The effect of music on sleep in hospitalized patients: A systematic review and meta-analysis

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ABSTRACT

Sleep is often severely disturbed in hospitalized patients due to multiple factors such as noise, pain, and an unfamiliar environment. Since sleep is important for patient recovery, safe strategies to improve sleep in hospitalized patients are warranted. Music interventions have been found to improve sleep in general, and the aim of this systematic review is to assess the effect of music on sleep among hospitalized patients. We searched 5 databases to identify randomized controlled trials evaluating the effect of music interventions on sleep in hospitalized patients. Ten studies including a total of 726 patients matched the inclusion criteria. The sample sizes ranged from 28 to 222 participants per study. The music interventions varied in how the music was chosen as well as duration and time of day. However, in most studies, participants in the intervention group listened to soft music for 30 minutes in the evening. Our meta-analysis showed that music improved sleep quality compared to standard treatment (standardized mean difference 1.55 [95% CI 0.29-2.81], z = 2.41; p = 0.0159). Few studies reported other sleep parameters, and only one study used polysomnography for objective sleep measurement. No adverse events were reported in any of the trials. Hence, music may constitute a safe and low-cost adjunctive intervention to improve sleep in hospitalized patients. Prospero registration number: CRD42021278654.

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Introduction

Hospitalized patients often suffer from severe sleep disturbances with negative consequences for health outcomes.1-4,7 A large-scale study comparing sleep in the general hospital wards to habitual sleep at home found that self-reported sleep quality and quantity was significantly reduced during hospitalization due to factors such as noise, anxiety, medical devices, and pain.5 Similarly, studies show poor quality and quantity of sleep in intensive care patients using both self-report and objective measures of sleep such as polysomnography.6,7

Sleep difficulties at the hospital is a multifactorial issue caused by both environmental factors, medications, hospital procedures, and the critical illness itself.3,6 Sleep is essential for recovery, and in hospital care, disrupted sleep is associated with impaired immune functioning, poor resistance to infections, and reduced cognitive function.1,4,7 Therefore, interventions to improve sleep during hospitalization are essential to ensure optimal recovery.

Pharmacological interventions can increase the risk of polypharmacy,8 and therefore there has been a great interest in nonpharmacological interventions to promote sleep in hospitals.3,9-11 Listening to music is commonly used as a strategy to improve sleep in the general population,12-14 and music has been found effective for improving sleep quality in various populations with poor sleep.15 Music neuroscience has documented effects of music on the human body, mind, and brain,16 and it is increasingly used as an intervention in health care settings.17 In relation to the impact of music on sleep at hospitals, several mechanisms are relevant. Firstly, music can reduce physiological arousal as measured by heart rate, blood pressure, and stress hormone levels. The reduction of physiological arousal is important to facilitate the transition from wakefulness to sleep. A large meta-analysis including 61 studies found a significant reduction in measures of physiological arousal in participants receiving music interventions compared to controls.18 In addition, experimental studies show that bodily responses are closely linked to the music characteristics with slow, predictable music facilitating relaxation, whereas fast and dynamic music can increase cardiovascular and respiratory activity.19,20 Secondly, music can

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reduce pain and anxiety in hospitalized patients. This is important to sleep as both pain and anxiety are mentioned as main factors disturbing sleep in hospitalized patients. Music for postoperative recovery has received a lot of attention, and large systematic reviews document a beneficial effect of music for decreasing pain and anxiety in relation to medical procedures. Here, the patient influence on music choice seems to be an important factor mediating the analgesic and anxiolytic effect. A third mechanism underlying the influence of music on sleep in hospitalized patients is the ability of music to mask external noise. Noise is a major factor disturbing sleep in hospitals, and by creating a stable, soothing auditory environment, music can cover the environmental noise and thereby facility better circumstances for sleep. In summary, listening to music can address some of the factors disturbing sleep in hospitalized patients, and the aim of the systematic review is to evaluate the effect of music as sleep aid in a hospital setting.

Methods

This review was conducted following the Preferred Reporting Items for Systematic reviews and Meta-Analyses guidelines (see Supplementary Table A.1). The protocol was registered a priori in the Prospero database (registration number: CRD4201278654).

Eligibility criteria

The following were the pre-defined inclusion criteria for this systematic review: randomized controlled trials (RCTs) investigating the effect of listening to music for improving sleep in hospitalized adults (age < 18). We did not specify the cause of admission, only that participants had to receive the intervention during hospitalization. We included interventions where the patient listened to pre-recorded music to improve sleep. Nature sounds were considered only when they were used in combination with music. The music intervention could be with or without additional instructions, and it could be selected by the participant, by researchers, or by hospital personnel. The intervention group had to be compared to a control group receiving treatment as usual. Studies were excluded if conducted at a rehabilitation center or using active music therapy intervention. Furthermore, we excluded review papers and conference abstracts.

Search methods

We searched 5 different databases (PubMed, Scopus, Embase, PsycINFO, and Cinahl) to identify potentially relevant studies. We included peer-reviewed studies with no limit on the date of publication. For the database searches, we used the following search string: (Sleep OR Insomnia) AND music AND (RCT OR randomized controlled trial OR random* controlled trial) AND (hospital* OR clinic*) NOT infant* (see Supplementary Table A.2). In addition to the database searches, we screened other relevant sources such as reviews and reference lists of the included studies.

Selection of studies and data extraction

Study selection and data extraction were done independently by 2 authors (K.V.J. and M.H.H.) using the online software Covidence. After duplicates were removed, the titles and abstracts were screened to identify potentially relevant papers. Next, full-text articles were retrieved and assessed in detail according to the inclusion and exclusion criteria. Disagreements were resolved through discussion. The relevant information from the included studies was extracted using a standardized, predesigned extraction sheet.

Extracted data included 1) citation details, 2) methods, 3) patient and intervention characteristics, and 4) outcomes.

The primary outcome was subjective measurements of sleep quality measured by questionnaires or rating scales. Secondary outcomes included other sleep parameters such as total sleep time (TST), Sleep Onset Latency (SOL), sleep efficiency, sleep fragmentation, and the degree of restorative sleep measured by subjective ratings in sleep logs or objective methods such as actigraphy and polysomnography.

Quality assessment

To assess the quality of the included studies, we used the Cochrane risk of bias assessment tool. The assessment was conducted individually by 2 researchers (K.V.J. and M.H.H.) using Covidence. Disagreements were resolved by discussion. Each study was rated at low, high, or unclear risk in 7 domains: 1) random sequence generation (selection bias), 2) allocation concealment (selection bias), 3) blinding of outcome assessors (detection bias), 4) blinding of participants and personnel (performance bias), 5) incomplete outcome data (attrition bias), 6) selective reporting (reporting bias), and 7) risk of other bias (eg, baseline differences or different procedures in intervention and control groups). The unclear risk of bias rating was used when there was insufficient information to determine if the risk of bias was high or low on a given domain.

Synthesis of results

Results from all studies were summarized narratively. Studies reporting on the primary outcome ‘Sleep quality’ were eligible for inclusion in the meta-analysis. In case of insufficient data, we contacted the authors asking for additional information. Results were synthesized using the inverse-variance method in a random effects model, and forest plots were used for visualization of the results. The restricted maximum likelihood-estimator was used to calculate the between-study variance. The outcome was continuous, and we used standardized mean differences (SMD) when the outcome was measured on different scales. Due to small sample sizes, we corrected for small-sample bias by using Hedges’ g for the effect size calculation. In case of differences in the direction of the scales (eg, one scale increases with symptom severity, whereas another decreases with symptoms severity), we reversed the relevant scales by subtracting the mean value from the maximum value of the scale to ensure the same directionality as recommended by the Cochrane Handbook of Systematic reviews. Statistical heterogeneity was assessed using I² statistics and explored via detection of outliers and influential cases. Outliers were defined as studies where the study confidence interval (CI) did not overlap with the CI of the pooled effect. Risk of publication bias was assessed with funnel plots.

All analyses were carried out in R version 4.0.2 using the packages ‘meta’ and ‘dmetar’.

Results

The database searches were conducted in June 2022. We identified 1101 records after removing duplicates. In the screening of title and abstract, 1072 records were excluded leaving 29 records for full-text retrieval. Of these 29 studies, 10 studies matched the criteria of this review and were included (see Fig. 1).

Characteristics of the included studies are shown in Table 1. The studies were published between 1996 and 2020. Two studies were conducted in China, 3 in Korea, and the others were conducted in Taiwan, Denmark, Italy, Turkey, and USA. All studies were RCTs comparing the effect of a music intervention to a treatment-as-usual...
(TAU) control group. In 2 studies, the control participants had 30 minutes scheduled rest at the same time as the music intervention, and 3 studies specified the use of eye mask and earplugs as part of TAU. Two studies used a design with 3 groups. The study by Zimmerman and colleagues had a music video group in addition to the music listening and the TAU group, and the study by Kim and colleagues had a third group receiving interactive music therapy. The data from these different interventions were not included.

The sample size of the studies ranged from 28 to 222 participants and comprised a total number of 726 participants included in this review. The reason for hospitalization varied. Two trials recruited participants from patients in the intensive care unit (ICU) without further information on diagnosis. 4 trials included patients undergoing cardiothoracic surgery, and the remaining trials included oncology patients, patients undergoing liver transplantation, colorectal surgery, or major surgery. All studies used pre-recorded music. The music was generally described as soft and relaxing, including mainly classical music and New Age tracks with nature sounds. Most studies used music selected by the researcher, but 3 studies gave the participants a choice among a number of playlists of different genres such as western classical, folk, pop, or New Age, and one study used music with guided imagery. The duration of the music ranged from 30 to 240 minutes with most studies using a 30-minute listening period. The timing of the intervention was most often in the evening around bedtime. Two studies had more than one intervention session per day, and the intervention period ranged from 1 to 7 days.

A number of different questionnaires were used to evaluate sleep quality. Four studies applied the Richards-Campbell Sleep questionnaire, which was developed to measure sleep in the critically ill. The mean of the 5 included items comprises a total score with higher scores indicating better quality of sleep. The Richards-Campbell Sleep questionnaire assesses the sleep of the previous night, and tests show good scores of reliability and validity. Three studies used the Verran and Snyder-Halpern Sleep Scale. The Verran and Snyder-Halpern Sleep Scale was developed as an easy tool to measure quality of sleep the previous night. It includes 8 items summarized in a total score ranging from 0 to 80 with higher scores indicating better sleep. The scale has shown good psychometric properties.

The remaining studies used the Pittsburgh Sleep Quality Index (PSQI), a Visual Analogue Scale (VAS), and the Leeds Sleep

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**Fig. 1.** PRISMA flow chart showing the number of studies identified, screened, excluded, and included.
Table 1: Characteristics of the included studies

<table>
<thead>
<tr>
<th>N</th>
<th>Country</th>
<th>Reason for hospitalization</th>
<th>Control group</th>
<th>Mean age (years)</th>
<th>Music intervention period (days)</th>
<th>Intervention duration (min)</th>
<th>Timing of sleep measure</th>
<th>Who chose the music</th>
<th>Sleep measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td>Denmark</td>
<td>Coronary artery bypass surgery</td>
<td>TAU</td>
<td>63</td>
<td>Daytime rest</td>
<td>30</td>
<td>Daytime rest</td>
<td>Researcher</td>
<td>RCSQ</td>
</tr>
<tr>
<td>35</td>
<td>China</td>
<td>Cardiac surgery</td>
<td>ICU postoperative care</td>
<td>51.7</td>
<td>Daytime rest</td>
<td>30</td>
<td>Daytime rest</td>
<td>Researcher</td>
<td>RCSQ</td>
</tr>
<tr>
<td>69</td>
<td>Turkey</td>
<td>Breast cancer</td>
<td>TAU</td>
<td>46.4</td>
<td>Daytime rest</td>
<td>30</td>
<td>Daytime rest</td>
<td>Researcher</td>
<td>RCSQ</td>
</tr>
<tr>
<td>37</td>
<td>South Korea</td>
<td>Liver transplant</td>
<td>TAU</td>
<td>55.7</td>
<td>Daytime rest</td>
<td>30</td>
<td>Daytime rest</td>
<td>Participant choice among pre-defined playlists</td>
<td>RCSQ</td>
</tr>
<tr>
<td>86</td>
<td>Italy</td>
<td>Colorectal surgery</td>
<td>TAU</td>
<td>46</td>
<td>Daytime rest</td>
<td>30</td>
<td>Daytime rest</td>
<td>Researcher</td>
<td>RCSQ</td>
</tr>
<tr>
<td>13</td>
<td>Taiwan</td>
<td>Cardiac surgery</td>
<td>TAU</td>
<td>61.2</td>
<td>Daytime rest</td>
<td>30</td>
<td>Daytime rest</td>
<td>Researcher</td>
<td>RCSQ</td>
</tr>
<tr>
<td>33</td>
<td>South Korea</td>
<td>Lung transplant</td>
<td>TAU</td>
<td>61.8</td>
<td>Daytime rest</td>
<td>30</td>
<td>Daytime rest</td>
<td>Researcher</td>
<td>RCSQ</td>
</tr>
<tr>
<td>28</td>
<td>China</td>
<td>MVR</td>
<td>TAU</td>
<td>55.3</td>
<td>Daytime rest</td>
<td>30</td>
<td>Daytime rest</td>
<td>Participant choice among pre-defined playlists</td>
<td>RCSQ</td>
</tr>
<tr>
<td>222</td>
<td>Taiwan</td>
<td>ICU patients</td>
<td>TAU</td>
<td>67</td>
<td>Daytime rest</td>
<td>30</td>
<td>Daytime rest</td>
<td>Participant choice among pre-defined playlists</td>
<td>RCSQ</td>
</tr>
</tbody>
</table>

CABG, Coronary Artery Bypass Graft; ICU, Intensive Care Unit; MVR, Mitral valve replacement; RCSQ, Richards-Campbell Sleep Questionnaire; TAU, Treatment as usual; VAS, Visual Analogue Scale measuring sleep quality; VSH, Veran and Snyder-Halpern sleep scale.

Risk of bias

All 10 studies were evaluated for risk of bias using the Cochrane Risk of Bias assessment tool. We graded each study at high, low, or unclear risk of bias in 7 domains: random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessors, incomplete outcome data, selective reporting, and other sources of bias (see Supplementary Fig. A.1).

Most studies had adequate procedures for randomization and allocation concealment, but 3 studies did not provide information on sequence generation and were rated as being at unclear risk of bias. Similarly, 4 studies did not provide information on allocation concealment procedures and were rated as being at unclear risk of bias in this domain. Because of the nature of the intervention, it is not possible to blind participants to the intervention, and it can be challenging to blind personnel. Therefore, all studies were judged to be at high risk of bias on this domain. However, it is possible to blind outcome assessors, and 2 studies did this resulting in low risk of bias judgements. Some studies provided no information, and 2 studies reported no blinding of outcome assessors resulting in high risk of bias. All studies had adequate reporting of attrition and missing data and were consequently judged to be at low risk of bias in the 'incomplete outcome data' domain. Most studies were also at low risk of bias related to selective reporting, but 2 studies had limited reporting of the results for all groups and were rated to be at unclear risk of bias on this domain. The assessment of other bias was based on risk of bias not included in the previous categories. Here, we assessed 8 studies to be at low risk of bias, and 2 studies were rated to be at unclear risk of other bias. One study reported baseline differences in melatonin levels and pre-operative insomnia which could lead to bias, and the other study lacked baseline information.

The funnel plot evaluating risk of publication bias reflected a much higher effect size and a larger standard error in the study by Lafci & Öztunc compared to the remaining studies that appeared randomly scattered in the plot (see Supplementary Figs. A.2 and A.3). Egger’s test did not indicate publication bias (Intercept = 3.735, CI -4.44 to -11.91, t = 0.895, p = 0.4052197).

Primary outcome

The pre-defined primary outcome was sleep quality of the hospitalized patients. All 10 studies reported on quality of sleep using self-report questionnaires. The meta-analysis showed that music improved sleep quality in patients listening to music compared to controls (SMD 1.55 [95% CI 0.29-2.81], z = 2.41; p = 0.0159) (see Fig. 2). Heterogeneity was high (I² = 93%), and we identified the
study by Lafci & Oztunc as an outlier given that the CI of this study (SMD 7.82 [95% CI 6.29-9.35]) did not overlap with the CI of the pooled effect (SMD 1.55 [95% CI 0.29-2.81]). Running the meta-analysis without this outlier study reduced heterogeneity ($I^2 = 85\%$), changed the effect estimate to SMD 0.94, and narrowed the range of the 95% CI (9 RCTs, SMD 0.94 [95% CI 0.51-1.31], $z = 4.97$, $p < 0.0001$).

**Subgroup analyses**

For the 10 studies reporting sleep quality outcomes, we conducted 5 subgroup analyses to investigate the influence of the music duration, the number of music listening sessions, timing of the intervention, who chose the music and the reason for hospitalization. The subgroup analyses showed a larger effect with longer exposure time to the music intervention. However, this effect was driven by the outlier study by Lafci & Oztunc (2015) which also differs in other aspects such as a longer intervention period and the use of a different questionnaire for assessing sleep quality. When running the analysis without this study, there was no difference in the effect of studies using a 30-minute or 45-52 minutes intervention time (see Table 2). The results of the subgroup analyses showed a trend towards a larger effect for patients undergoing cardiac surgery compared to other patient groups and no differences in the effect based on number of music listening sessions, timing of the intervention, or who selected the music.

---

**Table 2**

<table>
<thead>
<tr>
<th>Subgroup analyses</th>
<th>$g$</th>
<th>95% CI</th>
<th>n studies</th>
<th>$I^2$</th>
<th>$p$-Subgroup</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Music duration</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 min</td>
<td>0.88</td>
<td>0.43-1.33</td>
<td>7</td>
<td>88%</td>
<td>0.3100*</td>
</tr>
<tr>
<td>45-52 min</td>
<td>1.22</td>
<td>0.75-1.68</td>
<td>2</td>
<td>0%</td>
<td>0.001</td>
</tr>
<tr>
<td>240 min</td>
<td>7.82</td>
<td>6.29-9.35</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Number of sessions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.9572*</td>
</tr>
<tr>
<td>1 session</td>
<td>0.92</td>
<td>0.52-1.31</td>
<td>5</td>
<td>56%</td>
<td>0.8165*</td>
</tr>
<tr>
<td>2-3 sessions</td>
<td>0.53</td>
<td>0.20-0.85</td>
<td>2</td>
<td>0%</td>
<td>0.001</td>
</tr>
<tr>
<td>6-9 sessions</td>
<td>1.35</td>
<td>0.11-2.59</td>
<td>2</td>
<td>91%</td>
<td>0.0623*</td>
</tr>
<tr>
<td><strong>Timing of sessions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0737*</td>
</tr>
<tr>
<td>Afternoon</td>
<td>1.08</td>
<td>0.17-2.00</td>
<td>3</td>
<td>93%</td>
<td>0.001</td>
</tr>
<tr>
<td>Evening</td>
<td>0.96</td>
<td>0.47-1.45</td>
<td>4</td>
<td>67%</td>
<td>0.001</td>
</tr>
<tr>
<td><strong>Music choice</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.6623*</td>
</tr>
<tr>
<td>Researcher-selected</td>
<td>0.84</td>
<td>0.50-1.17</td>
<td>6</td>
<td>52%</td>
<td>0.001</td>
</tr>
<tr>
<td>Participant choice among playlists</td>
<td>1.06</td>
<td>0.13-1.99</td>
<td>3</td>
<td>93%</td>
<td>0.001</td>
</tr>
<tr>
<td><strong>Reason for hospitalization</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.88%</td>
</tr>
<tr>
<td>Cardiac surgery</td>
<td>1.24</td>
<td>0.65-1.91</td>
<td>4</td>
<td>88%</td>
<td>0.001</td>
</tr>
<tr>
<td>ICU patients</td>
<td>0.83</td>
<td>0.32-1.34</td>
<td>2</td>
<td>0%</td>
<td>0.001</td>
</tr>
<tr>
<td>Other reasons</td>
<td>0.39</td>
<td>0.25-0.83</td>
<td>5</td>
<td>0%</td>
<td>0.001</td>
</tr>
</tbody>
</table>

*Hedges' $g$ effect size; $I^2$, $I^2$ statistic for heterogeneity.

* Significant at $p < 0.01$.

* Analysis excluding outlier study.

* Study detected as outlier.
Secondary outcomes

Additional sleep outcomes were reported in 3 of the included studies. One study used polysomnography to measure objective sleep parameters such as TST, SOL, percentages of non-rapid eye movement sleep stage 1 (N1), non-rapid eye movement sleep stage 2 (N2), non-rapid eye movement sleep stage 3 (N3), and rapid eye movement (REM) sleep. The results showed that the music group had significantly less N2 and more N3 sleep than the control group, as measured in the first 2 hours of nocturnal sleep. No significant differences were found in the mean TST, sleep efficiency, SOL, and stage N1 sleep when comparing the groups. Two other studies reported TST measured with a morning sleep diary. Zhang and colleagues found that patients in the music group had significantly longer sleep duration than controls after mitral valve replacement (Intervention mean 312 minutes, standard deviation (SD) 21 vs. Control mean 256 minutes, SD 29). Similarly, Ryu and colleagues found that patients receiving a percutaneous transluminal coronary angiography in the intensive care unit had longer sleep duration when listening to music in the evening compared to controls receiving treatment as usual. None of the included studies reported any adverse events.

Discussion

This systematic review and meta-analysis suggest that listening to music can improve sleep quality in hospitalized patients. Ten studies comprising a total of 726 patients were included, and the results were pooled in a meta-analysis. The meta-analysis showed a large improvement in sleep quality compared to treatment as usual. Few studies reported other sleep outcomes. Risk of bias was generally low, but all studies were at high risk of performance bias since it is difficult to blind participants to the music intervention. The participants included ICU patients, patients undergoing cardiothoracic surgery or other types of major surgery, and oncology patients. The intervention period ranged from 1 to 7 days with most studies implementing one 30-minute session at bedtime.

The results of this review are in line with previous findings on the impact of music on sleep. One review has had a similar focus, investigating the effect of music interventions on sleep quality in critically ill and surgical patients. Despite the similarity, this review only contained 5 studies with a total sample size of 259 participants. As such, our study contributes with additional evidence by identifying more studies and reaching a sample size of 726 participants. The results of our meta-analysis showed a large effect size of the music intervention on sleep quality, and this is in line with the findings of Kakar and colleagues. Other systematic reviews on the effect of music on sleep quality have found similar effect sizes in patients with age-related sleep problems and adults with a complaint of insomnia. At the same time, the size of the effect seems to be slightly larger than the effect sizes found for the analgesic and anxiolytic effect of music in hospitalized patients. This points towards a substantial potential for using music to improve sleep in hospitalized patients, and importantly none of the studies reported any adverse events.

The participants differed substantially in terms of the reason for hospitalization, and the results showed a trend towards a larger effect in the participants undergoing cardiac surgery compared to ICU and other patients. This may relate to illness severity with ICU patients typically being in a more acute state. It may also relate to the fact that the cardiac patients often had longer intervention periods and thus more time for post-operative recovery compared to studies with ICU patients that measured the effect of just one intervention night (see Table 1). Still, the subgroup analyses did not point towards a difference in the effect depending on the number of sessions per se, and more studies are needed to disentangle any differences in the effect of music for sleep in different patient groups.

Some characteristics of the intervention differed among the studies. The music used was generally described as soft and slow, but in some studies all participants listened to the same researcher-selected music whereas other studies gave participants a choice among playlists of different genres. The subgroup analyses did not point towards a difference in the effect related to whether it was chosen by the researcher or if participants had a choice among pre-defined playlists. This is in line with a previous systematic review on music and sleep showing no difference in sleep change between studies using researcher-chosen music and studies in which participants could choose among playlists of different genres. However, a recent study on music to relieve anxiety prior to bronchoscopy found that taking patient preferences into account was essential for the anxiolytic effect of the music. The importance of music preference is highlighted by neuroscience research showing that listening to music that participants experience as pleasurable elicits increased activity in the mesolimbic reward network of the brain including the dorsal and ventral striatum. Therefore, music preferences seem essential to consider when emotion regulation is underlying the desired effect. Anxiety can be one of the causes of sleep difficulties among hospitalized patients, and it is important to ensure that the music is well-liked, but with the current number of studies available, it is hard to draw any firm conclusions on the importance of who selects the music. If the main mechanism of the sleep music is relaxation, then the characteristics of the music may be more important. Studies have shown that music can affect autonomous nervous system activity, and specifically tempo has a substantial influence of physiological arousal as measured by heart rate, respiration, and blood pressure. Slow-tempo music can decrease heart rate, and this effect has also been demonstrated in a study evaluating the impact of music on sleep in healthy adults. In addition to the reduced heart rate, this study also reported reduced N2 sleep and a trend towards increased N3 sleep in the participants listening to music at bedtime. These polysomnography results are similar to the included study on hospitalized patients measuring sleep with polysomnography.

When it comes to the mechanisms, they may also depend on the timing of the intervention. In some of the included studies, participants used the music at bedtime, whereas other studies used the music during the afternoon. Listening to music in the afternoon may facilitate relaxation via reduced physiological arousal or mental distraction or put the participant in a better mood by providing a pleasant experience as discussed above. This may enhance the general state of the hospitalized patient and thereby facilitate sleep quality at night. When listening to music at bedtime, these effects can be expected to have a more direct impact on sleep. In addition, other mechanisms may come into play such as the masking effect of music whereby music facilitates sleep by covering noise from the hospital environment. Still, no studies implemented the intervention for the entire night, so the masking effect can primarily have played a role for facilitating sleep initiation. In the subgroup analysis, we saw no difference in the effect between studies with music interventions in the afternoon compared to the evening, but one previous study has shown that music listening had a larger effect on sleep quality when used at bedtime compared to daytime in adults with chronic renal failure.

The use of a rigorous methodology was a strength of this review, and we identified more relevant studies than previous reviews. Still, a couple of limitations should be taken into account when considering the results. Heterogeneity of the included studies was high. One study was detected as an outlier, and the removal of this study reduced heterogeneity. In addition, subgroup analyses pointed towards clinical characteristics such as the reason for hospitalization as one factor potentially explaining part of the variation in the effect. Another limitation is that few of the studies reported other sleep outcomes than sleep quality. Only one study implemented objective sleep measures using polysomnography which is the gold standard of sleep assessment. The use of polysomnography would enable more specific knowledge about the impact of music on variables.
such as TST, sleep efficiency, and SOL in hospitalized patient, and it would also facilitate insight into changes in sleep architecture and the effect of music on the different sleep stages. Still, questionnaire data on sleep quality should not be underestimated in a clinical context since sleep quality is first and foremost a subjective experience.

Overall, there has been a call for non-pharmacological interventions to improve sleep in hospitalized patients, and this systematic review shows that listening to music can improve self-reported sleep quality in this population. A few studies also suggest longer sleep duration with the music intervention, but more studies are needed to follow up on these results.

Declaration of conflict of interest

The authors report no conflict of interest.

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CRediT authorship contribution statement

K.V. Jespersen conceptualized the study and contributed to study design, data extraction and analysis, writing and editing. M.H.H. contributed to data collection, data extraction and analysis, writing and editing. P.V. contributed to conceptualization, writing and editing. All authors approved the final version of the article.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.sleh.2023.03.004.

References


