Music in intervention for children and adolescents with autism: a meta-analysis  
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CRD summary
The author of this review concluded that all music interventions for children and adolescents with autism were effective, but further research is required. The poor reporting of review methods, lack of a validity assessment, evidence from a small number of diverse studies and limitations in the analysis make the reliability of the conclusions about effectiveness uncertain.

Authors' objectives
To examine the effects of music as an intervention for children and adolescents with autism.

Searching
Three relevant journals and an online database of dissertations and theses were searched using 'music' and 'autism' or 'autistic' as the keywords. Full papers were obtained from the American Music Therapy Association from 2002. The reference lists of all collected published and unpublished papers were checked, as were the references contained in two relevant books. The studies needed to have been published or presented in the USA.

Study selection

Study designs of evaluations included in the review
To be eligible, the studies needed to have a no-intervention control condition.

Specific interventions included in the review
To be eligible, the studies needed to compare group or individual music treatment that incorporated both pitch and rhythm versus no music. Most interventions in the included studies were targeted at the individual. The studies were from either a music therapy, education, psychology or occupational therapy discipline. Half of the studies were conducted by music therapists. Three different theoretical approaches were used: developmental social-pragmatic, discrete trial-traditional behavioural, and contemporary applied behaviour analysis. Some studies used live music whilst others used recorded music. A variety of musical interventions were explored: social stories set to music, sung instructions, background music, picture identification and direction following, music therapy session and music to accompany activities.

Participants included in the review
To be eligible, the studies needed to be of children or adolescents diagnosed with autism. Studies of diverse populations of children with special educational needs, even where these included those with an autistic spectrum disorder, were excluded. The participants were aged from 3 to 21 years and the majority were male.

Outcomes assessed in the review
To be eligible, the studies needed to report quantitative results in sufficient detail to extract an effect size. The studies were classified according to whether they examined outcomes relating to social behaviour, cognitive skill or communication.

How were decisions on the relevance of primary studies made?
The author did not state how the papers were selected for the review, or how many reviewers performed the selection.

Assessment of study quality
The author did not state that they assessed validity.
Data extraction
The author did not state how the data were extracted for the review, or how many reviewers performed the data extraction.

Variables from individual studies were selected for incorporation into the meta-analysis based on a hierarchy. Where more than one variable with quantitative data was available, the primary variable was selected based on the title of the study or the focus of the intervention. If several variables could be identified as primary variables and were of the same type of data, they were combined into one variable. Where it was not possible to select one variable or to combine multiple variables, up to two variables considered to be the most important were selected. Where multiple baseline conditions were reported, the baseline condition immediately prior to the music condition was used. The variables were converted to an estimated effect size (Cohen's d).

Methods of synthesis
How were the studies combined?
The studies were combined using meta-analysis to create an overall effect size. No details of the methods used were provided.

How were differences between studies investigated?
Statistical heterogeneity was investigated through the Q test. The meta-analysis was repeated after excluding one outlying study (n=1 with large effect size).

Results of the review
Ten studies (13 variables) with a total of 76 participants were included in the review.

The studies were small with sample sizes ranging from 1 to 20. All effects were in a positive direction, with effect sizes for music interventions ranging from 0.09 to 3.36; the overall effect size (d) was 0.83 (confidence intervals were not reported). There was no evidence of statistical heterogeneity. The exclusion of an outlier study with a sample size of one resulted in an overall effect size (d) of 0.77 (95% confidence interval: 0.46, 1.08), with no statistically significant heterogeneity.

Authors' conclusions
All music interventions, regardless of purpose or implementation, were effective for children and adolescents with autism. However, further research is required.

CRD commentary
This single-author review had broadly defined inclusion criteria for the participants, interventions, outcomes and study designs. The searches encompassed a range of sources of published and unpublished materials but did not appear to include major databases in health or psychology. The review was restricted to studies presented or published in the USA, so relevant studies might have been missed. Study quality was not assessed, thus the influence of any study bias on the results could not be determined. Attempts to reduce bias when selecting studies for the review and extracting the data (such as the use of a second reviewer) were not documented.

The methods used to combine studies (i.e. fixed-effect or random-effect models) were not reported. Although statistical heterogeneity was investigated and found to be not significant, there was considerable variation in the included studies in terms of their methods, disciplines and interventions. Therefore, the pooling of results might not have been appropriate. In addition, some studies contributed more than one effect size to the meta-analysis. The lack of reporting of review methods, lack of validity assessment, evidence from a small number of diverse studies and limitations in the meta-analysis make the reliability of the conclusions regarding effectiveness uncertain.

The overall conclusion on the potential of music for children and adolescents with autism appears appropriate, but further research with larger samples would be needed to determine the most appropriate interventions to maximise
gains in this population.

**Implications of the review for practice and research**

Practice: The author did not state any implications for practice.

Research: The author stated that studies with larger sample sizes are needed to investigate the efficacy of specific applications of music in the treatment of children and adolescents with autism.

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This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.