Lyrics Versus No Lyrics: The Role of Music in Adolescent Sleep Quality

Trent Lewis
East Hamilton High School

Sleep deprivation, or the lack of a healthy amount of sleep, is a major problem for adolescents that can lead to many mental health issues, obesity, and drowsy driving (Owens et al., 2014). Many studies have found that bedtime music, or music that is listened to before or during sleep, can improve sleep quality in adolescents due to its relaxing nature and its ability to distract the listener from potential stresses (Loewy, 2020; Trahan et al., 2018). However, no studies have analyzed the differences in how lyrical and non-lyrical bedtime music impact adolescent sleep quality. The researcher conducted a quantitative correlational study utilizing an electronic survey as the instrument, with the intent of discerning if there was any correlation between lyrical or non-lyrical bedtime music and sleep quality and adolescents. The study found no major differences between the average sleep quality scores of non-bedtime music listeners, lyrical bedtime music listeners, and non-lyrical bedtime music listeners. However, the results did indicate that adolescents who listened to a mix of lyrical and non-lyrical bedtime music had better overall sleep quality than all other groups. A comparison between lyrical and non-lyrical bedtime music indicated that lyrical bedtime music was slightly better for adolescent sleep quality than non-lyrical bedtime music. This study opens the door for future studies aimed towards analyzing a potential causational relationship between lyricism in bedtime music and overall sleep quality.

Introduction

Sleep deprivation, or the lack of a healthy amount of good quality sleep, is a worldwide issue that can have major negative impacts on many different populations. A study conducted by LeAnne M. Forquer, a researcher with a Ph.D. in Applied Experimental Psychology from the University of Central Michigan, on sleep patterns of the student body from a North Central university found more than a third of the students took longer than thirty minutes to fall asleep, 43% woke up at least once nightly, and more than a third reported feeling tired during the day (Forquer et al., 2008). These findings shed light on not only the prevalence of this issue in young adults, but also how detrimental sleep deprivation can be for the overall quality of life for these people. Despite these findings coming from a

focused sample, it still provides valuable insight to how sleep deprivation could impact the global population, underscoring the commonality of sleep deprivation in modern society.

Studies have also shown that sleep deprivation is much more prominent in adolescents relative to the general population. According to Judith Owens, a professor of neurology at Harvard University, sleep deprivation is an especially major issue for adolescents, as a lack of a proper night's rest is extremely common during adolescent time periods (Owens et al., 2014). The prominence of sleep deprivation in teenagers stems from many different causes ranging from biological processes, caffeine intake, and school start times. Many biological processes occur during adolescence, creating "a more evening-type circadian phase preference," causing teenagers to have a difficult time going to sleep in the early evening and waking up refreshed in the morning (Owens et al., 2014). A circadian phase preference refers to "the preferred timing of sleep and wake as well as daytime activities" (Owens et al., 2014). This involuntary shift in circadian rhythm preference causes a natural predisposition towards staying awake later into the evening, causing these teenagers to get less sleep on a nightly basis. This acts as a mechanism for sleep deprivation in adolescents, and other factors such as school start times cause them to still have to get up early in the morning despite going to bed later in the evening. (Owens et al., 2014). With no other option, these students turn to caffeine to try and stay awake and active in spite of their sleep deprivation, but many studies have linked caffeine intake to sleep deprivation, furthering the cycle of sleep deprivation in teenagers (Owens et al., 2014).

Adolescent sleep deprivation can have extremely adverse impacts on teenagers, leading to mental health issues including depression, mood disturbances, and suicidal thoughts (Owens et al., 2014). Many mental health issues can negatively impact a teenager's overall quality of life, making it more difficult for them to do basic self-care activities and even threatening their personal safety and long-term developmental trajectory. This illustrates the importance of adolescents getting the best sleep quality possible, as not doing so could be life-threatening. Sleep quality is the overall quality of an individual's sleep, including factors such as sleep latency, or the amount of time it takes for an individual to fall asleep, and the amount of sleep disturbances throughout the night. Sleep deprivation also leads to obesity and drowsy driving, which can lead to many health conditions and an overall worse quality of life (Owens et al., 2014).

Even with all these negative impacts of sleep deprivation, most prescribed sleep-aid medications are expensive and have potential negative side effects (Trahan et al., 2018). According to Tabitha Trahan, an English data scientist who primarily researches psychology and works

at the Goldsmiths University of London Department of Psychology and her colleagues, pharmaceutical sleep medications can have a vast array of negative side effects, including seizures, nausea, dependency and withdrawal, and more (Trahan et al., 2018). Furthermore, the substantial expense associated with sleep-aid medication, when coupled with the high market demand, significantly constrains public accessibility to pharmaceutical solutions (Trahan et al., 2018). While many supplements like Melatonin are often marketed as alternatives to prescription medication for sleep disorders, there is a lack of evidence for its long-term impacts on many organ systems and the overall safety of long-term (Tuft et al., 2023). In contrast, bedtime music, or music that is listened to before or during sleep, has been shown to be a promising and effective alternative to mainstream sleep-aid medications, and has potential to be a primary means to fight against sleep disorders such as chronic insomnia and sleep deprivation (Trahan et al., 2018). It is important to gain a better understanding of how bedtime music can impact sleep quality, particularly in adolescents, to develop an affordable and accessible way to fight against adolescent sleep deprivation.

Literature Review
Bedtime Music and Sleep Quality
Many studies support Trahan et al.'s claim that bedtime music can have a positive impact on sleep quality. Joanne Loewy, the founding Director of the Louis Armstrong Center for Music and Medicine conducted an analysis on two studies: one on infants comparing pharmacologic sedation (the use of pharmaceutical tools as a means for slowing down activity within the brain) to music therapy, and another utilizing a music protocol including patients, staff, and the environment (Loewy, 2020). She concluded music therapy can improve sleep if it effectively involves the environment, patient, and staff. Additionally, both her analysis and the broader literature indicate that personal familiarity to music plays a major role in bedtime music efficacy, as people who listen to more familiar music are more likely to feel less anxious and in turn have better sleep quality. The main difference between this study and the broader literature is that Loewy concentrated on how sleep quality can be impacted by a specifically planned treatment course including a music therapist as opposed to regular household use of bedtime music.

Laszlo Harmat, from Semmelweis University Institute of Behavioral Sciences expands upon the ideas presented by Loewy, narrowing the scope to 19–28-year-olds. Harmat conducted a study on 94 students with sleep complaints, where the participants were randomly assigned into one of three groups: group 1 contained students tasked with listening to relaxing classical music for at least 45 minutes nightly, group 2 consisted of students given 11 hours of audiobooks to listen to for 45 minutes a night, and group 3 was the control group, receiving no intervention

(Harmat et al., 2008). Harmat found 30 of the 35 students in group 1 responded well to the classical music and became better sleepers, illustrating how bedtime music positively affects sleep quality through its relaxing nature (Harmat et al., 2008). However, Harmat and his colleagues found listening to audiobooks at bedtime had no impact on sleep quality (Harmat et al., 2008). The ineffectiveness of the spoken word (audiobooks) compared to the musical stimulus powerfully supports the hypothesis that music's benefit stems from its unique relaxing properties and capacity to lower physiological arousal; a mechanism that verbal content does not replicate. By isolating the effect of music through this comparative design, Harmat's work synthesizes with the broader literature, confirming the positive impact of music and highlighting its potential as a non-pharmacological behavioral intervention for sleep complaints in young adults.

The Variables that Impact how Bedtime Music Affects Sleep Quality
Gaelen Thomas Dickson and Emery Schubert expound upon the ideas presented by Loewy and Harmat by conducting an analysis on 167 pieces of bedtime music reported by 161 student-participants of an online survey. Dickson and Schubert both have extensive backgrounds in musicology, and Emery Schubert is a professor at the University of New South Wales in Sydney, Australia. The analysis found 78% of the pieces reported in the survey were successful in aiding sleep quality. They concluded successful music had legato articulation as opposed to staccato articulation (smooth transitions between sounds as opposed to "bumpy" transitions between sounds), a relatively lower main frequency, and excluded "high rhythmic activity" (Dickson & Schubert, 2020). They also stated "[t]he features most common in successful music were proportionally more energy in the middle frequency range, an average tempo of 107 bpm, legato articulation, major mode, presence of lyrics, and in a classical, pop, ambient, folk, or alternative music genre" (Dickson & Schubert, 2020). This study illustrates many variables contributing to the effectiveness of bedtime music, and how although many types of bedtime music are effective in improving sleep quality, there are patterns seen throughout them. While these variables are observational patterns and do not establish a universal guarantee of efficacy, the study provides crucial empirical correlations. By detailing the measurable features common to successful sleep music, Dickson and Schubert furnish practical parameters for selecting non-pharmacological interventions that are most likely to facilitate the physiological calming necessary for improving sleep quality.

Tabitha Trahan and her colleagues took a closer look at how music genres in bedtime music impact sleep quality in their own study, conducting an online survey within the public on musicality (sensitivity or talent for music), sleep habits, and what music they use to help them sleep and why. They found a large diversity in the music their participants

listened to, which would support the idea that self-selected music is the best possible type of genre for bedtime music, and it all depends on the individual listener themselves (Trahan et al., 2018). While these findings do not eliminate the possibility of genre having a significant impact on sleep quality, they do indicate that it may be better to look at other factors regarding bedtime music to optimize sleep quality. Furthermore, Trahan and her colleagues sophisticate the argument presented by Loewy and Harmat by concluding bedtime music can also be effective towards improving sleep quality because of its ability to distract the listener from things such as daily stresses and intrusive thoughts or interruptions (Trahan et al., 2018). This exemplifies how, while bedtime music is effective due to its relaxing qualities, it can also be effective due to other qualities equally beneficial to an individual.

Majeed Nadyanna, who has a master's degree in philosophy and is a researcher at the Singapore Management University, and their colleagues further sophisticate the main argument regarding the importance of genre in how bedtime music impacts overall sleep quality by examining the differences between the impacts of happy and sad bedtime music on sleep quality. Nadyanna conducted a 15-day randomized crossover trial on 62 young adults, in which they would record their sleep quality after listening to happy bedtime music (typically characterized by fast tempo, energetic rhythms), sad bedtime music (slower tempo, softer dynamics), and pink noise (sounds like bustling leaves or drizzling rain). The authors concluded both sad and happy music saw an increase in sleep quality but saw no significant difference between the two (Majeed et al., 2021). However, all songs used were non-lyrical, meaning there was no way to analyze the potential correlation of any lyrical presence.

How the Presence of Lyrics Impacts Sleep Quality
Michael K. Scullin, a researcher and professor at the Department of Psychology and Neuroscience at Baylor University, and his colleagues chose to take an unexplored path with regard to variables of bedtime music and took a deep dive into how lyrics in bedtime music impact sleep quality. Scullin and his colleagues conducted two separate studies and then conducted an analysis on them. Study 1 sought to analyze the impacts earworms have on general sleep quality. An earworm is defined as a song stuck in an individual's head for an extended period of time after listening to the song. They found earworms were responsible for more sleep disturbances and an overall worsened quality of sleep (Scullin et al., 2021). Study 2 was conducted on 50 young adults, who were either assigned to listen to bedtime music containing lyrics for 7 days or purely instrumental bedtime music for 7 days. They concluded instrumental music was more likely to induce earworms than their lyrical counterparts (Scullin et al., 2021). However, these two studies had slightly different age ranges, with study 1 having an average age range of around 36 years old

and Study 2 having an average age range of approximately 21 years old. Furthermore, this study focuses on earworms, and not any of the other variables related to how lyrics impact overall sleep quality. In other words, the study looks at how bedtime music without lyrics negatively impacts sleep quality via induced earworms as opposed to looking at how it impacts sleep quality with the consideration of all possible variables. Lastly, neither of the studies looked at how bedtime music with lyrics impacted adolescent sleep quality.

The Gap

Although studies have already asserted that lyrical music is less likely to induce earworms than non-lyrical bedtime music, and that earworms are negatively correlated with overall sleep quality (Scullin et al., 2021), no research has actively analyzed any specific correlation between lyricism in bedtime music and overall sleep quality. Additionally, this topic has not been specifically focused on adolescents, despite adolescents being the most at risk for sleep deprivation (Owens et al., 2014). Furthermore, they only looked at sleep quality through the scope of earworms and disregarded the many other factors playing into how music impacts sleep quality. The study will explore which type of bedtime music yields better adolescent sleep quality: lyrical or non-lyrical bedtime music.

Methodology

Study Design

The method of the study addresses the question: *What are the effects of bedtime music with lyrics versus non-lyrical bedtime music on adolescent sleep quality?* The goal is to discern if lyrical or non-lyrical bedtime music yields more positive effects on adolescent sleep quality. The researcher hypothesized bedtime music containing lyrics would yield more positive impacts on adolescent sleep quality than non-lyrical bedtime music. This research could lead to a more advanced understanding of how bedtime music impacts sleep quality, allowing for scientists to be able to develop an inexpensive and accessible means for combatting adolescent sleep deprivation. It is important to realize the researcher made a significant assumption within the research question. Asking "what are the effects of bedtime music…on adolescent sleep quality?" implies they believe bedtime music is guaranteed to impact adolescent sleep quality.

A quantitative correlational study was conducted by the researcher. Due to the study mainly focusing on two variables–the frequency individuals listen to bedtime music and the overall sleep quality–across different bedtime music listening habits, a correlational study was conducted since this methodology was the best way to analyze how these two variables affect one another in different groups. Furthermore, because both frequency and sleep quality were measured numerically, a quantitative study was utilized. A survey was chosen as the instrument for

this research due to its ability to yield quantitative data, which aligns with many of the methodologies used in works (e.g., Forquer et al., 2008; Trahan et al., 2018; Scullin et al., 2021). Additionally, a correlational analysis was utilized because the study aims to discern which type of bedtime music has a stronger link to quality sleep.

Participants

The sample consisted of high school aged students (N = 36, 58.3% male, 38.9% female, 2.78% did not disclose gender) between 14 and 18 years old. Thus, the researcher chose to make the age range 14-18. The sample consisted of students from multiple public high schools. The average participant age was 16.42 years old. Not a single 14-year-old had a qualifying response for the study. 88.9% of the participants did not share a room with a sibling or another family member, while 11.1% did. Additionally, 58.3% of the students lived with 3-4 other family members, and 38.9% considered their yearly household income to be $100,000 or more.

Procedure

Before any data was collected, informed consent was received from the administrators of the public high schools (see Appendix A). The researcher reached out to five different high schools of varying economic statuses, and three of them gave informed consent for QR codes to be placed in their schools. The survey was administered digitally via google forms, and was administered between January 12, 2023 and February 10, 2023. Upon receiving informed consent form the researcher's own high school, the researcher reached out to various teachers and placed QR codes/google forms links in classrooms around the high school to effectively diffuse the survey throughout the school. These QR codes were either printed by the researcher or printed by the administrator/school staff responsible for distributing the QR code. The other principals allowed for the researcher to reach out to one or more staff members to print out the QR code and place it in their classroom for their students to access. Students completed it voluntarily during the school day whenever they had the time to do so. They were informed their responses were entirely anonymous and they were allowed to close out of the survey at any time without any sort of penalty. They were also informed they would receive nothing in return for completing the survey, and the survey would take approximately 10-15 minutes to complete.

Measures

Bedtime Music Listening Habits and Frequency. After consenting to participate in the survey, the students began section one of the survey, which asked three short questions regarding their bedtime music listening habits (See appendix B). The first question asked, "Have you listened to bedtime music in the past month while sleeping?" If the participant

answered "yes" then they were instructed to answer the next two questions before moving onto section two. If they answered "no" then they were instructed to directly move on to section two. The next two questions aimed to gain an advanced understanding of the participants' bedtime music listening habits, asking questions such as "How often have you listened to bedtime music in the past month?" This question was measured on a five-point Likert scale (1 = once or twice a month, 2 = one or twice a week, 3 = three or four times a week, 4 = almost every day, 5 = every day) to quantify the frequency participants listened to bedtime music.

Sleep Quality. The Pittsburgh Sleep Quality Index (Buysse et al., 1989) assesses participant's overall sleep quality within the past month (See appendix C). It contains 9 questions, one of which containing 10 subparts, and an additional six optional questions for the participant's bedroom partner. For this survey, the six optional questions were omitted because most participants would be too young to have a bedroom partner. Some questions from the Pittsburgh Sleep Quality Index (PSQI) include "During the past month, how would you rate your overall sleep quality?" and "During the past month, when have you usually gone to bed at night?" Responses to questions 5-8 of the survey were measured on a 4-point Likert scale   (1 = not during the past month, 2 = less than once a week, 3 = once or twice a week, 4 = three or more times a week). Additionally, question nine was measured on a separate four-point Likert scale (1 = no problem at all, 2 = only a very slight problem, 3 = somewhat of a problem, 4 = a very big problem). Afterwards, the researcher utilized all the data from the PSQI responses to calculate the overall sleep quality for each participant based on the instructions provided by Daniel J. Buysse and his colleagues (Buysse et al., 1989). This was done by organizing each response into seven different sleep components and then adding all of them together to calculate the global PSQI score (see Appendix C). The PSQI has been used in many large-scale sleep studies (see, e.g., Trahan et al., 2018; Scullin et al., 2021) further verifying it as appropriate for use in this study. The survey ended with a final section containing questions regarding demographics (i.e. race/ethnicity, gender, age, etc.).

Results

There were originally 57 responses to the survey, but after analyzing the data, 22 responses were determined unusable for the study. 16 participants were disqualified due to them submitting impossible sleep efficiency ratings. Sleep efficiency is the time an individual spends sleeping at night divided by the number of hours spent in bed and is used to measure the percentage of time spent in bed actually sleeping. These participants submitted sleep efficiency ratings over 100%, indicating they sleep for longer periods of time than they spend in bed. Additionally, five participants were disqualified from the study as they did not follow the instructions to not answer   Lastly, one participant was disqualified for

leaving an inappropriate message in an optional free response question in section two of the survey. This left the researcher with 36 usable responses for their study (N = 36).

The mean PSQI global sleep score out of all the qualifying participants was 7.83. For reference, a global PSQI score > 5 "provide[s] a sensitive and specific measure of poor sleep quality, relative to clinical and laboratory measure" (Buysse et al., 1989). Additionally, it could mean an individual has major sleeping problems in two of the seven sleep components measured, or moderate sleeping issues in three or more sleep components (Buysse et al., 1989). This indicates the average high school student has poor sleep quality on a nightly basis. Additionally, only six of the students had a PSQI score of 5 or less.
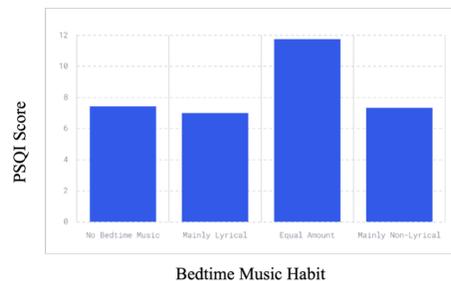

FIGURE 1. PSQI Scores Across Different Bedtime Music Habits[1]

Figure 1 shows a comparison of the average global PSQI scores of groups with different bedtime music listening habits. Lyrical bedtime music listeners had the lowest average global PSQI score, with a mean of 7.00. However, this average was relatively similar to global PSQI scores of non-bedtime music listeners (7.43) or non-lyrical bedtime music listeners (7.33). On the other hand, participants who listened to an equal amount of lyrical and non-lyrical bedtime music had an average PSQI score of 11.75. This mean score was much higher than any of the other three categories (Figure 1).

---

[1] The bar graph is divided into four different groups based on bedtime music listening habits(as shown by the key to the right of the graph). It is only examining the average PSQI scores of participants from each group.
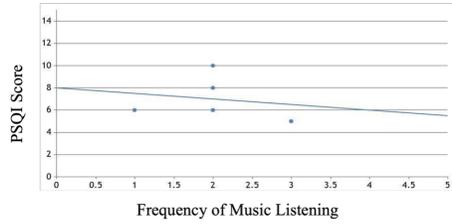
FIGURE 2. Relationship Between Frequency by which bedtime music was listened to and PSQI Score in Lyrical Bedtime Music Listeners[2]
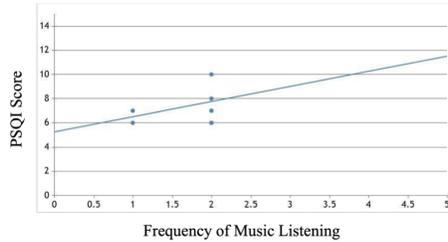

FIGURE 3. Scatter Plot of Frequency and PSQI Score in Non-Lyrical Bedtime Music Listeners[3]

Figures 2 and 3 are scatter plot graphs of two separate groups: students who mainly listen to lyrical bedtime music (Figure 2) and students who mainly listen to non-lyrical bedtime music (Figure 3). Figure 2 contained five participants (N = 5), and Figure 3 contained six participants (N = 6). Figure 2, $r(3) = -.177$, $p < .01$, shows a negative, weak but statistically significant correlation between the frequency lyrical bedtime music listeners utilize bedtime music while sleeping and their global PSQI score. Figure 3, $r(4) = .429$, $p < .001$, exemplifies a positive, moderate and statistically significant correlation between the frequency non-lyrical bedtime music listeners listen to bedtime music while sleeping and their global PSQI score.

Discussion

Bedtime music has been shown by many different studies to have a positive impact on overall sleep quality in a vast multitude of demographics, including but not limited to adolescents (Dickson & Schubert, 2020; Harmat et al., 2008; Loewy, 2020). However, very little research has been conducted on the differences of how lyrical and non-lyrical bedtime music impact sleep quality in adolescents. Based on past

---

[2] In this graph, the x-axis represents the frequency by which bedtime music was listened to and the y-axis represents the global PSQI score. "Frequency" refers to the number of times in which an adolescent listened to bedtime music in the past month measured on a five-point Likert scale (1 = once or twice a month, 2 = one or twice a week, 3 = three or four times a week, 4 = almost every day, 5 = every day) (see Appendix B).
[3] Similarly to Figure 2, the x-axis represents the frequency by which bedtime music was listened to and the y-axis represents the global PSQI score. Frequency is measured on the same Likert scale shown in Figure 2 (see Appendix B).

research, the researcher hypothesized lyrical bedtime music would have a more significant positive impact on adolescent sleep quality than non-lyrical bedtime music. Results indicate that lyrical bedtime music is slightly better for adolescent sleep quality than non-lyrical bedtime music meaning it yielded a slightly higher PSQI score.

Overall Results

Overall results indicate the average adolescent high school student gets poor sleep on a nightly basis. Figure 1 is a bar graph showing average participant global PSQI scores grouped into four separate categories: Bedtime music listeners, lyrical bedtime music listeners, individuals who equally listen to lyrical and non-lyrical bedtime music, and non-lyrical bedtime music listeners. The category with the lowest average global PSQI score was the lyrical bedtime music category. However, the average PSQI score for lyrical bedtime music listeners was not largely lower than the non-bedtime music or non-lyrical bedtime music listeners. Therefore, it can only be concluded that lyrical bedtime music is slightly better at improving sleep quality than non-lyrical bedtime music. However, the average PSQI score of the participants who equally listened to lyrical and non-lyrical bedtime music was 11.75, over four points higher than the other PSQI scores. Thus, it was concluded there is a significant difference between not listening to bedtime music and listening to lyrical or non-lyrical bedtime music on adolescent sleep quality. However, it was also concluded listening to a combination of lyrical and non-lyrical bedtime was associated with better overall on adolescent sleep quality.

Lyrical vs. Non-lyrical Bedtime Music

Figures 2 and 3 were scatter plots, in which figure 2 consisted of mainly lyrical bedtime music listeners, while Figure 3 contained non-lyrical bedtime music listeners. As reported in the results section, it was found there was a negative, weak correlation between the frequency and the global PSQI score by which bedtime music was listened to in the lyrical bedtime music group, while there was a positive, moderate correlation in the non-lyrical bedtime music group. The weak, negative but significant correlation shown in Figure 2 indicates the frequency by which an adolescent listens to lyrical bedtime music throughout the course of a month has a small, but significantly positive impact on their overall sleep quality. This could be associated with bedtime music's known ability to distract the listener from their stresses of everyday life and/or its ability to relax the listener, thus facilitating better overall sleep (Trahan et al., 2018; Dickson & Schubert, 2020). On the other hand, the moderate, positive and significant correlation shown in Figure 3 indicates the frequency by which an adolescent listens to non-lyrical bedtime music over a period of one month has a moderate and significantly negative impact on their overall sleep quality. This coincides with the results found in Michael Scullin's work, which states non-lyrical bedtime music is more likely to cause

individuals to develop earworms, which negatively impact overall sleep quality (Scullin et al., 2021). Therefore, while the average adolescent PSQI scores for lyrical and non-lyrical bedtime music listeners were nearly identical, lyrical music was found to be somewhat better for adolescents as it slightly improved sleep quality the more often adolescents listened.

Implications

The results from this study indicate not listening to bedtime music, listening to lyrical bedtime music, and listening to non-lyrical bedtime music all have a relatively similar impact on adolescent sleep quality. This indicates adolescents are best doing either of the three aforementioned options to help them fall asleep. Whichever one works best for them is likely the greatest option overall. However, the results also indicate individuals who listened to an equal amount of lyrical and non-lyrical bedtime music had a much worse average PSQI score, meaning listening to an equal amount of lyrical and non-lyrical bedtime music severely negatively impacts sleep quality. This knowledge could be useful in helping adolescents maintain decent overall sleep quality, as knowing what kind of bedtime music listening habits to not utilize could prevent some teenagers from suffering worse sleep quality. The study also compared lyrical and non-lyrical bedtime music, and how the frequency by which adolescents utilized each type of bedtime music impacted their overall sleep quality. It was found lyrical bedtime music was slightly better for adolescent sleep quality, as there was a weak, negative correlation between the frequency teenagers utilized lyrical bedtime music and PSQI score, whereas there was a moderately positive correlation between the frequency adolescents utilized non-lyrical bedtime music and PSQI score. This knowledge could be helpful for doctors trying to treat individuals with sleep problems, as they could recommend patients to try using lyrical bedtime music if they have not done this yet.

Conclusion

Sleep is an important part of adolescence, allowing for teenagers to healthily develop into adulthood. However, sleep deprivation is a common ailment leading to mental health issues like depression or suicidal thoughts, as well as obesity. This study sought to discern the differences between lyrical and non-lyrical bedtime music on adolescent sleep quality. It was deduced that average teenage high school students get relatively poor sleep on a nightly basis, and there were no major differences in average PSQI scores between teenage non-bedtime music listeners, teenagers lyrical bedtime music listeners, and teenager non-lyrical bedtime music listeners. However, it was found adolescents who listened to an equal amount of lyrical and non-lyrical bedtime music had a much worse average PSQI score. Additionally, results indicated lyrical music was slightly better for adolescent sleep quality than non-lyrical bedtime music.

Based on the results, it is recommended adolescents adopt whatever bedtime music habits they feel is necessary and mainly stick to one type of bedtime music if they choose to listen to any at all.

Limitations

The only major limitation the researcher encountered was the major differences in sample sizes for the different bedtime music listening habits. For instance, there were 21 participants who did not listen to bedtime music, but there was an average of five participants for the other three categories used in Figure 1. However, this difference gave the researcher insight into how widely used different forms of bedtime music were by the general adolescent population. Furthermore, the differences in sample sizes did not hinder the researcher's ability to calculate the data. Additionally, the overall sample size for this experiment was extremely small, meaning the findings from the data may not be reliable. More research on this topic may need to be done on a broader scale to verify the findings from this study.

Future Studies

While this study analyzed how lyrical and non-lyrical bedtime music impacted adolescent sleep quality, it did not look at how listening to the aforementioned bedtime music types impacted the brain. In the future, a researcher could analyze how listening to lyrical and non-lyrical bedtime music during adolescence impacts brain development. This could also be accomplished by gathering a group of teenagers, analyzing their brains and recording their bedtime music listening habits, and then re-analyzing their brains a decade later to see if there were any stark differences in overall brain development between the different music listening habits.

References

Åkerstedt, T., Kecklund, G., & Axelsson, J. (2007). Impaired sleep after bedtime stress and worries. *Biological Psychology*, 76(3), 170–173. https://doi.org/10.1016/j.biopsycho.2007.07.010

Altan Sarikaya, N., & Oğuz, S. (2016). Effect of passive music therapy on sleep quality in elderly nursing home residents. *Journal of Psychiatric Nursing*, 7(2), 55-60. https://doi.org/10.5505/phd.2016.05900

Bowers, J. P., Casselberry, J. J., Isbell, D., Kyakuwa, J., Li, Y., Mercado, E. M., & Wallace, E. M. (2019). A descriptive study of the use of music during naptime in Louisiana Child Care Centers. *Journal of Research in Childhood Education*, 33(2), 212–224. https://doi.org/10.1080/02568543.2019.1577770

Buysse, D. J., Reynolds, C. F., III, Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. Psychiatry Research, 28(2),

193–213. https://doi.org/10.1016/0165-1781(89)90047-4

Chen, C. K., Pei, Y. C., Chen, N. H., Huang, L. T., Chou, S. W., Wu, K. P., Ko, P. C., Wong, A. M. K., & Wu, C. K. (2014). Sedative music facilitates deep sleep in young adults. *The Journal of Alternative and Complementary Medicine,* 20(4), 312-317. https://doi.org/10.1089/acm.2012.0050

Chlan, L. L., & Heiderscheit, A. (2014). Music intervention. In R. Lindquist, M. Snyder, & M. F. Tracy (Ed.), *Complementary and alternative therapies in nursing* (7th ed., pp. 99-116). Springer Publishing Company. http://stikespanritahusada.ac.id/wp-content/uploads/2017/04/Ruth-Lindquist-PhD-RN-APRN-BC-FAAN_-Mariah-Snyder-PhD_-Mary-Frances-Tracy-PhD-RN-CCNS-FAAN-Complementary-Alternative-Therapies-in-Nursing_-Seventh-Edition-Springer-Publishing-Company-2013.pdf#page=126

Cordi, M. J., Ackermann, S., & Rasch, B. (2019). Effects of relaxing music on healthy sleep. *Scientific Reports*, 9(9079), 1-9. https://doi.org/10.1038/s41598-019-45608-y

De Niet, G., Tiemens, B., Lendemeijer, B. & Hutschemaekers, G. (2009). Music-assisted relaxation to improve sleep quality: Meta-analysis. *Journal of Advanced Nursing*, 65(7), 1356-1364. https://doi.org/10.1111/j.1365-2648.2009.04982.x

Dickson, G. T., & Schubert, E. (2020). Musical features that aid sleep. *Musicae Scientiae*, 1-19. https://doi.org/10.1177/1029864920972161

Eggermont, S., & Van den Bulck, J. (2006). Nodding off or switching off? The use of popular media as a sleep aid in secondary-school children. *Journal of Paediatrics & Child Health*, 42(7/8), 428–433. https://doi.org/10.1111/j.1440-1754.2006.00892.x

Field, T. (1999). Music enhances sleep in preschool children. *Early Child Development and Care*, 150(1), 65–68. https://doi.org/10.1080/0300443991500106

Forquer, L. M., Camden, A. E., Gabriau, K. M., & Johnson, C. M. (2008). Sleep patterns of college students at a public university. *Journal of American College Health*, 56(5), 563-565. https://doi.org/10.3200/JACH.56.5.563-565

Gao, D., Long, S., Yang, H., Cheng, Y., Guo, S., Yu, Y., Liu, T., Dong, L., Lu, J., & Yao, D. (2020). SWS brain-wave music may improve the quality of sleep: An EEG study. *Frontiers in Neuroscience*, 14(67), 1-7. https://doi.org/10.3389/fnins.2020.00067

Harmat, L., Takács, J., & Bódizs, R. (2008). Music improves sleep quality in students. *Journal of Advanced Nursing*, 62(3), 327-335. https://doi.org/10.1111/j.1365-2648.2008.04602.x

Hernández-Ruiz, E. (2005). Effect of music therapy on the anxiety levels and sleep patterns of abused women in shelters. *Journal of Music Therapy*, 42(2), 140-158. https://doi.org/10.1093/jmt/42.2.140

Jespersen, K.V., Koenig, J., Jennum, P., & Vuust, P. (2015). Music for insomnia in adults. *Cochrane Database of Systematic Reviews*, (8).

https://doi.org/10.1002/14651858.CD010459.pub2

Johnson, J. E. (2003). The use of music to promote sleep in older women. *Journal of Community Health Nursing*, 20(1), 27-35. https://doi.org/10.1207/S15327655JCHN2001_03

Johnson, J. M., & Durrant, S. J. (2021). Commentary: SWS brain-wave music may improve the quality of sleep: An EEG study. *Frontiers in Neuroscience*, 15(609169), 1-3. https://doi.org/10.3389/fnins.2021.609169

Kavurmaci, M., Dayapoğlu, N., & Tan, M. (2020). Effect of music therapy on sleep quality. *Alternative Therapies in Health & Medicine*, 26(4), 22–26. https://www.researchgate.net/publication/333949636_Effect_of_Music_Therapy_on_Sleep_Quality

Koenig, J., Jarczok, M. N., Warth, M., Harmat, L., Hesse, N., Jespersen, K. V., Thayer, J. F., & Hillecke, T. K. (2013). Music listening has no positive or negative effects on sleep quality of normal sleepers: Results of a randomized controlled trial. *Nordic Journal of Music Therapy*, 22(3), 233–242. https://doi.org/10.1080/08098131.2013.783095

Lafçi, D., & Öztunç, G. (2015). The effect of music on the sleep quality of breast cancer patients. *International Journal of Caring Sciences*, 8(3), 633.

Lai, L. H. & Good, M. (2005). Music improves sleep quality in older adults. *Journal of Advanced Nursing*, 49(3), 234-244. https://doi.org/10.1111/j.1365-2648.2006.03693.x

Lazic, S.E. & Ogilvie, R.D. (2007). Lack of efficacy of music to improve sleep: A polysomnographic and quantitative EEG analysis. *International Journal of Psychophysiology*, 63(3), 232-239. https://doi.org/10.1016/j.ijpsycho.2006.10.004

Loewy, J. (2020). Music therapy as a potential intervention for sleep improvement. *Nature and Science of Sleep*, 12, 1–9. https://doi.org/10.2147/nss.s194938

Loewy, J., Stewart, K., Dassier, A. M., Tesla, A., & Hornel, P. (2013). The effects of music therapy on vital signs, feeding, and sleep in premature infants. *Pediatrics*, 131(5), 902-918. https://doi.org/10.1542/peds.2012-1367

Majeed, N. M., Lua, V. Y. Q., Chong, J. S., Lew, Z., & Hartanto, A. (2021). Does bedtime music listening improve subjective sleep quality and next-morning well-being in young adults? A randomized cross-over trial. *Psychomusicology: Music, Mind & Brain*, 31(3–4), 149–158. https://doi.org/10.1037/pmu0000283

McFarlane, S.J., Garcia, J.E., Verhagen, D.S., & Dyer, A.G. (2020). Alarm tones, voice warnings, and musical treatments: A systematic review of auditory countermeasures for sleep inertia in abrupt and causal awakenings. *Clocks & Sleep*, 2(4), 416-433. https://doi.org/10.3390/clockssleep2040031

Owens, J., The Adolescent Sleep Working Group, & The Committee on Adolescence. (2014). Insufficient sleep in adolescents and young adults: An update on causes and consequences. *Pediatrics*, 134(3) e921-e932. https://doi.org/10.1542/peds.2014-1696

Scullin, M. K., Gao, C., & Fillmore, P. (2021). Bedtime music, involuntary musical imagery, and sleep. *Psychological Science* (0956-7976), 32(7), 985–997. https://doi.org/10.1177/0956797621989724

Trahan, T., Durrant, S. J., Müllensiefen, D., & Williamson, V. J. (2018). The music that helps people sleep and the reasons they believe it works: A mixed methods analysis of online survey reports. *PLoS ONE*, 13(11), 1–19. https://doi.org/10.1371/journal.pone.0206531

Tuft, C., Matar, E., Schrire, Z. M., Grunstein, R. R., Yee, B. J., & Hoyos, C. M. (2023). Current Insights into the Risks of Using Melatonin as a Treatment for Sleep Disorders in Older Adults. In *Clinical Interventions in Aging* (Vol. 18, pp. 49–59). Dove Medical Press Ltd. https://doi.org/10.2147/CIA.S361519

Uhlig, S., Groot, J., Jansen, E., & Scherder, E. (2019). Rap & sing music therapy and sleep in adolescents: A single-blind cluster randomized control trial. *Nordic Journal of Music Therapy*, 28(1), 60-70. https://doi.org/10.1080/08098131.2018.1542613

Appendices Table of Contents

Blank Copy of Administrator Consent Form
Note: The researcher's personally identifiable information has been crossed out to maintain anonymity. This form was utilized for all participating institutions.

Administrative Consent Form

Title of the Study: Lyrics Versus No Lyrics: The Role of Music in Adolescent Sleep Quality
Researcher Name:

The purpose of this research study is to conduct research on how bedtime music with and without lyrics can impact the sleep quality of teenagers. The purpose of your participation in this study is to help the researcher collect data on adolescent bedtime music listening habits and sleep habits/sleep quality through the use of a survey. Your high school was selected as a possible participant in this study because it contains a large number of students ages 14-18 that would qualify to take the survey and would provide a service for the research study with regard to data

collection.

While participating in this study, your students will be asked to fill out a survey asking about their bedtime music listening habits, sleep quality in the past month, and general demographic information. The survey will take approximately 10-15 minutes to complete, and it will be completed independently. Each participant will be shown a separate consent form in the first section of the survey, and will have to check a box indicating that they have read the form and consent to their data being used in the research. The remainder of the survey is divided into three sections. The first section aims to garner an understanding of the participant's bedtime music listening habits, with questions such as "Do you listen to bedtime music while sleeping?" and "How often have you listened to bedtime music while sleeping in the past month?" The second part of the survey will ask questions pertaining to the participant's sleep quality throughout the past month, with questions such as "During the past month, how many hours of actual sleep did you get at night?" and "During the past month, how would you rate your sleep quality overall?" The third part contains questions relating to demographic data, with questions such as "What is your age?" and "What is your ethnicity?" Besides the questions regarding demographics, the survey will not ask for any personal information (name, address, etc.) and will remain entirely anonymous.

If you agree for ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮ to participate in this research study, the following will occur: You will be sent a link for the survey, which is a Google Form, and you will be sent the QR code for the survey. You will be asked to send the links to all of your teachers so that they can distribute them to their students, and to place the QR codes around the school building for students to access during a time period in which they would have access to their personal cell phones. Additionally, you will be asked to inform the students of this survey through your school's announcements, stating that it is for students ages 14-18, it is about "the impact of different kinds of bedtime music on sleep quality," and that it will be available to fill out through February 10. The collection of data will last approximately 4 weeks; from January 12, 2023 to February 10, 2023. After this, the survey will be locked from submissions and you will be instructed to take down the QR codes. The data will be analyzed via a quantitative correlational analysis and stored in a safe thumbdrive with the researcher until the project is over, and then the data will be stored with the researcher's teacher for at least seven years. Findings from this study will be used to gain a better understanding of what types of bedtime music will facilitate the best sleep quality in adolescents. Furthermore, data from this study will be used in a student thesis that presents the findings of the research, as well as an oral defense presentation to the instructor of Advanced Placement Capstone Research, as well as a board that is created in response to the content of the study.

Findings of the research have the potential to be published in a scholarly journal.

I hereby give my consent for my students to participate in this research study. I acknowledge that the researcher has provided me with:

A. An explanation of the study's purpose and procedure.

B. Answers to any questions I have asked about the study procedure.

I understand that:

A. My students' participation in this study will take approximately four weeks.

B. Participating in this research may result in slight discomfort due to the specificity of certain questions regarding sleep habits. Furthermore, questions regarding general demographics may cause participants to feel uncomfortable.

C. Research sessions will not be held when important academic material is being covered.

D. The potential benefits of this study include development of a better overall understanding of how different types of bedtime music impact adolescent sleep quality. Additionally, this survey requires participants to examine their own sleep habits, which could cause these students to realize that they need to make adjustments to their sleep schedules/habits in order to better their quality of life.

E. My students will not be compensated for participating in this study.

F. My decision to allow my students to participate is voluntary, and I may withdraw my consent and discontinue my students' participation in the study at any time. My refusal to allow students to participate will not result in any penalty or disadvantage for me or my students.

G. In addition to my written consent, my students will give informed consent to participate in the research via a checkbox at the beginning of the survey that they are required to select in order to continue. My students will be able to discontinue their participation at any time, without penalty, and this will be explained to them before they agree.

H. My students' responses in this study will be kept confidential, to the extent permitted by law. The data will be stored in a password protected computer and a thumb drive that will be stored in the researcher's bedroom, will be available to the researcher, and research reports will only present findings on a group basis, without any personally identifying information of me or my students.

Name of School (Printed):

_____

Name of Administrator (Printed):

_____

Administrator Signature: _____
          Date: _____

Appendix B. Section 1 of Survey
1. Do you listen to bedtime music while sleeping? y/n
2. <u>If you answered yes to question 1, please answer the following two questions. If you answered no, skip to part 2</u>: How often have you listened to bedtime music while sleeping in the past month?
   Not during the past month _____ Once or twice a month _____

   Once or twice a week_____ Three or four times a week _____

   Almost every day _____ Every day _____
3. Do you listen to bedtime music with or without lyrics?
   N/A _____ I only listen to bedtime music with lyrics _____

   More often than not, I listen to bedtime music with lyrics _____
   I listen to an equal amount of bedtime music with lyrics and bedtime music without lyrics _____
   More often than not, I listen to bedtime music without lyrics. ____
   I only listen to bedtime music without lyrics _____

Appendix C. Pittsburgh Sleep Quality Index (Buysse et al., 1989)
The following questions relate to your usual sleep habits during the past month *only*.
1. During the past month, when have you usually gone to bed at night?
   USUAL BED TIME _____
2. During the past month, how long (in minutes) has it usually taken you to fall asleep each night?
   NUMBER OF MINUTES _____
3. During the past month, when have you usually gotten up in the morning?
   USUAL GETTING UP TIME _____
4. During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spend in bed.)
   HOURS OF SLEEP PER NIGHT _____

For the remaining questions, check the one best response. Please answer *all* questions.

5. During the past month, how often have you had trouble sleeping because you…

a) Cannot get to sleep within 30 minutes

Not during the past month _____   Less than once a week _____

Once or twice a week _____   Three or more times a week _____

b) Wake up in the middle of the night or early morning

Not during the past month _____   Less than once a week _____

Once or twice a week _____   Three or more times a week _____

c) Have to get up to use the bathroom

Not during the past month _____   Less than once a week _____

Once or twice a week _____   Three or more times a week _____

d) Cannot breathe comfortably

Not during the past month _____   Less than once a week _____

Once or twice a week _____   Three or more times a week _____

e) Cough or snore loudly

Not during the past month _____   Less than once a week _____

Once or twice a week _____   Three or more times a week _____

f) Feel too cold

Not during the past month _____   Less than once a week _____

Once or twice a week _____   Three or more times a week _____

g) Feel too hot

Not during the past month _____   Less than once a week _____

Once or twice a week _____   Three or more times a week _____

h) Had bad dreams

Not during the past month _____   Less than once a week _____

Once or twice a week _____   Three or more times a week _____

i) Have pain

Not during the past month _____   Less than once

a week _____
Once or twice a week _____   Three or more times a week _____

j) Other reason(s), please describe _____ How often during the past month have you had trouble sleeping because of this? Not during the past month _____   Less than once a week _____
Once or twice a week _____   Three or more times a week _____

6. During the past month, how would you rate your sleep quality overall?
Very good _____   Fairly good _____   Fairly bad _____ Very bad _____

7. During the past month, how often have you taken medicine (prescribed or "over the counter") to help you sleep?
Not during the past month _____   Less than once a week _____

Once or twice a week _____   Three or more times a week _____

8. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?
Not during the past month _____   Less than once a week _____

Once or twice a week _____   Three or more times a week _____

9. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?
No problem at all _____   Only a very slight problem _____

Somewhat of a problem _____   A very big problem _____

Scoring:

Questions are divided into 7 components:

Subjective Sleep quality item(s): 6
Sleep Latency Item(s): 2, 5a
Sleep Duration Item(s): 4
Habitual Sleep Efficiency Items(s): 4, 3, 1
Sleep Disturbances Item(s): 5b-5j
Use of Sleeping Medication Item(s): 7
Daytime Dysfunction Item(s): 8, 9

All items were scored from 0-3 for calculations only. For the Sleep

Latency, Sleep Disturbances, and Daytime Dysfunction components, the scores of the items were added together to create the score for each component. For instance, for the Sleep Latency Component, the scores for items 2 and 5a were added together to create the overall score for that component. For the Habitual Sleep Efficiency component, the time from item 1 was subtracted from the time for item 3 to calculate the number of hours spent in bed. Then, the number of hours slept (item 4) was divided by the number of hours spent in bed and then multiplied by 100 to calculate the habitual sleep efficiency percentage. If the percentage was greater than 85%, the participant received a score of 0 for the component. If the percentage was between 75 and 84, the participant received a score of 1 for the component. If the percentage was between 65 and 74, the participant received a score of 2 for the component. If the percentage was less than 65%, the participant received a score of 3 for the component.

The scores of components 1-7 were added together to calculate the overall sleep score for each participant, which was used to measure the overall sleep quality of each participant.