Effectiveness of music therapy for autism spectrum disorder, dementia, depression, insomnia and schizophrenia: update of systematic reviews

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Background: Music therapy (MT) aims at maintaining, restoring and furthering physical/emotional/mental health. This review assesses effectiveness of MT and its methods for autism spectrum disorder (ASD), dementia, depression, insomnia and schizophrenia. **Methods:** A search for systematic reviews and health technology assessment reports was conducted and yielded 139 hits. Given the large amount, we focused on five frequent diagnostic groups with available Cochrane reviews. A second search was conducted in four databases. Two authors independently performed study selection, data extraction and assessed methodological quality. Only trials with moderate/low risk of bias (RoB) were selected. **Results:** Ten randomized controlled trials (1.248 participants) met inclusion criteria. For schizophrenia, no studies with low/moderate RoB were found; therefore, updating was not possible. The Cochrane authors stated that quality of life (QoL), social functioning, global/mental state improved for schizophrenia, but not global functioning. For ASD, MT improved behaviour, social communication, brain connectivity and parent–child relationship. For depression, mood was enhanced, and for insomnia, sleep quality, stress, anxiety, total sleep time, disease severity and psychological QoL improved. MT positively affected mood, neuropsychiatric behaviour, apathy, communication and physical functions for dementia; behavioural/psychological symptoms improved only in severe, and memory and verbal fluency only in mild Alzheimer's disease. Cognition improved for dementia in one of four studies. Both active (playing music) and receptive (listening to music) methods were used for dementia, whereas for ASD and depression, active methods were applied. For insomnia, only receptive methods were used. **Conclusion:** These findings provide evidence that MT helps patients improving their physical/psychosocial health. More research investigating long-term effects is needed.

Introduction

Music therapy (MT) is a systematic process of intervention wherein clients seek to improve health with support of therapists using music experiences and relationships formed through them.[1] MT aims at maintaining, restoring and furthering physical, emotional and mental health.[2] It is a conscious and planned intervention for many diagnostic groups, such as psychosocial and physiological diseases, using individual clients' resources.[3]

Active and receptive forms of MT can be distinguished as possible methodological approaches, although it is not uncommon to combine them in the same course of treatment.[4] In receptive MT, participants are guided in listening to recorded/live music, whereas active MT involves producing music (e.g. improvisation, songwriting or singing/voice work).[4]

MT as health profession

The numbers of music therapists and the levels of service implementation and official recognition vary across countries. Currently, there are ~6.500 music therapists in Europe [http://emtc-eu.com], 8.500 in the USA [www.cbmt.org] and 600 in Australia [www.austmta.org.au]. In some countries (e.g. Austria, UK), MT is a registered and legally regulated health profession.[5–7] Elsewhere, music therapists are still working towards government recognition as a profession, while MT as an intervention is often already well-established in health care services. In some countries, MT is recommended in national

treatment guidelines, e.g. for psychosis in Norway.[8] The development over the last decades shows the numerical growth of the occupational group[7,9] and an even more significant boost in the number of professional music therapists can be expected in the future.[9]

Research questions

In the context of the numerical growth of music therapists, an important health policy question is in which diagnostic groups evidence benefits of MT exist. The review aims to provide decision support for the reimbursement of different music therapeutic approaches for five high-volume patient groups by focussing on autism spectrum disorder (ASD), dementia, depression, insomnia and schizophrenia and on MT methods applied (active and/or receptive).

Methods

Initial research questions and literature search

This report initially aimed to investigate the effectiveness of MT, conducting an overview of reviews. To identify all potential diagnostic groups, we screened the literature (hand search) and conducted two expert interviews with music therapists (see Supplementary appendix, Interview guide).

A first systematic literature search was conducted on 29/06/2020 in six databases [Medline via Ovid, Embase, The Cochrane Library,

PsycINFO, CRD (DARE, NHS-EED, HTA) and INAHTA]. The systematic search was limited to systematic reviews and HTA reports in English, Spanish or German, published from 2010 to 2020. After deduplication, we attained 786 citations, whereof 139 were included (see Supplementary appendix, Search strategy I).

Given the large amount of identified systematic reviews, we decided to concentrate on high-volume diagnostic groups, focussing on ASD, dementia, depression, insomnia and schizophrenia. Consequently, we decided to conduct an update of Cochrane reviews. From the initial literature search, we identified five systematic Cochrane reviews[10–14] covering these five diagnostic groups.

Systematic literature update search

Based on these Cochrane reviews, a second literature search was conducted to identify randomized controlled trials (RCTs) and controlled clinical trials (CCTs) for the five selected diagnostic groups. As the literature search of the oldest included Cochrane review was conducted in 2013, we limited the second literature search to publications from 2013 to 2020. The systematic update search was conducted on 21/07/2020 in following databases: Medline via Ovid, Embase, The Cochrane Library and PsycINFO (see Supplementary appendix, Search strategy II).

Inclusion criteria

The inclusion criteria for relevant studies are summarized in table 1.

Selection of studies

The update search yielded 832 hits. After deduplicating and collating the update search with the previous search, 693 references remained. The references were screened by two independent researchers (L.G. and J.M.). We contacted corresponding authors of Trial Records references to enquire preliminary results, but no completed results were found. After screening the abstracts, 39 studies were read in full to check for suitability, in accordance with the Preferred Reporting Items for Systematic and Meta-Analyses.[15] Sixteen full-text articles were excluded, resulting in 23 included studies (see figure 1).

Analysis, data extraction and presentation of findings

Twenty-three full texts were systematically assessed for quality and risk of bias (RoB) by two independent researchers (L.G. and J.M.). The 'Cochrane Collaboration's tool'[16] and the 'RoB Non-randomized Studies of Interventions'[17] tool were used for assessing the RoB for RCTs and CCTs (see Supplementary appendix tables SA1 and SA2). Trials with high/serious RoB or insufficient information to assess the RoB were excluded ($n = 13$; RCTs: $n = 10$, CCTs: $n = 3$). Disagreements were solved through discussion, consensus, or involvement of a third researcher.

Effectiveness outcome measurements can be found in table 2. We extracted all data concerning study characteristics and effectiveness outcomes (see table 3); data retrieved from the finally selected trials ($n = 10$) were systematically extracted into data extraction tables (see Supplementary appendix tables SA3–12). Data extraction was executed by one researcher (L.G.). A second person (J.M.) examined the completeness and correctness of extracted data. Both are independent researchers, not involved in any MT field.

Results

To update the Cochrane reviews in terms of effectiveness of MT, we exclusively considered trials with low/unclear/moderate RoB (see Supplementary appendix tables SA1 and SA2). Ten RCTs,[18–27] with a total of 1.248 patients, met the inclusion criteria. Unfortunately, no study for schizophrenia met the inclusion criteria and therefore, results for this diagnostic group were not updated. Effectiveness outcome measurements of Cochrane reviews and update search are presented in table 2. Detailed study characteristics (Supplementary appendix tables SA3 and SA5–8) and effectiveness outcomes (Supplementary appendix tables SA4, SA9–12) are provided in the Supplementary appendix.

Safety outcomes

Four Cochrane reviews reported no safety events[10,11,13,14] and one reported worsening of depressive symptoms due to MT in one patient.[12] In the update search, adverse events were investigated in two studies;[18,20] one found only rare cases of planned short-term hospitalization periods for children with ASD,[18] and one reported that one patient felt worried about losing the electroencephalography (EEG) machine while sleeping.[20] In one study, no safety outcome occurred,[21] and in the others, safety outcomes were not reported.[19,22–27]

MT methods

In the Cochrane reviews, one review,[11] investigating music interventions in patients with insomnia, included only studies using receptive methods; the remaining four Cochrane reviews included studies applying a mix of active/receptive approaches.[10,12–14] In the update search, bedtime music listening was used as a receptive method in insomnia.[20–22] In the studies regarding ASD[18,25] and depression,[19] active methods were applied. Active methods were also used in one study[27] with patients with dementia, whereas three others[23,24,26] used mixed forms.

Authors reported that qualified music therapists[18] and accredited therapists[25] conducted active MT sessions. In two other studies, therapists practised active[27] and mixed[23] MT forms. Furthermore, a researcher pre-recorded music for receptive use,[22] nurses provided a preferred music listening group[24] and trained therapists[26]

Table 1 Inclusion criteria

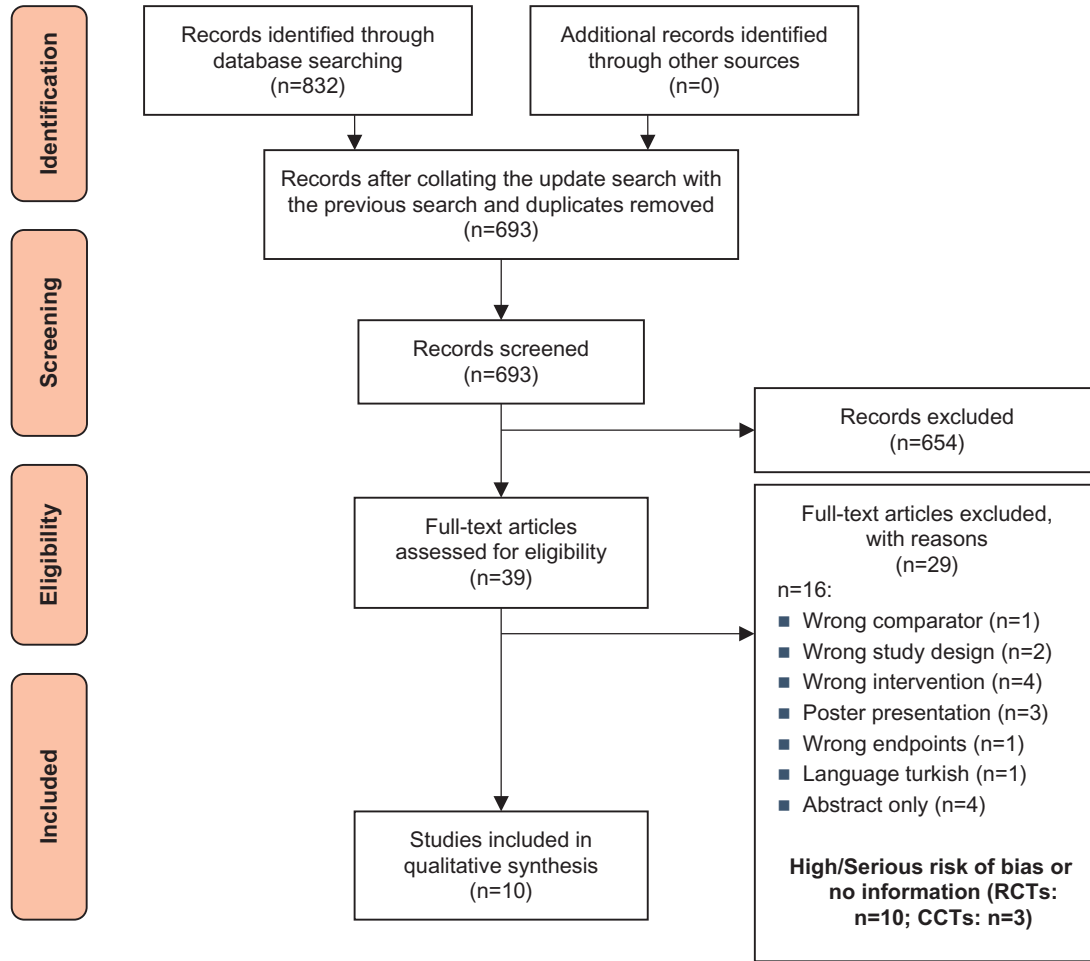| Population	Children, adolescents and adults with medical indications (exclusion: prisoners/inmates/offenders) Indications: ASD, dementia, depression, insomnia and schizophrenia
Intervention	Active and receptive music therapeutic interventions
Control	Standard treatment and no treatment (e.g. waiting list)
Outcomes	*Effectiveness outcomes* of the individual indications: ASD: behaviour, parent–child relationship, communication, social interaction and symptom severity Dementia: cognition, behaviour, mood, apathy, memory and physical function Depression: depressive symptoms, QoL, happiness and anxiety Insomnia: sleep quality, objective and subjective sleep parameters and QoL Schizophrenia: QoL, global and mental state *Safety outcomes*: adverse events and side effects
Study design	RCTs and CCTs
Setting	Inpatient and outpatient care
Publication period	2013—June 2020
Languages	English, German and Spanish

Figure 1 Study selection (PRISMA flow diagram)

Table 2 Effectiveness outcome measurements

Indication	Effectiveness outcomes of the Cochrane reviews	Effectiveness outcomes of the update search
ASD	Mother Play Intervention Profile, Parent–Child Relationship Inventory, Childhood Autism Rating Scale, Pervasive Developmental Disorder Behavior Inventory, Vineland Social-Emotional Early Childhood Scales (Vineland), Social Responsiveness Scale (SRS), Early Social Communication Scales and MacArthur-Bates Communicative Development Inventories—Words and Gestures	Autism Diagnostic Observation Schedule, SRS-II, Children's Communication Checklist-2, Peabody Picture Vocabulary Test-4, Beach Family QoL Scale, Vineland Adaptive Behaviour Scales and Resting-state functional magnetic resonance imaging
Dementia	Cohen-Mansfield Agitation Inventory, Mini-Mental State Examination (MMSE) and Neuropsychiatric Inventory (NPI)	MMSE, Montreal Cognitive Assessment (MoCA), NPI, Apathy Evaluation Scale-Clinician, Holden's Communication Scale, Barthel Index (BI), Tinetti Scale, Yesavage Geriatric Depression Scale (GDS), Cornell Scales, World Health Organization University of California-Los Angeles Auditory Verbal Learning Test and Semantic Verbal Fluency test
Depression	Hamilton Rating Scale for Depression, Montgomery-Åsberg Depression Rating Scale, Beck Depression Inventory (BDI), Thai Depression Inventory, GDS, Global Assessment of Functioning (GAF) Scale, Thai version of Short-Form Health Survey-36, Health-related QoL Survey-36, Hamilton Anxiety Scale and Hospital Anxiety and Depression Scale—Anxiety	BDI and Oxford Happiness Questionnaire
Insomnia	Pittsburgh Sleep Quality Index (PSQI)	PSQI, Perceived Stress Scale, State Anxiety Inventory, Insomnia Severity Index, Psychological domain of the WHO QoL questionnaire—abbreviated version), Polysomnography, Electroencephalography (EEG), sleep measurements for total sleep time (stages 1–4) and investigator-developed sleep diary
Schizophrenia	Positive and Negative Symptoms Scale, Brief Psychiatric Rating Scale, Scale for the Assessment of Negative Symptoms, GAF, General Well-Being Schedule and Social Disability Screening Schedule	

Table 3 Overview table of effectiveness outcomes

Effectiveness outcome[a]	Number of included patients (age range/mean)	Length of trial	MT methods
ASD			
Quality of parent–child relationship*,[10] Initiating behaviour*,[10] Social interaction*,[10] Non-verbal communicative skills**,[10] Verbal communicative skills*,[10] Social-emotional reciprocity*,[10] Social adaptation*,b,[10]	165 (2–9 years)	1 week to 8 months	Active, receptive
Symptom severity**,[18] Social affect**,c,[18]	364 (4–7 years)	5 months	Active
Social communication skills*,[25] Family QoL*,[25] Maladaptive behaviour*,[25] Brain connectivity*,[25] Symptom severity: Interpersonal behaviour, communication and repetitive behaviour**,[25] Receptive vocabulary**,[25]	51 (6–12 years)	8–12 weeks	Active
Dementia			
Emotional well-being including QoL (end-of-treatment effects)*,[14] Emotional well-being including QoL (long-term effects)**,[14] Mood disturbance or negative affect: anxiety (end-of-treatment effects)*,[14] Mood disturbance or negative affect: anxiety (long-term effects)**,[14] Mood disturbance or negative affect: depression (end-of-treatment effects)*,[14] Mood disturbance or negative affect: depression (long-term effects)**,[14] Cognition (end-of-treatment effects; long-term effects)**,[14] Behavioural problems: overall (end-of-treatment effects)*,[14] Behavioural problems: overall (long-term effects)**,[14] Behavioural problems: agitation or aggression (end-of-treatment effects; long-term effects)**,[14] Social behaviour (end-of-treatment effects)*,[14] Social behaviour (long-term effects)**,b,[14]	1.097 (55–103 years)	4 weeks to 6 months	Active, receptive
Cognition (MMSE + MoCA)*,[27] Neuropsychiatric behaviour*,[27]	60 (overall mean age 69.8 ± 7.9 years)	3 months	Active
Apathy*,[26] Communication*,[26] Cognition**,[26]	77 [mean age: 75.88 years (SD = 5.09); range: 65–90]	12 weeks	Active, receptive
Physical function (activities of daily living, balance, gait; BI + Tinetti Scale)*,[24] Mood (Cornell Scale)*,[24] Mood (GDS)**,[24] Cognition**,[24]	119 [mean= 80.52 years (SD = 7.44)]	8 weeks	Active, receptive
Verbal fluency (all participants; participants with mild Alzheimer's disease)*,[23] Behavioural and psychological symptoms (all participants; participants with severe Alzheimer's disease)*,[23] Short- and long-term memory (participants with mild Alzheimer's disease)*,[23] Caregiver distress (participants with moderate or severe Alzheimer's disease)*,[23] Cognition (all participants; participants with mild, moderate or severe Alzheimer's disease)**,[23] Short- and long-term memory (all participants; participants with moderate or severe Alzheimer's disease)**,[23] Behavioural and psychological symptoms (participants with mild or moderate Alzheimer's disease)**,[23] Verbal fluency (participants with moderate or severe Alzheimer's disease)**,[23] Activities of daily living and mobility (all participants; participants with mild, moderate or severe Alzheimer's disease)**,[23]	298 ['MT': mean= 68.9 years (SD = 7.1); 'controls': mean = 69.9 years (SD = 7.9)]	3 months	Active, receptive

(continued)

Table 3 Continued

Effectiveness outcome[a]	Number of included patients (age range/mean)	Length of trial	MT methods
Depression			
Depressive symptoms (clinician-rated)*,[12] Depressive symptoms (patient-reported; MT vs. treatment as usual)*,[12] Depressive symptoms (patient-reported; MT vs. psychological treatment)**,[12] QoL**,[12] Anxiety*,[b,12]	421 (14–86 years)	n.a.	Active, receptive
Depression*,[19] Happiness*,[19]	30 (n.r.)	n.r.	Active
Insomnia			
Sleep quality*,[b,11]	314 (19–83 years)	3 days to 5 weeks	Receptive
Sleep quality*,[22] Stress*,[22] Anxiety*,[22]	121 (>18 years)	2 weeks	Receptive
Subjective total sleep time*,[20] Sleep onset latency**,[20] Daytime fatigue of sleep disturbance**,[20] Objective sleep parameters**,[20]	71 [mean = 41.06 years (SD = 16.66)]	6 days (4 test days)	Receptive
Disease severity (Baseline—post-test score changes MT group; Baseline to follow-up)*,[21] Sleep quality (Baseline—post-test score changes MT group)*,[21] Psychological QoL (Baseline—post-test score changes MT group; Baseline to follow-up)*,[21] Objective sleep (Baseline—post-test score changes MT group; Baseline to follow-up)**,[21]	57 [mean = 50.2 years (SD = 11.6)]	3 weeks	Receptive
Schizophrenia			
QoL*,[13] Global state*,[13] Mental state*,[13] Global functioning**,[13] Social functioning*,[b,13]	1.215 (mean 24–38)	1–6 months	Active, receptive

a: Only outcomes with *P*-values reported by the authors are included.
b: Referring to Cochrane review.
c: Primary outcome was the social affect score of the ADOS.
*, significant and **, non-significant.

performed mixed MT forms. Others did not report who conducted MT with the patients.[19–21]

Autism spectrum disorder
Study characteristics
The authors of the Cochrane review included 165 patients (age range 2–9 years); the duration of the treatment intervention was daily for 1–2 weeks or weekly for 5 weeks to 7 months.[10]

Two RCTs[18,25] evaluating MT in ASD were identified in the update search. Improvisational MT plus standard care (SC) compared with SC was examined in one study, including 364 children (4–7 years).[18] This multicentre trial investigated MT in an outpatient setting over 5 months, with a 12 months follow-up.[18] In the other RCT, 51 children (6–12 years) were involved in weekly individual MT sessions over 8–12 weeks.[25] Improvisational approaches, including songs and rhythms, were applied. MT was compared with a non-musical active intervention.[25]

Results of the Cochrane review
MT interventions positively impacted social interaction, adaptation and social-emotional reciprocity. Furthermore, initiating behaviour and verbal communicative skills improved due to MT, but not non-verbal skills. Positive effects of MT were also reported on the parent–child relationship.[10]

Results of the update search
Symptom severity did not improve differently to SC after MT interventions.[18,25] Brain connectivity, family quality of life (QoL), and social communication skills significantly improved after 8–12 weeks, while there was a lack of effects on receptive vocabulary.[25]

Dementia
Study characteristics
The Cochrane review included 1.097 patients (55–103 years). The MT intervention was daily to weekly, 6–156 sessions (30–120 min) for 4 weeks to 6 months.[14]

Four RCTs were identified in the update search;[23,24,26,27] sixty (mean age 69.8),[27] 77 (mean age 75.9),[26] 119 (mean age 80.5)[24] and 298 (mean age 69.4)[23] patients with dementia were analyzed. Different MT interventions were applied, e.g. musical sensory stimulation,[26] singing/listening to songs[23] compared with routine drug therapy[27] and SC.[23,24,26] Effectiveness of MT was examined in hospitals[23,27] or nursing homes[24,26] with a trial length between 8 weeks[24] and 3 months.[23,27] The treatment duration was between 30 and

50 min, 3 times daily,[27] and 50 min 3 times weekly.[26] Two studies[23,27] conducted a follow-up 3 months after intervention completion.

Results of the Cochrane review

MT improved overall behavioural problems and emotional well-being, including QoL. Mood and negative affect (anxiety/depression) and social behaviour were positively affected. No effects on cognition were found. Behavioural issues (agitation/aggression) did not improve due to MT. No long-term impacts of MT were found.[14]

Results of the update search

Cognition improved after active MT,[27] while MT using mixed approaches did not significantly affect cognition.[23,24,26] Neuropsychiatric behaviour[27] and behavioural/psychological symptoms (only severe AD)[23] improved. Apathy and communication significantly improved after 12 weeks of MT.[26]

After 8 weeks, physical function and mood (Cornell Scale) significantly improved in patients with dementia, while mood did not improve, measured by the Yesavage Geriatric Depression Scale.[24] Verbal fluency and memory improved in patients with mild AD and caregiver distress (moderate/severe disease stage) due to 3 months of MT.[23] MT intervention did not significantly affect activities of daily living and mobility.[23]

Depression
Study characteristics

The authors of the Cochrane review included 421 patients (14–86 years). MT was applied weekly to six sessions per week, 8–48 sessions (20–120 min) for 6–12 weeks.[12]

One RCT was included in the update search, involving 30 patients (age not reported), comparing 12 MT sessions to no intervention. A 2 months follow-up was conducted.[19]

Results of the Cochrane review

MT compared with SC positively affected anxiety and patient-reported/clinician-rated depressive symptoms; assessing patient-reported depressive symptoms for MT compared with psychological therapies, no significant effects could be found. QoL did not improve due to MT.[12]

Results of the update search

In women with depression, MT significantly reduced depression and increased happiness.[19]

Insomnia
Study characteristics

The Cochrane review included 314 patients (19–83 years), and the application duration of music for health-promoting goals was daily (25–60 min) for 3–35 days.[11] For insomnia, three RCTs[20–22] were included enrolling 121 pregnant women (>18 years),[22] 71 (mean age 41.1)[20] and 57 (mean age 50.2) adults. Bedtime music listening[20–22] was compared with general prenatal care,[22] music video watching and no intervention[20] or audiobook listening and no intervention.[21] Patients listened to music for minimum 30 min/day.[20–22] The length of trials was between 6 days[20] and 3 weeks;[21] one conducted a 4-week follow-up.[21]

Results of the Cochrane review

Patients diagnosed with insomnia had enhanced sleep quality following music listening.[11]

Results of the update search

Sleep quality improved in two studies,[21,22] as did psychological QoL.[21] Objective sleep measured by two studies[20,21] did not improve while listening to music significantly affected subjective total sleep time after 6 days.[20]

After 2 weeks, stress and anxiety significantly improved,[22] and disease severity decreased after 3 weeks of music listening.[21] Sleep onset latency and daytime fatigue of sleep disturbance did not improve after 6 days of music interventions in patients with insomnia.[20]

Schizophrenia
Study characteristics of the Cochrane review

The authors of the Cochrane review included 1.215 patients (15–64 years). The duration of the intervention was weekly to six sessions per week (40–120 min) for 1–6 months.[13]

Results of the Cochrane review

QoL and social functioning improved in patients with schizophrenia. Global/mental states improved following MT interventions, while global functioning did not.[13]

Update search

We found one study on the effectiveness of MT in patients with schizophrenia, which we excluded due to the high RoB.[28] Therefore, no results for schizophrenia are added in the updated review.

Discussion

This report aims to update the findings of five Cochrane reviews regarding the effectiveness of, and methods applied in MT interventions in five high-volume diagnostic groups: ASD, dementia, depression, insomnia and schizophrenia. The available evidence is limited due to a lack of good-quality studies; furthermore, the effects are dependent on the quality and type of comparison groups.[29] In this report, we excluded studies with high/serious RoB and insufficient information.

Syntheses of the Cochrane reviews and the update

Comparing the findings on common endpoints and MT methods reported in the Cochrane reviews with the update results, we are focussing on differences and similarities of psychosocial outcomes.

For ASD, improved parent–child relationship was reported in the Cochrane review.[10] Our update search verifies this finding, confirming better family QoL after MT interventions.[25] Furthermore, MT ameliorated initiating behaviour[10] and improved social communication in children with ASD.[25] These consistent positive findings indicate that MT may indeed be beneficial regarding certain psychosocial outcomes in children with ASD.

In the Cochrane review for dementia, authors reported mood improvements and less negative affect, focussing on anxiety and depression; no significant long-term effects were found.[14] Updating the findings of this review, significant mood improvements measured by the Cornell Scale but not using the Geriatric Depression Scale were found.[24] This difference may be due to the validity of the different scales applied. The Cornell Scale is described as a scale with higher sensitivity and specificity than the Geriatric Depression Scale.[30] Overall, many different scales were used, which is a barrier to direct comparison.

Neither in the Cochrane review[14] nor in the update search[23,24,26,27] on dementia, long-term effects were found in cognition. However, cognition improved after 3 months of active MT.[27] Comparing MT approaches as reported in the Cochrane review[14] and the update,[23,24,26,27] active methods may be better for patients

with dementia to improve cognition than mixed forms of active and receptive methods. Furthermore, memory improved in patients with mild AD, but not in participants with moderate/severe disease stage.[23] Given the progressive nature of the disease's serious detrimental effects on memory and thinking, it is not unreasonable that MT (or any intervention) might still be beneficial for memory in early stages but might not be able anymore to affect memory in people with severe AD.

The Cochrane authors found improvements in behavioural problems in patients with dementia; no long-term effects were reported.[14] Focussing on agitative or aggressive behaviour, MT did not positively affect patients with dementia.[14] The update search found enhanced behavioural and psychological symptoms in patients with severe AD but not with mild/moderate disease severity,[23] and improved neuropsychiatric behaviour[27] after 3 months of MT. In AD, neuropsychiatric symptoms are recognized as core features; greater symptom severity predicts a faster cognitive decline.[31] Further research is needed to determine how MT improves symptoms in various stages of dementia severity.

The Cochrane authors reported positive effects on clinician-rated depressive symptoms in patients with depression after MT.[12] When compared with SC, MT improved patient-reported depressive symptoms, while when compared with psychological therapies, no significant effect was found.[12] Updating these findings, we additionally found improvements in depression and happiness due to active MT.[19] These outcomes show that MT therapy compared with SC[12] and no intervention[19] yielded better effects than compared with psychological therapies.[12]

In the Cochrane review, sleep quality improved in patients with insomnia,[11] and our update search yielded the same findings.[21,22] Additionally, in the update, psychological QoL[21] and subjective total sleep time[20] ameliorated following music interventions. Other sleep parameters like sleep onset latency and objective sleep parameters[20] did not improve after 6 days of music listening, and objective sleep did not improve after 3 weeks.[11] Our findings are consistent with literature documenting subjective–objective mismatch in patients with insomnia.[32]

In children with ASD, verbal communication and social interaction/adaptation improved due to MT, based on the Cochrane review.[10] The update search supports this finding.[25] Based on the Cochrane review, MT positively affects social behaviour in patients with dementia, but no long-term effects were found.[14] Additionally, our update search revealed positive effects on communication and apathy after 12 weeks[26] and verbal fluency only in patients with mild AD after 3 months of MT.[23] In dementia research, verbal fluency patterns exist in mild cognitive impairment and AD.[33] Although the intervention group of mildly cognitively impaired patients was more impaired than the control group, verbal fluency patterns were more similar to healthy participants.[33] Comparing this finding with ours, we can conclude that verbal fluency may be improved in mild but not moderate/severe AD due to verbal fluency patterns in mildly cognitively impaired patients.

Adverse events and side effects

One Cochrane review stated a worsening of depressive symptoms due to MT[12]; no explanation for these effects was given. However, only one participant out of 33 in the MT group experienced worsening depression. One patient felt worried about losing the electroencephalography (EEG) machine while sleeping[20], and one study found only rare cases of planned short-term hospitalization periods for children with ASD.[18] No other adverse events or side effects occured or were reported.

MT methods

Comparing the Cochrane reviews and the update search, we found no differences in the used mix of MT methods in patients with dementia. For ASD and depression, the authors of the update search used active methods, while the study authors included in the Cochrane reviews used mixed forms. For insomnia, all study authors applied receptive methods.

It is obvious that in patients with insomnia, receptive methods are preferred due to the relaxing effect of listening to music passively. Because ASD is characterized by persistent interaction and social communication difficulties,[18,25] and people with schizophrenia often remain unengaged in social settings,[13,34] active MT methods with their potential for non-verbal social communication may be seen as particularly useful. Patients with depression show symptoms of apathy, social withdrawal and are more likely to have low extraversion, i.e. be less talkative and outgoing.[35] Therefore, active methods may be preferred in recent studies to help alleviate these symptoms.

Limitations

The results reported in this update of Cochrane review findings need to be interpreted with caution, as no study of high quality was found, and, therefore, these findings may not be reliable. Although careful attention was given to adequate methodological quality by including only studies of low or moderate RoB, heterogeneity regarding rigour in design and methods between studies was still considerable (e.g. regarding sample size, randomization, blinding), thus limiting the extent to which our conclusions are generalizable. Addressing such statistical heterogeneity methodologically was beyond the scope of this general update but will be taken into account by future updates of Cochrane reviews for each specific diagnostic group. The included studies have very short or no follow-up, and consequently, it is not possible to evaluate the long-term effects of MT. MT interventions are described as very heterogeneous in different studies.

The use of aggregated data always implies a loss of more detailed qualitative information that might be explanatory in the interpretation of the findings. Additionally, only outcomes with *P*-values reported by the authors were included, which yields a loss of information; trends were not taken into account. Notwithstanding these limitations, we believe that the results provide a valid representation of the effectiveness of MT in the respective patient groups.

Conclusion

Recent findings indicate that MT helps patients diagnosed with ASD, dementia, depression, insomnia and schizophrenia. Based on current evidence, MT is a safe and low-threshold method leading to improvements in terms of physical, psychological and social aspects, though not in all of the outcomes measured. MT can be seen as a non-pharmaceutical alternative and complement to other disease-specific therapies. The update search showed that for active MT methods, qualified and (where applicable) accredited music therapists are essential for providing MT sessions. For receptive approaches, also nurses and other health professionals trained in applying them are capable of providing music interventions leading to patient-related improvements. No general recommendation for active, receptive or mixed forms of MT can be given: MT methods vary, depending on the patient group.

The studies show that even short trials, i.e. 6 days, with low frequencies (30 min per session), yielded patient-related improvements. In the trials identified for the update, long-term effects extending over more than 6 months have received limited attention. High-quality research on long-term effects, intensity of MT and long-term follow-up assessments are needed.

Acknowledgements

Supplementary data

Supplementary data are available at *EURPUB* online.

Conflicts of interest: All authors declare they have no conflicts of interest. LG and JM are independent researchers, not involved in any MT field. MG is a certified music therapist.

Key points

- This update of systematic reviews aims at assessing the effectiveness of music therapy (MT) and its methods for autism spectrum disorder, dementia, depression, insomnia and schizophrenia.
- Ten randomized controlled trials involving 1.248 patients met the inclusion criteria.
- The findings provide evidence that MT helps patients to improve their physical and psychosocial health.
- MT has its role in public health policy and practice and can be seen as a useful non-pharmaceutical alternative and complement to existing interventions.

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36 Additional references can be found in the Supplementary material.