9 hours. Building a routine further helped participants undertake CBT-I interventions, specifically sleep restriction, which supports Baranwal et al.'s (2023) findings on maintaining a consistent sleep-wake schedule by establishing a regular bedtime routine.

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In addition to routine-building facilitating sleep restriction, other CBT-I interventions were also reported to enrich the Filipino undergraduate students' sleep-wake schedules. The majority of the participants found relaxation training (e.g., breathing exercises, PMR) particularly beneficial in aiding sleep onset, which further reinforces the established studies on relaxation training (Russo et al., 2017; Sharpe et al., 2021). Those who found cognitive restructuring helpful shared that countering overthinking tendencies reduced their typical pre-sleep anxieties. These findings corroborate with literature on the negative impact of preservative cognition on sleep quality (Clancy et al., 2020; Tutek et al., 2020; McAlpine et al., 2024).

The combination of establishing consistent routines—a process significantly aided by active sleep diary monitoring and the resulting personalized insights—and the strategic application of core CBT-I techniques such as sleep restriction, relaxation training, and cognitive restructuring, proved instrumental in enhancing participants' sleep latency and fostering more stable, predictable sleep-wake schedules. However, participants also noted limitations with the diary, particularly its inability to capture external factors that were not explicitly part of its tracking legend yet nevertheless impact their sleep quality. This observation naturally leads to the next recurring theme: the significant influence of external factors on sleep quality.

External Factors Affecting Sleep Quality

Sleep-related concerns, like other health issues, are rarely unifaceted. As Barlow and Durand (2017) highlight, multiple interrelated factors—such as genetic dispositions, environment, and personality—often contribute to sleep disturbance. Our observations aligned with this, revealing several external factors that significantly impact participants' sleep quality, and are not accounted for by the PSQI. These included time constraints due to heavy academic workload during submission timelines, sudden early morning obligations, social or extracurricular commitments, and other environmental factors within or outside their sleep quarters.

Through the lens of Reactance Theory (Steindl et al., 2015), we observed that for some participants, the program may be perceived as an additional workload, sometimes creating a sense of being tied to more responsibilities. As the theory posits, this perceived loss of freedom in personal choices can lead to psychological reactance. This was particularly evident as participants navigated responsibilities that disrupted their sleep-wake schedule building. While our program aimed to provide routine, a strict adherence to its guidelines could be perceived as restricting their ability to engage in other activities. Their reactance, therefore, occasionally manifested as veering from recommended sleep practices to regain a sense of autonomy and accommodate spontaneous plans. Participants reported challenges in consistently following program guidelines due to prioritizing other commitments (e.g., thesis work, internships, organization-related activities). These accounts of external factors highlight the need for further refinement of the program for better adaptability to Filipino undergraduate students.

Our findings revealed that an individual's sleep valuation, or the importance placed on sleep quantity and quality, also significantly influenced adherence (Nielson et al., 2021). Despite reported willingness to practice sleep-promoting strategies, one participant, for instance, explained they found the techniques inapplicable to their context because they did not consider their sleep habits problematic. This highlights that a participant's perception of their sleep can be profoundly influenced by how much they personally value it, potentially leading to a lack of

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perceived need for behavioral modification. This observation underscores the critical role of cognitive restructuring within CBT-I, particularly in challenging participants' initial beliefs about their sleep quality and the necessity of behavioral change. It suggests that interventions aimed at altering fundamental sleep valuation may require more intensive or prolonged engagement to effectively address deeply ingrained beliefs among this population.

Sleep valuation became even more evident when considering participants' early morning obligations. A significant number reported that early class schedules or work shifts, and their respective commutes, severely affected their sleep routine. For these individuals, sleep reportedly became less of a priority, as they prioritized other commitments over achieving sufficient rest in favor of early morning preparations for classes or internships. This situation also manifested as reactance to the program, as participants perceived a lack of control over their wake-up times due to these responsibilities. The program's emphasis on consistent sleep-wake schedules could inadvertently intensify this feeling of reduced control, sometimes leading to deliberate resistance to adjusting their bedtime (e.g., behaviors akin to 'revenge bedtime procrastination'—staying up late to assert control over limited free time). Furthermore, these early morning activities and related external factors often led to reduced motivation to start the day and contributed to challenges captured by the Daytime Dysfunction PSQI component, even if nighttime sleep patterns showed improvement.

Beyond situational factors, other predispositions could also influence adherence to a consistent sleep schedule. In the middle of the program, one participant disclosed receiving a mood-disorder diagnosis, which subsequently affects their sleep with episodes occurring at night and interfering with sleep onset or maintenance. Furthermore, various sleep-related cognitive distortions were revealed during sessions and interviews (e.g., rigid beliefs about needing a full 7 to 8 hours of sleep to function), further underscoring the broader utility of cognitive restructuring in addressing such maladaptive thought patterns. While evidence supports this general recommendation, such rigid expectations can become an added burden for college students, potentially leading to increased rumination or worrying when attempting to sleep (Rossman, 2019; Walker et al., 2022). Thus, it may be beneficial for future implementation to integrate individualized approaches to group-based sleep interventions, offering targeted support for diverse predispositions and cognitive patterns.

Peer Support's Influence on Program Adherence

Despite the multitude of external challenges and individual predispositions that can complicate sleep interventions, our findings revealed a significant protective factor in program adherence: peer support. While our quantitative analysis did not reveal statistically significant improvements in overall subjective sleep quality among participants except for sleep latency, the rich qualitative narratives highlighted peer support's influence on following through the recommended sleep-promoting behaviors. This was primarily facilitated through group discussions and subsequently influenced adherence through interconnected pathways informed by CBT and SDT. As a component of behavioral activation (in CBT), these discussions offered an active platform for engaging with CBT-I techniques and sharing experiences, which also helped challenge unhelpful beliefs. Notably, group discussions contributed to fulfilling the psychological needs of relatedness and competence in SDT, which

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eventually enhanced their motivation and engagement. This theme further aligns with broader literature on peer support (Bani et al., 2023) and the methodological considerations raised by Friedrich and Schlarb (2017), who advocate for a stronger focus on non-randomized controlled trials (RCTs) and a more comprehensive examination of outcome measures beyond just significant effect sizes.

Building on the understanding that positive social relationships (e.g., with family, friends, and classmates) can significantly enhance the sleep quality of college students (Wang & Bíró, 2020), we observed that pre-existing social connections among some participants specifically laid the groundwork for positive program adherence. Familiarity and comfort significantly enhanced their engagement in what was essentially a Collaborative Learning Environment (CLE). In this environment, participants actively shared experiences and supported one another, which aligns with the findings that CLEs promote crucial social interaction and the development of interpersonal skills vital for overall well-being and future professional success (Esteves et al., 2018). The engaging nature of these group discussions also fostered experiential learning. As participants disclosed their attempts at applying sleep hygiene-related and CBT-I techniques and observed their peers' outcomes, they were actively applying theoretical knowledge in practical contexts—a method shown to improve learning outcomes and deepen understanding (Brooks, 2024). For instance, one participant's observation of peers actively integrating sleep techniques into their routines fostered a sense of influence, motivating them to adopt similar behaviors, highlighting the power of observational learning and social modeling within this collaborative and experiential setting. Furthermore, peer interaction facilitated vicarious learning and reflective comparison, prompting participants to compare diverse experiences and outcomes of sleep strategies with their own patterns. This reflective process encouraged introspection and the consideration of new, personally relevant implementation strategies—a valuable cognitive benefit derived from this shared learning experience. Participants themselves highlighted the value of CLEs, explicitly linking it to Filipino cultural values of pakikisama (fellowship or camaraderie) and magandang loob (goodness of heart or benevolence) in creating a conducive atmosphere for discussing sleep-related issues. However, despite these positive influences, the interactive nature of group discussions also presented potential complexities. Opportunities for social comparison, for instance, could influence self-perception and introduce subtle pressures. To illustrate this, one participant felt that they might have been "too generous" in their self-rating of the PSQI after comparing their experience to peers; this could be interpreted as a subtle form of reactance against perceived expectations. In a related vein, while psychological reactance may suggest potential initial resistance to interventions, the supportive and collaborative nature of peer discussions likely mitigated such feelings by fostering a sense of agency and reducing isolation.

V. CONCLUSION

We observed a statistically significant improvement in participants' PSQI Sleep Latency component, a notable outcome given that Filipinos report higher rates of trouble falling asleep compared to other populations (Wang et al., 2023). Additionally, Filipino undergraduate students' improved sleep satisfaction aligns with improved sleep hygiene and reduced engagement in pre-bedtime activities that interfere with sleep quality, consistent with findings by Schmickler et al. (2024). These improvements stemmed from practical behavioral changes within the program: participants consistently tracked their individual activities and sleep, identifying correlations between

their daytime behaviors (e.g., caffeine intake, exercise timing) and their nighttime sleep quality. For example, some regular caffeine consumers began avoiding it after 4 PM, as they identified this as previously hindering their ability to fall asleep. Building a routine also helped participants undertake CBT-I interventions, specifically sleep restriction, which reinforces the importance of consistent sleep-wake schedules, echoing findings by Baranwal et al. (2023). Participants also found relaxation training to be another effective CBT-I intervention, especially for promoting sleep onset, similar to established studies (Russo et al., 2017; Sharpe et al., 2021). This provides valuable context, particularly given Friedrich and Schlarb's (2018) meta-analysis, which noted high variability in relaxation category effect sizes but confirmed CBT approaches generally yielded the best effects for sleep variables in college students. Finally, the high engagement and satisfaction reported in the program, exemplified by participants' active participation and comprehensive outcomes, aligning with the high consent rates indicative of student appeal seen in studies like Tadros et al. (2024).

It is crucial to interpret these findings with caution, as statistical significance was not uniformly observed across all quantitative sleep variables in this pilot study. However, the rich qualitative data consistently supported the efficacy and impact of the program. Specifically, psychoeducation was foundational in increasing their sleep valuation and cultivated a sense of autonomy, aligning with SDT's emphasis on intrinsic motivation. Peer support also served as a mitigating influence on external factors in overall sleep quality. Within the CLE, participants engaged in various forms of learning—experiential, observational, and vicarious—while also providing mutual support and validation. This communal aspect, notably amplified by Filipino cultural values of pakikisama and magandang loob, created a highly conducive academic atmosphere which reinforced commitment and promoted program adherence and satisfaction.

VI. IMPLICATIONS AND RECOMMENDATIONS

Based on the observed effectiveness of the semi-structured, participant-centered approach, and the identified influencing factors, the following recommendations are put forth for designing and implementing sleep hygiene program, particularly in university settings:

- Program design should prioritize blended and interactive sleep psychoeducation, exploring various modalities to suit diverse student populations, such as scholars or working students.
- Individualized strategy applications should be accommodated within group-based interventions, fostering autonomy and allowing participants to tailor their intervention goals.
- Continuous application of sleep diaries beyond the intervention period (i..e, beyond four weeks), especially for addressing nuanced cognitive aspects like those involved in cognitive restructuring, may support lasting behavioral change.
- Leveraging peer support by incorporating semi-structured group discussions, where participants could disclose their experiences in a small or group setting.

These recommendations not only reinforces psychoeducational content and provides a platform for experiential and vicarious learning (Brooks, 2024; Esteves et al., 2018), but also builds a supportive community that enhances motivation and shared accountability, particularly amplified by Filipino cultural values

of pakikisama and magandang loob. Facilitators should, however, remain mindful of potential social comparison effects, ensuring that discussions remain supportive and collaborative.

The insights from our study also pave the way for several avenues for future investigation. For example, administering the PSQI on a weekly basis rather than monthly could help determine specific external factors' impact on sleep intervention outcomes. Additionally, conducting larger-scale and longitudinal studies with more diverse samples would be beneficial. Future research should also rigorously explore specific CBT-I intervention components designed to preemptively mitigate psychological reactance in student populations, and quantitatively measure sleep valuation and its impact on program adherence and overall sleep satisfaction.

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