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CLINICAL INVESTIGATION

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Effect of music therapy on improving sleep quality in older adults: A systematic review and meta-analysis

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Abstract

Objectives: Poor sleep quality is a common issue among older adults; it can lead to a poor quality of life and impairments in cognitive function and physical health. This study aimed to conduct a systematic review and meta-analysis of the effect of listening to music on sleep quality in older adults.

Design: Systematic review and meta-analyses.

Setting: Five databases, including Embase, Ovid Medline, Cochrane Library, Scopus, and the Index to Taiwan Periodical Literature System, were searched to identify studies assessing the efficacy of music therapy in older adults aged 60 years and older published through February 20, 2021.

Participants: Adults aged 60 years and older.

Measurements: We searched English- and Chinese-language studies of randomized control trials. All studies were reviewed by two independent investigators. The primary sleep outcome was the Pittsburgh sleep quality index. The Cochrane Collaboration tool was used to assess the risk of bias, and Review Manager 5.3 software was used to conduct the meta-analysis.

Results: Five randomized control trials were included in the meta-analysis. Older adults who listened to music experienced significantly better sleep quality than those who did not listen to music [mean difference (MD): −1.96, 95% CI −2.23 to −1.73, $P = 0.003$]. The subgroup analysis revealed that older adults who listened to sedative music obtained a more effective improvement in sleep quality than those who listened to rhythm-centered music (MD: −2.35, 95% CI −3.59 to −1.10, $P = 0.0002$). Furthermore, listening to music for longer than

Some of these findings were presented at the 23rd East Asian Forum of Nursing Scholars (EAFONS) conference.

4 weeks (MD: −2.61, 95% CI −4.72 to −0.50, $P = 0.02$) was to be effective at improving sleep quality.

Conclusions: Music therapy is safe and easy to administer and can effectively improve sleep quality among older adults, particularly those listening to more sedative music for at least a four-week duration.

KEYWORDS

meta-analysis, music, older adults, sleep quality, systematic review

1 | INTRODUCTION

Sleep disturbance is a common symptom in older adults due to age-related changes in sleep architecture and circadian regulation. According to previous epidemiological studies, 40–70% of older adults are estimated to have sleep problems,[1] and up to 41.4% of community-dwelling older adults suffer from insomnia.[2] Common complaints are "frequently waking up in the middle of the night" or waking up early in the morning".[3] Unresolved sleep problems in older adults lead to a poor quality of life, cognitive impairment, and emotional distress, as well as a decline in physical function and increased risk of falling incidents.[4-8]

Listening to sedative music may be an effective strategy to improve sleep quality in older adults.[8] Music has also been classified as sedative and rhythmic in terms of the level of arousal. Sedative music is commonly characterized by a slow tempo of 60–80 beats per minute, a soft volume, and smooth melody,[9,10] while rhythmic music is characterized by fast tempos, a loud volume, and rhythmic patterns.[11] Based on psychophysiological theory, listening to sedative music can improve sleep by modulating sympathetic nervous system activity and the release of neuroendocrine levels of cortisol, thereby lowering levels of anxiety and stress responses.[12-15] However, the effect of listening to music on improving sleep quality among community-dwelling older adults remains unclear. Chang et al[16] found that listening to music promotes better sleep quality. Lai and Good[17] also obtained similar results and showed that listening to music improves sleep quality in community-dwelling older adults aged at least 60 years. However, Yap et al[18] found that older adults who listened to rhythmic-centered music (i.e., drum or percussion instrument sounds) did not experience significantly improved sleep quality or the level of depression compared to a control group.

A previous systematic review and meta-analysis of randomized controlled trials (RCTs) confirmed that listening to music is potentially a successful nonpharmacological intervention for improving sleep quality in adults.[19,20] As the effects of music therapy on improving sleep quality in older adults remain uncertain, the aim of this study was to conduct a systematic review and meta-analysis to evaluate the effects of listening to music on sleep quality in older adults.

Key Points

- Music therapy is an effective strategy for improving sleep quality among older adults.
- Listening to sedative music provides a significantly greater improvement in sleep quality in older adults than listening to rhythm-centered music.
- Music therapy lasting for more than 4 weeks in older adults was most effective at improving sleep quality.

Why Does this Paper Matter?

- Listening to sedative music was more effective at improving sleep quality in community-dwelling older adults than listening to rhythm-centered music, particularly when older adults listening to music for a duration of longer than 4 weeks.

2 | METHODS

2.1 | Search strategy

This study followed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) Statement[21] (Table S1 shows the PRISMA checklist) to explore the efficacy of a music intervention on improving sleep quality in older adults. Five electronic databases, namely, Ovid Medline, Embase, Cochrane Library, Scopus, and the Index to Taiwan Periodical Literature System, were systematically searched to identify relevant articles published through February 20, 2021. Reference lists were reviewed as well. The three main concepts of older individuals, music and sleep disorders, and search strategy

were used with a controlled vocabulary (5 MeSH terms and 5 Emtree terms) and free-text terms (17 synonyms plus truncation symbols when appropriate) to retrieve relevant studies (Table S2 shows the search strategy).

2.2 | Inclusion criteria

Our inclusion criteria were (1) peer-reviewed publications in either the Chinese or English language, (2) randomized controlled trials, (3) older adults (aged 60 years and over) with sleep disturbances, (4) an experimental group that received a music intervention, (5) a control group that received standard care (or no treatment), and (6) the primary outcome was an improvement in sleep quality. The exclusion criteria are as follows: (1) patients diagnosed with cognitive dysfunction, such as Alzheimer's disease or Parkinson's disease; and (2) patients with hearing impairment.

2.3 | Data extraction and quality assessment

Two reviewers (C. T. Chen and Y. C. Chen) independently assessed the methodological quality of RCTs using the Cochrane Collaboration tool for assessing the risk of bias. The seven domains used to assess the risk of bias included random sequence generation (selection bias), allocation concealment (selection bias), blinding of participants and personnel (performance bias), blinding of outcome assessment (detection bias), incomplete outcome data (attrition bias), selective reporting (reporting bias), and other bias.[22] Each individual item was rated as either a low, unclear, or high risk of bias. Any disagreements or uncertainty were resolved by a discussion with the third reviewer (C. J. Fang).[22]

2.4 | Data synthesis and analysis

This study used Review Manager 5.3 software (The Cochrane Collaboration, The Nordic Cochrane Centre, Copenhagen, Denmark) for data synthesis. The outcome measures of this meta-analysis are presented as the mean differences (MDs) between the intervention and control groups with the corresponding 95% confidence intervals (CIs). Heterogeneity was assessed using the I^2 statistic. Due to inherent heterogeneity in studies of music interventions, a random-effects meta-analysis was applied. Sensitivity analyses were performed based on risks of bias in the study characteristics and definitions of music therapy. Additionally, subgroup analyses were planned to explore whether the effectiveness of music intervention differed according to the varying study and treatment durations, as measured in weeks.

3 | RESULTS

3.1 | Literature search

Four hundred and fifty-eight articles were retrieved in the initial search. Two hundred and thirty-four articles were removed due to duplication. After the title, abstract, and keywords were reviewed, 200 articles were discarded because they did not meet the study criteria, leaving a total of 24 full-text articles that were downloaded for consideration. Nineteen articles were excluded for the following reasons: not published in the English/Chinese language ($n = 1$), mixed intervention ($n = 2$), patients aged less than 60 years ($n = 14$), and same study reported twice ($n = 2$). Ultimately, five articles met all inclusion criteria and were included in the qualitative synthesis (Figure 1). All RCTs included in the present overview were published between 2005 and 2017.

3.2 | Study characteristics

Five RCTs are characterized in Table S3. The total sample size of all studies was 288, with sample sizes ranging from 42 to 64 participants. One hundred and forty-two participants were included in the music therapy groups, and 146 participants were enrolled in the control groups. The participants were recruited from community-dwelling older adults. The music intervention types included live playing of rhythmic music (conga, cowbell, djembe, ashiko, tan-tans, dunun, shakers, and wood blocks),[18] Western or Chinese classic, meditative, orchestra, synthesizer, harp, piano, jazz, and new age music.[23] The listening duration ranged from 30 min to 1 h over a period ranging from 2 days to 3 months. Sleep quality, our study outcome, was measured using the Pittsburgh sleep quality index (PSQI). No adverse events were reported in these studies.

3.3 | Methodological quality assessment of the included studies

Based on the Cochrane risk of bias tool, all studies were classified as having a low, high, or unclear risk of bias.[22] The result is depicted in Table S4. Five studies (100%) were rated as having a low risk of bias for both random allocation sequences and allocation concealment. Allocation

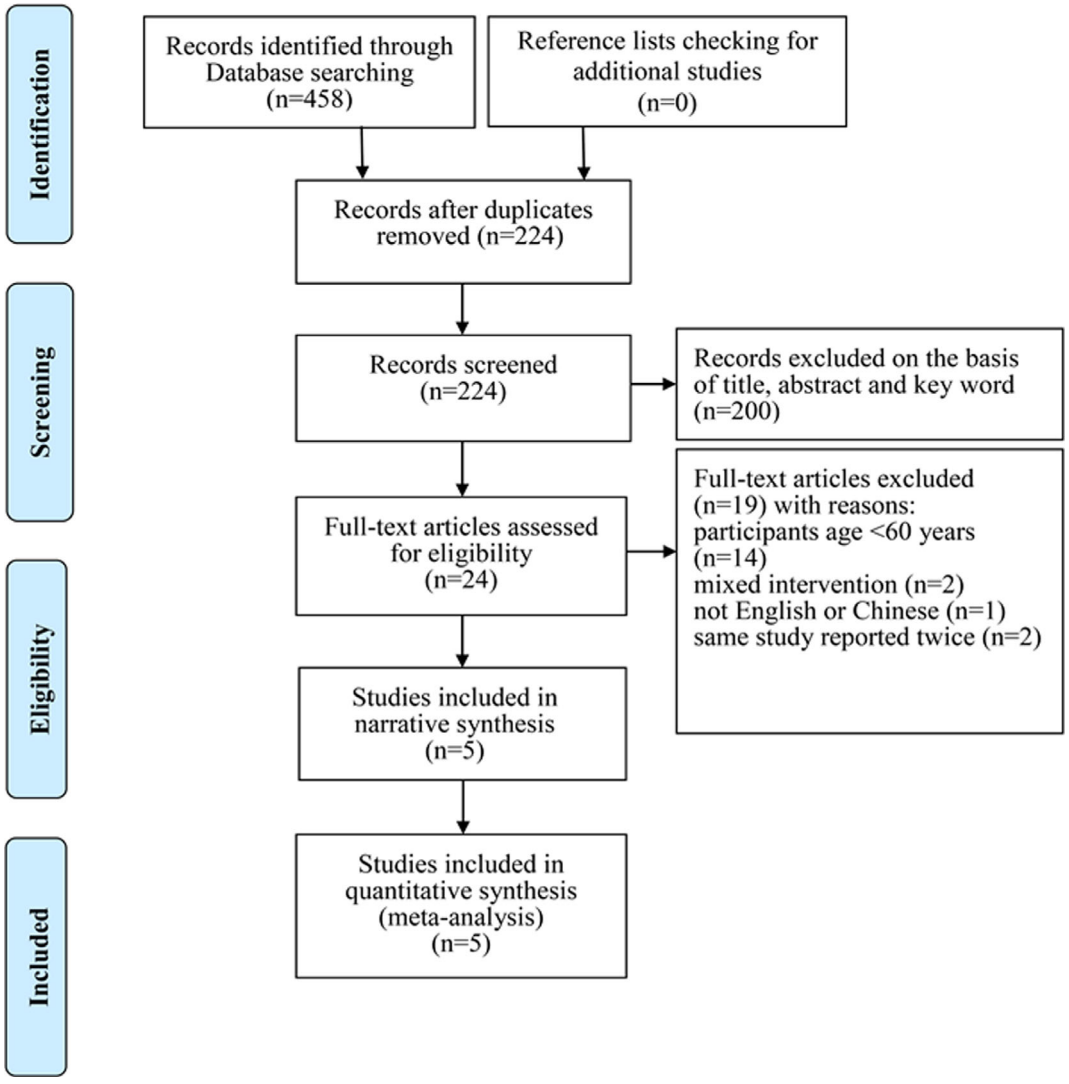

FIGURE 1 PRISMA diagram for the literature search and selection process

methods were employed using a sealed opaque envelope, random digits table, drawing cards from a bag, or a computerized random number generator. One study (20%) showed an unclear risk of blinding of the outcome assessor,[24] while three studies (60%) were rated as having a high risk of blinding of the outcome assessor.[17,18,23] Only one study presented a low risk of assessor blinding. Five studies had zero attrition, while one study (20%) had shorter sleep durations and daytime circadian dysfunction, which indicated a high risk for other bias.[17]

3.4 | Music therapy and sleep quality

Five studies[9,17,18,23,24] were included in our meta-analysis, and the results revealed that listening to music significantly improved subjective sleep quality in community-dwelling older adults (MD: −1.96, 95% CI: −3.23 to −0.69, $Z = 3.02$, $I^2 = 67\%$, $P = 0.002$) (Figure 2).

3.5 | The effect of different types of music on sleep quality

Not all music is therapeutic. We compared the effects of sedative music and rhythm-centered music on improving sleep quality among community-dwelling older adults. Sedative music use (MD: −2.35, 95% CI: −3.59 to −1.10, $P = 0.0002$) was significantly better at improving sleep quality than rhythm-centered music (MD: −0.25, 95% CI: −2.23 to 1.73, $P = 0.80$) (Figure 3).

3.6 | Sensitivity analysis

Due to the high heterogeneity and variety of music genres, a sensitivity analysis was conducted, excluding the study conducted by Yap and colleagues.[18] In Yap's trial, the intervention group used rhythm-centered music, defined as live playing of rhythmic music, including drum

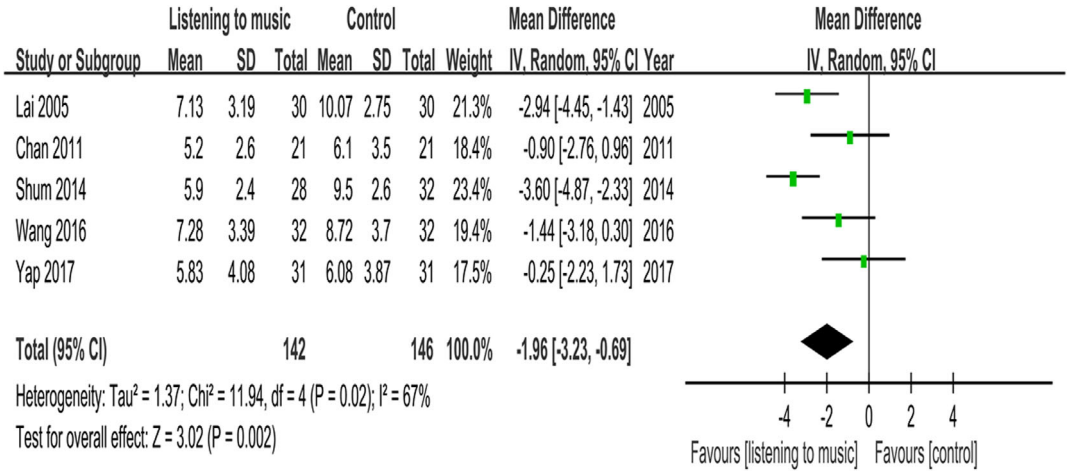

FIGURE 2 Mean difference in the effect of listening to music on sleep quality (Pittsburgh sleep quality index, PSQI) in older adults compared with the control [Color figure can be viewed at wileyonlinelibrary.com]

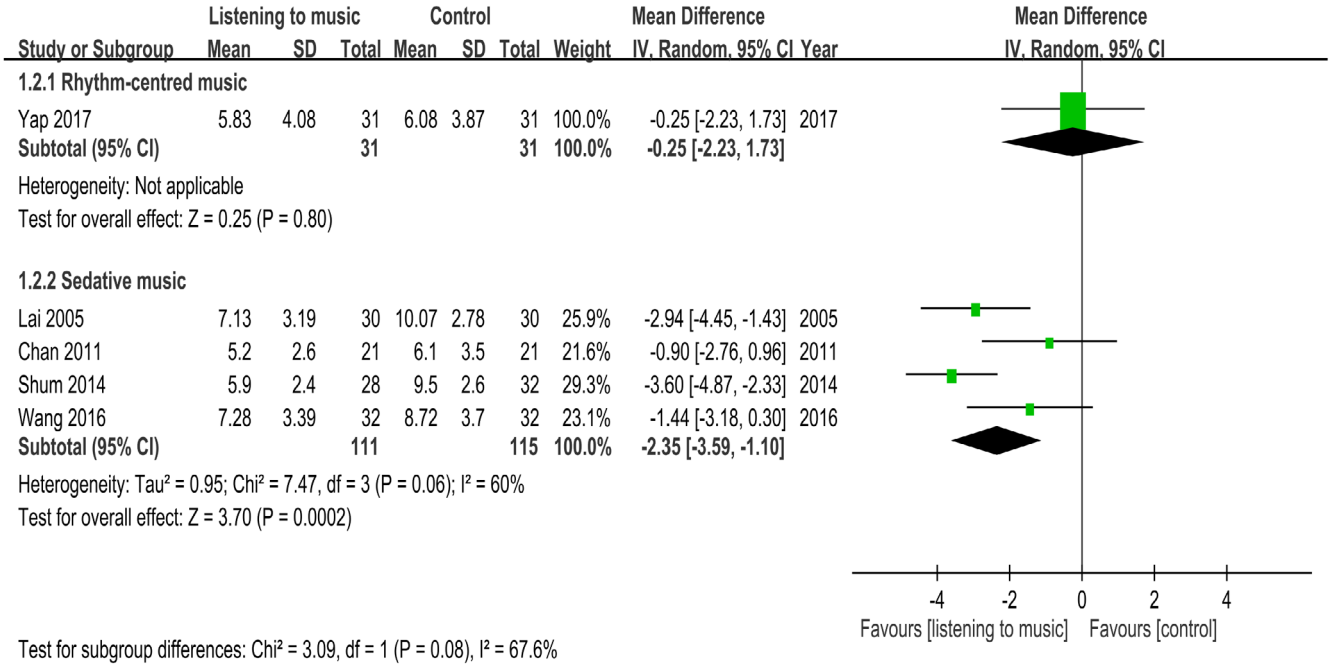

FIGURE 3 Mean difference in the effect of listening to music on sleep quality (sedative music versus rhythmic music) compared with the control [Color figure can be viewed at wileyonlinelibrary.com]

or percussion instruments; this approach was different than the other studies, which used quieter, slow tempo or melodic music. When one rhythmic-centered music study was excluded, the heterogeneity decreased from 66% to 60%.

3.7 | The effect of the duration of music therapy on sleep quality

After sensitivity analysis, four listening to sedative studies were used to compare the effect of different periods of music therapy on improving sleep quality among community-dwelling older adults. The results showed that listening to music for longer than 4 weeks (MD: −2.61, 95% CI: −4.72 to −0.50, $P = 0.02$) was more effective at improving sleep quality than receiving music therapy for a shorter duration (MD: −2.00, 95% CI −3.99 to −0.00, $P = 0.05$) (Figure 4).

4 | DISCUSSION

Although the effect of music therapy on sleep quality in an aged population has been examined,[25] the effects of

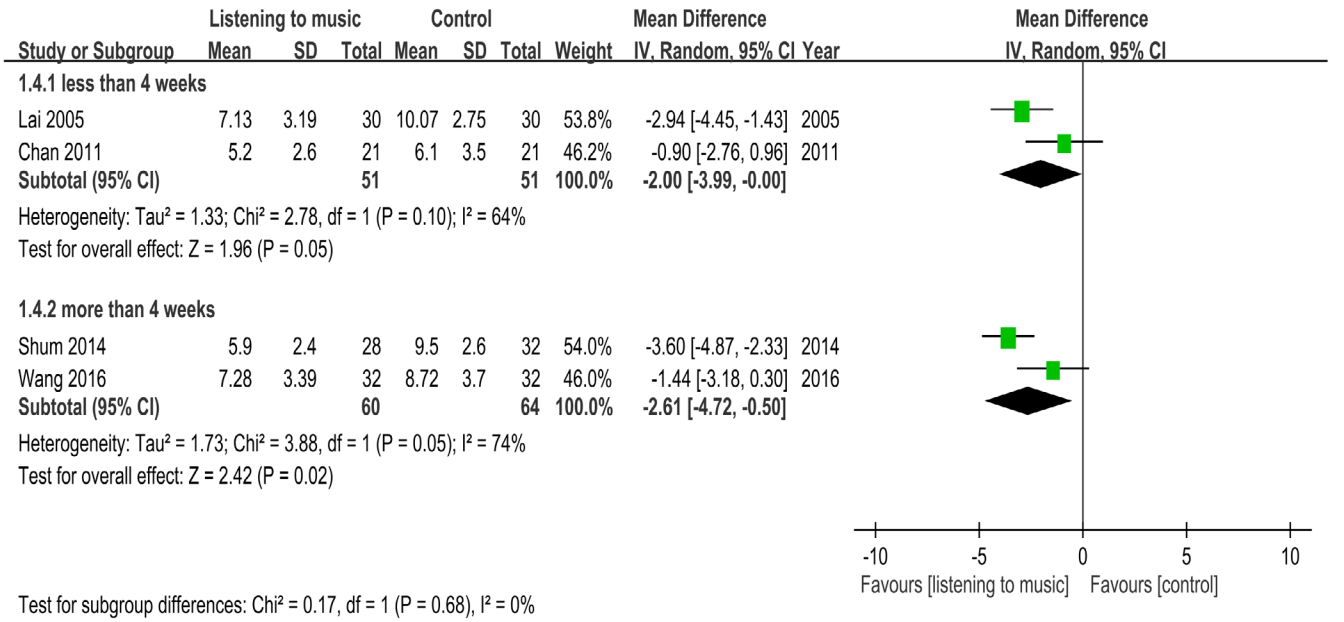

FIGURE 4 Mean difference in the effect of listening to sedative music on sleep quality (listening to music for longer than 4 weeks vs. for less than 4 weeks) compared with the control [Color figure can be viewed at wileyonlinelibrary.com]

listening to music on older adults' sleep quality remain uncertain due to the limited number of studies conducted with small sample sizes. This meta-analysis is the first focused on evaluating the effect of music therapy on sleep quality among older adults in Asia. The results of our meta-analysis revealed that older adults assigned to the group receiving music therapy reported significantly better sleep quality than the control group that did not listen to music (MD: −2.35, 95% CI −3.59 to −1.10, $Z = 3.70$, $I^2 = 60\%$, $P = 0.0002$).[9,17,23,24] The results were consistent with previous studies by Lai and Good and Shum et al,[17,23] who reported that listening to music modulates body rhythm by slowing it, thereby reducing sympathetic nervous system activity and circulating noradrenaline levels. Due to this physiological change, deep relaxation and calmness of the body is promoted, which improves sleep quality. Music therapy is relatively inexpensive and safe and can be easily self-administered. Our findings provide evidence for listening to music as an empirical-based intervention for improving sleep quality in older people.

In our subgroup analysis of different types of music, we found that listening to sedative music provided a significantly greater improvement in sleep quality than rhythm-centered music. The sedative music was typically characterized by a slow tempo of 60–80 beats per minute and a smooth melody.[9,10] Based on psychophysiological theory, listening to sedative music increases relaxation and distraction responses,[17,26] which may reduce neuroendocrine activity in the autonomic nervous system, resulting in reduced anxiety[27] and improved sleep quality.[28] Some studies have reported that sedative music exerts positive effects on sleep quality due to muscle relaxation and thought distraction.[15,29,30] Chen et al[10] also documented similar findings, reporting that listening to sedative music changes the sleep stages and prolongs the proportion of deep sleep.

To date, some RCTs have explored the effects of music on sleep quality in older adults.[9,17,18,23,24] However, the effective duration of the intervention period for music therapy remains unclear. Our findings showed that listening to music for longer than 4 weeks resulted in a greater improvement in sleep quality than listening for a shorter duration. This result was consistent with randomized controlled studies conducted by Shum et al and Wang et al.[9,23] The findings revealed that the 64 older persons in the music intervention group exhibited significant improvements in sleep quality after 1 month compared to the baseline group. In addition, Shum et al also documented similar findings in community-dwelling older adults. Current evidence indicates that long-term music therapy exerts a cumulative effect on improving sleep quality. We therefore propose that 4 weeks of music therapy may be needed to observe a beneficial improvement in sleep quality.

Age-related hearing impairment is one of the most common problems in older adults.[31] Our results showed a slightly lower effect on improved sleep quality in older adults than the findings of a previous meta-analysis, which assessed adults.[20] In a 2015 Cochrane review, Jespersen and colleagues reported a favorable effect of music listening on improved sleep quality in adults aged 19–83 years. The mean PSQI score in the music therapy group was 2.8 points lower, which indicates fewer sleep

problems. Compared to our finding, the effect of music therapy might improve the mean scores for sleep quality by approximately 2 points in older adults, which is slightly lower than the value reported in the previous meta-analysis by Jespersen.[20] Age-related hearing loss might alter the effectiveness of music therapy in improving sleep quality in older adults. Further research is needed to consider the effect of music therapy on sleep quality in different age groups.

This study has some limitations. First, the search was limited to studies published in Chinese and English. We included five studies with a high-performance bias, which may result in an overestimation of our outcome. Second, the types of music therapy varied widely, and we were unable to examine the exact effect of music genres on sleep quality. Third, the baseline subjective sleep quality of the participants in these studies was consistent across studies, which may contribute to the heterogeneity. Finally, all studies included community-dwelling participants; therefore, the sample was not representative of all older adults in different environments.

The results from this meta-analysis reveal that listening to music efficiently improves sleep quality in older adults aged 60 years or older. Listening to music for a duration longer than 4 weeks was more effective at improving sleep quality in older adults than listening to music for less than 4 weeks. Music intervention is an effective strategy and is easy to administer by a caregiver or healthcare worker. Music therapy might be the first line of therapy to recommend in older adults with sleep disturbances, which would reduce the need for or dependence on sedatives and sleeping medication.

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FINANCIAL DISCLOSURE

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CONFLICT OF INTEREST

The authors declare no potential conflict of interest in this study.

AUTHOR CONTRIBUTIONS

Chia-Te Chen and Yen-Chin Chen were responsible for this study's design. Chia-Te Chen completed analysis of data and manuscript preparation. Yen-Chin Chen and Heng-Hsin Tung were responsible for revising of the manuscript. Chia-Te Chen, Yen-Chin Chen, Heng-Hsin Tung, Ching-Ju Fang, Jiun-Ling Wang, Nai-Ying Ko, and Ying-Ju Chang approved the final manuscript.

SPONSOR'S ROLE

The sponsor had no role in this design of study, synthesis, analysis interpretation of the data and approval of the manuscript.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

Table S1: Checklist of PRISMA guideline
Table S2: Database searches of strategy
Table S3: Study characteristics of music intervention to improve sleep quality in older adults
Table S4: Risk of bias of studies of music therapy in older adults.

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