

ORIGINAL RESEARCH

Critical sleep interventions for nursing students: A pilot study of the Sleep Tool Kit

Jane Frances Anyango*¹, Ruthie LaMar², Constance E. McIntosh¹, Cynthia M. Thomas¹

¹School of Nursing, Ball State University, Muncie, Indiana, United States

²School of Nursing, Western Governors University, Salt Lake City, UT, United States

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ABSTRACT

Background and objective: Nursing students often experience inadequate sleep duration and poor sleep quality, which can negatively impact their academic performance and overall well-being. Addressing these challenges through structured interventions may help improve sleep health. The aim of this study was to determine how the implementation of a Sleep Toolkit focused on improving sleep hygiene impacts students' sleep patterns and quality.

Methods: A quasi-experimental pre-test and post-test design was used with 29 participants between March and April 2025. The Sleep Toolkit, adapted from the American Academy of Sleep Medicine, was administered to promote better sleep hygiene. Data were analyzed using SPSS version 26, with descriptive and inferential statistics.

Results: There was no statistically significant difference in average sleep hours ($p = .350$) or feelings of restedness ($p = 1.00$) after the intervention. Sleep-related habits also showed no significant change.

Conclusions: The Sleep Toolkit did not significantly improve sleep quality or duration. Longer interventions and behavioral reinforcement may be needed to achieve measurable improvement in students' sleep outcomes.

Key Words: Intervention, Pattern, Quality, Sleep Tool Kit, Sleep

1. BACKGROUND

Sleep is essential for maintaining energy and restoring bodily function.^[1] Sleep quality has a critical impact on the health and activity of an individual.^[1] Sleep quality is a multidimensional concept determined by several components: sleep efficiency, total sleep time to time in bed ratio, sleep disturbance, sleep latency, sleep duration, and waking after sleep onset.^[2] Sleep quality reflects an individual's subjective satisfaction with sleep, including aspects such as sleep duration, latency, efficiency, frequency of awakenings, and restfulness upon waking.^[3] A sleep pattern is defined as the habitual timing, duration, and structure of an individual's sleep and wake cycles over a 24-hour period.^[3] It includes when a per-

son goes to bed, how long they sleep, how often they wake during the night, and the consistency of these behaviors from day to day.^[3]

University and nursing students are among those most affected by sleep-related problems. Lack of sleep and sleep disorders are the main issues contributing to poor sleep quality among this group of students.^[4] Yet, sleep quality among nursing students has not been fully studied, and there is a paucity of research on sleep interventions that can be applied to nursing students to improve their sleep patterns and habits.

The American Academy of Sleep Medicine defines sleep hygiene as a series of healthy sleep habits that can improve

*Correspondence: Jane Frances Anyango; Email: jane.anyango@bsu.edu; Address: School of Nursing, Ball State University, 2000 W University Ave, Muncie, Indiana, United States.

an individual's ability to fall asleep and stay asleep.^[5] These habits can help improve sleep health.^[5] Nursing students recognize the need for adequate sleep but often fail to achieve it due to school and employment responsibilities, consistent with findings by Blome et al.^[6] Students often use substances to induce or maintain wakefulness, which may lead to adverse effects such as circadian rhythm changes, cardiac dysrhythmias, blood pressure changes, gastrointestinal disturbances, and cognitive abnormalities.^[7,8] Adverse effects of reduced sleep and use of stimulants can then negatively impact personal and patient safety.^[9] Students who experience lack of/reduced sleep often are at increased risk of poor cognitive performance and nutritional behaviors; mood and mental health disturbances and at higher risk of committing errors or near misses during clinical placements and coursework.^[9-12]

1.1 Objectives of study

The primary objective of this study was to investigate the impact of implementing a sleep toolkit on sleep hygiene, patterns, and sleep quality. Previous studies have revealed the negative impact poor sleep hygiene/quality can have on students' quality of work and patient safety; however, more information is needed regarding how improved sleep practices can impact nursing students' sleep habits and associated nursing clinical experiences. The research questions were as follows: How does the implementation of a sleep toolkit with a focus on nursing students impact their sleep patterns, and how does the implementation of a sleep toolkit with a focus on nursing students impact their sleep quality?

Researchers hypothesize that education and implementation of a sleep toolkit will result in improved sleep patterns and quality.

2. METHOD

2.1 Study design

The study employed a quasi-experimental design with pre- and post-test single-group designs.

The study design was chosen to determine if the implementation of the sleep toolkit directly impacts sleep hygiene. Data are collected at the pre-test (before the intervention) and post-test (after the intervention). For this study, a sleep toolkit was used as the intervention, comprising both daytime and nighttime habits that affect sleep.

2.2 Research questions

- 1) How does the implementation of a sleep toolkit with a focus group of nursing students impact their sleep patterns?
- 2) How does the implementation of a sleep toolkit with a focus group of nursing students impact their sleep quality?

(Do the participants report feeling more rested after the implementation of the sleep tool kit?)

2.3 Sample size and recruitment

A sample of 20-40 participants was selected from the School of Nursing roster, based on availability and interest in participating. Of the students approached, 29 participated in both pre- and post-surveys. The students were provided with educational materials and a toolkit designed to optimize their sleep practices. The pre- and post-surveys included questions related to sleep quantity and quality, as well as sleep hygiene practices.

To communicate with the participants, a link was shared on a classroom bulletin board during scheduled class time. Participants were instructed to click the link to access the survey. Once 40 participants were enrolled, the survey closed. The survey link was set to automatically expire once 40 participants had been reached.

Once a student had agreed to participate in the study, they were provided with a link. When they clicked 'agree,' the pre-assessment survey populated for them to complete. At the end of the pre-assessment survey, the nursing student participants proceeded to the sleep tool kit. There were no actual hard stops or mandates in place to require study participants to read and implement the toolkit; independent and voluntary review and implementation were encouraged, as voluntary action may represent how any healthcare consumer reacts to receiving health information materials. In addition, the consent form explained the procedure for participation which involved reading through the sleep tool kit which was emphasized before participants would proceed to the post test questions. The sleep tool kit/sleep hygiene material was delivered as part of the online survey and placed in between the pre and post test questions. After reading through the sleep hygiene material, the students then proceeded to answer the same survey questions.

2.4 Data collection

2.4.1 Inclusion criteria

The nursing student enrolled in the University's nursing courses that have an external clinical site component. All participants were over 18 years of age and were able to provide informed consent.

2.4.2 Data collection procedures and duration

A member of the research team shared a link with the course faculty and class instructor after seeking permission. A questionnaire was administered before (pre) and then followed by a post questionnaire once the toolkit was operationalized. After participants operationalized the toolkit for a four-week

period, the same brief questionnaire was administered to the same students (the questionnaire is available upon request).

Participants were asked to answer questions about sleep and its impact on their clinical practice. A study tool kit was then provided to participants to read and implement, after which they were asked to answer the same questions about their sleep practices.

2.4.3 Data storage, confidentiality, or anonymity

All data is maintained as confidential. Data was stored in a password-protected computer that could only be accessed by the research team. No identifying information, such as names, will appear in any publication or presentation of the data.

2.5 Data analysis

Data analysis was done using SPSS 26.0 for Windows software. Descriptive statistics using frequencies and percentages were used to describe the sample as well as all the questions. The online pre-survey and post-survey analyses occurred separately. The online pre-survey and post-survey (available upon request) administered a set of questions about sleep patterns and quality, and the sleep toolkit.^[5]

Prior to analysis, data were screened for completeness, accuracy, and missing values. Only participants who completed both the pre- and post-intervention surveys were included in the final analysis. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were computed to summarize participant characteristics and responses.

To evaluate changes in sleep patterns (average hours of sleep) and sleep quality (self-reported feeling of restfulness) following the implementation of the Sleep Toolkit intervention, both descriptive and inferential statistical analyses were performed.

A paired-samples *t*-test was conducted to compare the mean hours of sleep before and after the intervention. This test was used to determine whether there was a statistically significant difference in average sleep duration within the same group measured at two different time points. In addition, Cohen's *d* was calculated to estimate the effect size of the intervention. Cohen's *d* values were interpreted as follows: 0.2 = small effect, 0.5 = medium effect, and 0.8 = large effect, indicating the magnitude of change regardless of statistical significance. For participants' feelings of being well-rested (Yes/No) and habits that affect sleep (for example, caffeine limitation, light exposure), the McNemar's test was used to assess whether statistically significant differences existed between pre- and post-intervention responses.

All statistical tests were two-tailed, and a *p*-value of less than .05 was considered statistically significant. Results were summarized in tables showing pre- and post-intervention means, standard deviations, effect sizes (Cohen's *d*), and *p*-values. Findings were reported in aggregate form to maintain participant confidentiality.

2.6 Ethical consideration

Ethical approval for this study was obtained from the University's Institutional Review Board (IRB) prior to data collection. Participation in the study was voluntary, and informed consent was obtained from all participants before completing the pre-intervention survey. Participants were informed about the study's purpose, procedures, potential risks, and potential benefits, as well as the right to withdraw at any time without penalty or academic consequences.

Confidentiality and anonymity were strictly maintained throughout the study. No personal identifiers, such as names or student identification numbers, were collected. Data were stored on a password-protected computer accessible only to members of the research team. Results were reported in aggregate form to ensure that individual responses could not be linked to specific participants.

3. RESULTS

3.1 Description of study

Of the 40 participants invited, 29 nursing student participants started at least the preintervention survey study. All the 29 participants were in their sophomore year. The nursing student participants completed their first semester of nursing school courses, which included patient care skills and comprehensive health assessment. Twenty-six participants completed both pre- and post-surveys.

According to Table 1, participants reported slightly more (6.93) hours of sleep pre-intervention compared to post-intervention. The standard deviation decreased from 1.28 during the pre-intervention to 1.09 during the post-intervention.

Table 1. Description of the study sample

	Frequency	Percent
Complete	23	79.3
Pre-Only	6	20.7
Total	29	100.0

According to Table 2, there is no statistically significant difference (*p*-value = .329) in the number of self-reported hours of sleep between the pre-intervention and post-intervention periods for the participants. With almost the same 6.93 and 6.80 average number of hours of sleep reported during the

pre- and post-intervention, respectively. Further still no statistical significance exists between self reported number of hours of sleep during the pre and post intervention as shown in Table 3.

Table 2. Participants’ average number of hours of sleep pre- and post-intervention

How many hours of sleep (on average) do you obtain each night/day?	Mean	N	SD
Pre-intervention	6.93	22	1.28
Post-intervention	6.80	22	1.09

Table 3. Relationship between self-reported number of hours of sleep during pre- and post-intervention

	Self-report of number of hours of sleep pre and post- intervention	p-value
Pre-intervention Average hours of sleep	6.93	.329
Post-intervention Average hours of sleep	6.80	

Do the participants report feeling more rested after implementing the sleep toolkit? A total of 26 nursing students completed pre- and post-intervention assessments of subjective restedness following implementation of the sleep toolkit. When asked, “Considering the number of hours of sleep you obtain every 24 hours, do you feel rested?”. According to the findings in Table 4, before the intervention, 34% of the participants reported feeling well-rested, compared to 41% after the intervention. Furthermore, the proportion of individuals who did not feel well-rested decreased from 66% before the intervention to 59% after the intervention, indicating a slight improvement in restfulness following the intervention, although this was not statistically significant (p -value = 1.00).

Table 4. Self-reported feeling of being well rested before and after intervention

Feeling Well Rested	Yes (%)	No (%)	p-value
Pre-intervention	10 (34)	19 (66)	1.00
Post-intervention	9 (41)	13 (59)	

Additional information was collected to determine if there was a change in sleeping habits among participants before and after administering the sleep tool kit (intervention).

There was no statistically significant difference in the habits that affect sleep before (pre-intervention) and after (post-intervention) administering the sleep toolkit. Three participants (10%) reported that the area in which they slept was exposed to bright light before administering the sleep toolkit (preintervention), while 4 participants (18%) reported the same after administering the sleep toolkit.

Close to half (48%) of the participants reported that they always limit caffeine before the intervention, while 13 (3%) reported that they sometimes limit caffeine before bed. During the post-intervention, the same number (48%) of participants reported that they always limit caffeine before bed, while 2 (9%) reported that they sometimes limit caffeine before bed.

4. DISCUSSION

The purpose of this study was to investigate the impact of implementing a sleep toolkit tailored to nursing students on their sleep hygiene, sleep patterns, and sleep quality. Of the participants invited, 29 responded to the pre- and post-intervention questions.

The findings of this study did not reveal any statistically significant differences in sleep patterns and quality among participants before and after administering the sleep toolkit.

Furthermore, the findings of this study revealed no statistically significant difference (p -value = .329) in participants’ average sleep hours before and after the sleep toolkit intervention, with students sleeping an average of 6.93 hours before the intervention and 6.80 hours after the intervention and the standard deviation decreased from 1.28 to 1.09 during the pre-intervention and post-intervention respectively. The decrease in standard deviation from 1.28 to 1.09 hours of sleep suggests that participants’ sleep durations became more consistent (less spread out) over time, even though the average amount of sleep changed very little. Participants of the study were sleeping similar amounts to one another at post-test, but still averaging below the recommended 7–9 hours for adults. The findings of this study are similar to another study by Lund et al. (2010), who found that college students sleep for less than eight (8) hours.^[13]

These results contrast with those of Seyednazari and colleagues, who reported a significant increase in average sleep hours after implementing a structured sleep intervention.^[14] The discrepancy could be attributed to differences in the type of intervention, participant characteristics, or the duration of time allowed for toolkit implementation. This study employed a self-implementation approach, where participants completed a pretest and then read the sleep toolkit information, followed by the same set of questions in the post-intervention. It could be argued that self-implementing a toolkit may not have a positive impact on sleep quality.

Another study, conducted by Colt and colleagues in 2019, found results contrary to those of our study.^[15] Colt and colleagues in their study evaluated a school-based sleep education and behavior change intervention among adolescents and found a statistically significant increase in average sleep hours per night (from 6.9 to 7.8 hours, p = .0134) following

the intervention.^[15]

The discrepancy between this study's findings and those of Colt et al. could be due to differences in the study design, sample size, and population. Although sleep interventions show positive effects in some studies, the contrary finding could be due to the toolkit being less effective or a small sample size.

4.1 Effect of the implementation of the sleep toolkit on the sleep habits of the participants

The implementation of the sleep intervention toolkit did not have an impact on the sleep habits that affected the sleep of the participants. The results of our study found no statistically significant difference in sleep habits before and after administering the sleep toolkit. With 48% of participants reporting that they always limit their caffeine intake both pre- and post-intervention, while the proportion who reported sometimes limiting caffeine increased slightly from 3% to 9%, this difference was not statistically significant. This could be because students often feel pressured by their assignments, and therefore, despite all the interventions, they still sleep for a few hours.

The findings of this study are contrary to those of other studies, which reported significant behavioral changes among their participants after reducing pre-bedtime light exposure and caffeine consumption following a sleep intervention (16-18). The interventions directly targeting environmental light exposure and caffeine consumption can yield measurable improvements in sleep outcomes.

4.2 Did the participants report feeling more rested after implementing the sleep toolkit?

There is no statistical difference. Analysis of self-reported restedness scores revealed no statistically significant difference in feelings of restedness before and after the implementation of the sleep toolkit. The findings of this study indicate that the implementation of a Sleep Toolkit among nursing students did not result in a statistically significant improvement in sleep duration or feeling of restfulness. This outcome suggests that while participants may have gained knowledge about sleep hygiene, behavioral changes affecting actual sleep patterns may require a longer period or more intensive intervention to take effect.

These findings are consistent with those of Almojali and colleagues in 2017, who found that despite increased education and awareness of sleep hygiene, university students continued to experience insufficient and poor-quality sleep, largely due to academic demands and lifestyle stressors.^[16] Conversely, the results of this study are contrary to those of Hershner and Chervin, who found that comprehensive

sleep education combined with behavioral follow-up led to significant improvements in students' sleep quality and academic functioning.^[12] The discrepancy may be explained by differences in intervention intensity, duration, and participant engagement.

These findings are notable in the broader literature, which demonstrates that sleep interventions, such as sleep hygiene education and cognitive behavioral therapy for insomnia (CBT-I), can improve sleep quality and related outcomes in university and nursing student populations. However, effect sizes are often modest, and not all interventions yield improvements in all domains. For example, meta-analyses have shown moderate improvements in sleep quality but smaller or non-significant effects on sleep duration and daytime functioning, with considerable heterogeneity in intervention content and delivery.^[17-19] Furthermore, study results specifically targeting nursing students have highlighted persistent challenges with poor sleep quality and daytime sleepiness, even after educational interventions.^[6]

The lack of observed change in subjective restedness in this cohort may reflect the limited intensity or duration of the toolkit, variability in individual sleep needs, or the influence of external factors such as academic workload and technology use, which are well-documented contributors to sleep disturbance in this population.^[6] These results emphasize the need for further research to optimize intervention content, delivery, and outcome measurement in nursing student sleep health initiatives.^[9, 17-19]

5. CONCLUSION

The findings from this study indicate that the Sleep Toolkit intervention did not significantly improve the subjective quality of sleep among the nursing student participants. Although a small improvement in the "well-rested" perception was observed, it was not statistically meaningful. The duration of the intervention might have been too short to produce a measurable effect. Also, participants could have been affected by academic workload or stress factors that limited improvement in sleep patterns and the shorter duration of the intervention. There is a need to conduct another study on sleep habits that involves an intervention promoting long-term behavioral change, rather than a short educational toolkit.

5.1 Limitations

This is a pilot study with a small sample size, which limits its generalizability to a broader population. Additionally, with a limited number of participants, the study may have low statistical power, making it challenging to detect small but meaningful changes in sleep habits.

The sleep toolkit may have been administered over a brief period, which might not be enough to influence entrenched behaviors such as caffeine intake or light exposure.

Honesty may be an issue, as participants often fail to report the results of changes in habits, such as caffeine consumption and light exposure. Self-report is subject to recall bias, social desirability bias, and inaccurate reporting. Objective measures (e.g., actigraphy for sleep, light meters, or caffeine logs) were not used.

5.2 Implications for education research and practices

The results of this study indicate that a brief sleep toolkit intervention alone may not be sufficient to induce meaningful changes in sleep patterns and quality. There is a need to implement future interventions that are longer, more intensive, or involve environmental modifications (e.g blackout curtains) to effectively change sleep-affecting habits, quality, and pattern.

The findings also suggest that self-reported sleep behaviors may be resistant to change without reinforcement, structured support, or ongoing monitoring. Ultimately, this study's results highlight the need for further research that combines education, environmental adjustments, and behavioral reinforcement to enhance sleep hygiene and outcomes in target populations.

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AUTHORS CONTRIBUTIONS

All the authors had equal contribution towards the manuscript. Dr. Jane Anyango, Dr. Ruthie LaMar, Dr. Constance McIntosh and Dr. Cynthia Thomas were responsible for developing and designing the study, data collection, results interpretation, discussion, writing and revising the manuscript.

All authors read and approved the final manuscript.

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CONFLICTS OF INTEREST DISCLOSURE

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this manuscript.

INFORMED CONSENT

Obtained.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

DATA SHARING STATEMENT

No additional data are available.

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