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Is Music Therapy an Effective Intervention for Dementia? A Meta-Analytic Review of Literature

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A recent qualitative review of literature in the area of music/music therapy and dementias published since 1985 suggested that music/music therapy is an effective intervention for maintaining and improving active involvement, social, emotional and cognitive skills, and for decreasing behavioral problems of individuals with dementias (Brotons, Koger, & Pickett-Cooper, 1997). The present analysis sought to update and quantify this relationship, and investigate the extent to which methodological variables influenced treatment effectiveness. Twenty-one empirical studies, with a total of 336 subjects suffering from symptoms of dementia, were included in the meta-analysis. Overall, the effect of music/music therapy was found to be highly significant. A homogeneity analysis determined that the effect sizes were not consistent across studies; thus, a series of moderating variable analyses were conducted. We were unable to determine the source of variability between studies by analyzing type of therapeutic intervention (active or passive), music (live or taped), therapist's training (trained music therapist vs. other professional), dependent variable (behavioral, cognitive, or social), or length of treatment. Although the published literature demonstrates that music/music therapy is an effective method overall for treating symptoms of dementia, systematic variation of treatment protocols is necessary to identify the underlying mechanisms and delineate the most effective techniques.

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It is well known that the incidence of dementia is rising steadily, due at least partially to the increase in average life expectancy observed over the past century (Khachaturian & Radebaugh, 1996). During recent years, empirical and clinical efforts to delineate and adequately meet the physical, psychological, and social needs of the elderly have burgeoned. Anecdotal evidence and informal reports by health care professionals and family members suggest that music and music therapy may have a unique effect on people with dementias, and more specifically on those with a probable diagnosis of Dementia of the Alzheimer's type (DAT) (Cooper, 1991; Lloyd, 1992; Smith, 1992). Brotons, Koger, and Pickett-Cooper (1997) recently conducted an extensive review of literature published since 1985 in the area of music/music therapy and dementias and categorized, coded, and summarized the research outcomes. Although music therapy appeared overall to be an effective intervention for dealing with the symptoms of dementia, the qualitative nature of the review and methodological variability observed across studies precluded identification of the most effective music therapy practices.

The present study was conducted to update and statistically cumulate the findings of clinical-empirical investigations identified by Brotons et al. (1997). We used meta-analytic techniques which aggregate effect sizes across studies in order to assess the overall relationship between variables (Hunter, Schmidt, & Jackson, 1982; Rosenthal, 1984). Further, methodological differences may be analyzed to determine factors that moderate the size of effects (Hedges & Olkin, 1985). We hypothesized that music/music therapy would be an effective intervention for use with patients with dementia and that length of treatment would positively correlate with treatment effectiveness. Comparisons were made among studies conducted by trained music therapists versus other professionals, interventions requiring active participation in activities like singing and playing instruments or games versus passive involvement such as listening to music, studies using live versus taped music, and assessments of behavioral, cognitive, or social variables.

Method

The literature for this analysis was that identified by Brotons et al. (1997) as well as additional articles published since that review. On-line databases (e.g., Medline [1975–present], PsycLit [1974–

present]) were searched with the key words *music and dementia* and *music and Alzheimer's*. References published in refereed journals, written in English, that empirically addressed the use of music/music therapy for dementia were reviewed. Of the 69 references included in the review by Brotons et al., 15 were determined to meet the criteria of the present study. An additional 10 studies published since 1995 were located, 4 of which were deemed inappropriate for inclusion in this analysis (Clair & Ebberts, 1997; Kovach & Henschel, 1996; Rabins, 1996; Ward, LosKamp, & Newman, 1996). It should be noted that the majority of the studies selected for inclusion were within-subjects (repeated measures) designs, including comparisons of pre/postintervention performance. Studies were excluded from the meta-analysis if (a) they were theoretical/philosophical papers, (b) they were case studies of one or two individuals and therefore not appropriate for calculation of a statistical effect size, (c) evaluation was of caregivers rather than patients, (d) quantification of the dependent variable was not provided, or (e) the data did not enable us to test the hypothesis that music therapy or exposure to music would effect change or improvement. For example, studies which did not include a control condition or if music was used in the context of testing an alternate hypothesis such as the effect of intergenerational interaction (Ward et al., 1996) or comparative recall of song lyrics and spoken material (Prickett & Moore, 1991) were excluded from this analysis. Refer to the appendix for a complete bibliography of the included references.

Study statistics and qualities with potential moderating influence were coded by two independent analysts. In the few cases where the analysts disagreed, a third analyst was consulted, and in all cases, discussion led to agreement between the analysts. When a study contained multiple tests of significance that were pertinent to our hypothesis, we used the *method of mean result* whereby each p level from the study was transformed to its standard normal deviate (Z), the mean Z was calculated, and then the p level corresponding to the mean Z was determined (Rosenthal, 1984, p. 33). Effect sizes were computed from the reported study statistics using DSTAT software for meta-analysis (Johnson, 1989). See Table 1 for a list of the studies with the statistics as originally reported, their corresponding effect sizes, and the methodological variables included in the analysis.

TABLE 1

List of Included Studies, Statistics, and Study Qualities

First Author(s), Year	Study *n*	Study Statistic[1]	Effect Size[2] Cohen's *d*	Effect Size Pearson *r*
Brotons, 1996	20	$F = 16.33$	0.867	.4117
Carruth, 1997	04[3]	avg % correct 81 vs. 75	0.106	.0724
Casby, 1994	03	$t = 3.78$[4]	1.247	.7372
Clair, 1996	26	$t = 5.85$	1.112	.4976
Clair, Bernstein, 1994	28	avg $p = .375$[5]	0.232	.1185
Clair et al., 1995	28	$F = 23.93$	0.898	.4196
Denney, 1997	09	3.55 (5.02) vs. 2.44 (13.27)[6]	0.275	.1506
Gerdner, 1993	05	% reduced = .79[7]	2.262	.8165
Goddaer, 1994	29	$F = 8.52$	0.527	.2616
Groene, 1993	30	avg $p = .053$	0.503	.2503
Lindenmuth, 1992	10[8]	$t = 9.93$	2.871	.8435
Lord, 1993	40	$t = 1.93$[9]	0.598	.2919
Olderog-Millard, 1989	10	avg $p = .016$	1.172	.5398
Pollack, 1992	08	$x^2 = 14.2$	4.993	.9421
Ragneskog, Brane, et al., 1996	20	avg $p = .1379$[10]	0.463	.2346
Ragneskog, Kihlgren, et al., 1996	05	$t = 7.57$[11]	2.708	.8610
Smith, 1986	12	$t = 1.83$[12]	0.491	.2554
Smith-Marchese, 1994	10	avg $p = .036$	0.971	.4692
Snyder, 1996	05	$p = .05$	1.264	.6199
Tabloski, 1995	20	$F = 33.45$	1.241	.5430
Thomas et al., 1997	14	avg $p = .1492$	0.533	.2726

[1] All statistical tests were within-subjects unless otherwise noted.

[2] A positive effect size reflects an improvement in performance on the assessed measure.

[3] 7 subjects were included in the study, but only 4 were demented patients. We only included data for those 4.

[4] The original data were presented as mean number of vocalizations for each of the 3 subjects before, during, and after treatment. We conducted a dependent-groups *t* test, comparing vocalizations before and after treatment.

[5] As described in *Methods*, multiple relevant statistical analyses were combined using the method of mean result.

[6] The original data were presented as the mean (and variance) of agitated behaviors before and during intervention, and return to baseline and re-introduction of therapy (ABAB). Because the two "A" and two "B" conditions were comparable, we chose the second baseline and intervention averages as the variability was greater for the second intervention (13.27) and thus provided a more conservative estimate of treatment effectiveness.

[7] The original data were presented as the percent decrease of agitated behaviors during and after intervention. We used the average postintervention percent decrease for effect size computation.

[8] Ten healthy and 10 ADRD subjects served in this study, but separate analyses were reported for the 2 groups. The effect size was calculated using only the ADRD, within-group comparison.

[9] Between groups (music participation versus placebo group) *t* test; 20 subjects per group.

[10] We computed an effect size of the mean amount consumed during music (443.67) and no music (409) conditions, using the standard deviation for the soothing music condition (102) as it was the largest variability estimate and thus provided the most conservative estimate of treatment effectiveness. The resulting *p* value (.2951) was then averaged with the $p < .05$ for emotional symptom improvement using the method of mean result.

[11] The original data were presented as mean amount of time spent during a meal when music was present or absent. We conducted a dependent-groups *t* test, comparing average time before and after ($M = 12.93$), versus during, treatment ($M = 15.64$).

[12] Analyses were reported for three conditions (musically cued reminiscence, verbally cued reminiscence, and musical activity). We restricted our effect size calculation to the musical activity condition as this was most directly relevant to our hypothesis and consistent with our inclusion criteria.

TABLE 1
Continued

First Author(s), Year	Treatment Length (min)	Therapeutic Technique (Independent Variable; IV)	Coding of IV[13]	Music Type
Brotons, 1996	150	Singing, instrument playing, dancing/moving, musical games, composing/improvising	Active	Live
Carruth, 1997	40–80[14]	Listening to music sung by therapist	Passive[15]	Live
Casby, 1994	80; 160[16]	Listening to music	Passive	Taped
Clair, 1996	32	Listening to music sung by therapist	Passive	Live
Clair, 1994	900	Listening to background music	Passive	Taped
Clair, 1995	480	Playing instruments (drums)	Active	Live
Denney, 1997	1260	Listening to music during lunch meal	Passive	Taped
Gerdner, 1993	150	Listening to music	Passive	Taped
Goddaer, 1994	NS[17]	Listening to music during meals	Passive	Taped
Groene, 1993	75	Singing, instrument playing, dancing/moving	Active	Live
Lindenmuth, 1992	NS	Listening to music during sleep	Passive	Taped
Lord, 1993	180	Instrument playing	Active	Live
Olderog-Millard, 1989	120	Singing in group	Active	Live
Pollack, 1992	120	Singing, playing instruments or dancing/moving based on preference	Active	Live
Ragneskog, Brane, et al., 1996	NS	Listening to music during dinner meal	Passive	Taped
Ragneskog, Kihlgren, et al., 1996	780–1170[18]	Listening to music during dinner meal	Passive	Taped
Smith, 1986	60[19]	Singing	Active	Live
Smith-Marchese, 1994	NS	Instrument playing and moving	Active	Taped[20]
Snyder, 1996	100	Listening to (& receiving tactile stimulation by) music playing bear	Passive	Taped
Tabloski, 1995	30	Listening to music	Passive	Taped
Thomas et al., 1997	NS	Listening to music during bathing	Passive	Taped

[13] For the purposes of moderator variable analyses, therapeutic techniques (IVs) were categorized as active or passive.

[14] Music was presented for 10–20 min per session. We took the median of this range for calculation of the correlation between treatment length and effect size.

[15] Although patients were encouraged to sing along, it appeared that the intervention primarily consisted of the therapist singing.

[16] Two subjects received 2, 10 min sessions for 4 days; 1 subject received 2, 10 min sessions for 8 days. We took the mean length for calculation of the correlation between treatment length and effect size.

[17] NS: Not specified.

[18] Music was presented for 30–45 min per session. We took the median of this range for calculation of the correlation between treatment length and effect size.

[19] Three conditions were included in the report but we used only the musical activity condition for this analysis.

[20] Most of the music was taped, though "simple songs of dedication were used to greet each resident" (p. 48).

TABLE 1
Continued

First Author(s), Year	Diagnostic & Range[21]	Type of Professional[22]	Dependent Variable (DV)	Coding of DV[23]
Brotons, 1996	Reisberg 5, 6	RMT	Agitation	Beh Mgmt
Carruth, 1997	NS	RMT	Face-name recognition	Cognitive
Casby, 1994	Behavioral[24]	OTR/L	Disruptive vocalizing	Beh Mgmt
Clair, 1996	Reisberg 7	RMT	Alert responses	Social/Emotional
Clair, 1994	NS (severe)	RMT	Agitation	Beh Mgmt
Clair, 1995	Reisberg 6	RMT	Participation	Social/Emotional
Denney, 1997	Reisberg 6	RN	Agitation	Beh Mgmt
Gerdner, 1993	MMSE < 21	RN	Agitation	Beh Mgmt
Goddaer, 1994	MMSE < 18	RN	Agitation	Beh Mgmt
Groene, 1993	Reisberg 6, 7; MMSE < 20	RMT	Seating, wandering	Beh Mgmt
Lindenmuth, 1992	NS	NS	Sleeping	Beh Mgmt
Lord, 1993	NS	NS	Interaction, mood	Social/Emotional
Olderog-Millard, 1989	NS (midstage)	RMT	Sitting, social beh	Social/Emotional
Pollack, 1992	MMSE < 14, CDR 2, 3	RMT	Social behavior, participation	Social/Emotional
Ragneskog, Brane, et al., 1996	MMSE < 24	RN	Amount consumed, irritability, fear-panic, depression	Beh Mgmt
Ragneskog, Kihlgren, et al., 1996	MDDA[25] 3	RN	Time with dinner; cooperative behav	Beh Mgmt
Smith, 1986	MMSE < 20	RMT	MMSE	Cognitive
Smith-Marchese, 1994	NS (mid-late stage)	NS	Reality orientation, social beh	Cognitive, Social/Emotional
Snyder, 1996	NS (cognitive impairment)	RN	Relaxation beh, pulse	Beh Mgmt
Tabloski, 1995	Behavioral[26]	RN	Agitation	Beh Mgmt
Thomas et al., 1997	Reisberg (midstage NS)	Nursing asst.	Agitation during bathing	Beh Mgmt

[21] = Reisberg: Global Deterioration Scale; MMSE: Mini-Mental Status Examination; CDR: Clinical Dementia Rating; MDDA: Multidimensional Dementia Assessment; NS: Not Specified.
[22] = RMT: Professional Music Therapist; OTR/L: Occupational Therapist; RN: Registered Nurse; NS: Not Specified.
[23] = For the purposes of moderating variable analyses, the dependent variables were categorized as Behavior Managment (Beh Mgmt), Social/Emotional, and Cognitive.
[24] = Patient inclusion was based on the presence of disruptive vocalizations.
[25] = Patients scoring the highest (level 3) on the Multidimensional Dementia Assessment (MMDA) were considered severely demented and included in the study.
[26] = Patient inclusion was based on the presence of agitated behaviors.

The effect sizes for the 21 studies, contributing a total of 336 subjects, were combined using the DSTAT software (Johnson, 1989) which incorporates procedures described by Hedges and Olkin (1985). Briefly, the difference in within-group variability (in standard deviation units) between music and nonmusic conditions from each study was weighted by the reciprocal of its variance. The

weighting procedure favors studies with larger sample sizes. The resulting *d* statistics from the included studies were then averaged, providing a mean effect size expressed with a 95% confidence interval. As published studies may represent a biased sample wherein only significant results are reported (the so-called "file drawer problem"), we computed the number of studies averaging null results that would bring the acquired overall effect size to just significant at $p = .05$ (see Rosenthal & Rosnow, 1991, p. 509 for the computational formula).

In order to determine whether effect sizes were consistent across studies, a test of homogeneity was conducted. A statistically significant result reflects effect size differences across studies; study qualities may then be subjected to model testing to explore the source of the variability in results. The moderating variables assessed were: (a) treatment length in minutes, (b) therapists' training—music therapist versus other professional, (c) therapeutic intervention—active or passive exposure to music, (d) type of music presentation —live or taped music, (e) dependent variable—social/emotional, cognitive, or behavioral measure.

Although the studies were coded for the disease severity of the subjects, this variable was not included in the analysis due to the presence of a range of symptom severity within studies and divergent diagnostic criteria between studies (see Table 1). Thus, reports could not be distinguished on the basis of patient characteristics.

Results

The obtained mean effect size (*d*) was 0.7879, with a confidence interval (CI) of 0.62 to 0.95. As the CI does not include zero, this indicates a significant effect of music therapy on the amelioration of symptoms of dementia.[1] We found that 622 unpublished studies averaging null results would need to exist before concluding that our overall finding could be attributed to sampling bias (for further discussion of the "file drawer problem," see Rosenthal & Rosnow, 1991).

The effect sizes were not consistent across studies, as indicated by the significant value obtained in the homogeneity test, $Q(20) =$

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[1] This relationship may also be expressed as a Pearson's correlation coefficient ($r = .3666$, $p < .0001$), a statistic which some researchers prefer to *d* (see Rosenthal, 1984).

TABLE 2

Average Effect Sizes by Moderating Variable Class

Moderating Variable	Homogeneity Analysis *p* Value	Class	Number of Studies	Effect Size Cohen's *d*	95% Confidence Intervals	Effect Size *r*	*p* Value
Ind Var	.8647	Active	08	0.8043	0.5543/1.0542	.3731	.0096
		Passive	13	0.7753	0.5550/0.9956	.3614	.0031
Music Type	.4653	Live	08	0.8586	0.6070/1.1101	.3945	.0059
		Taped	13	0.7343	0.5151/0.9535	.3447	.0057
Therapist Type	.5609	RMT	09	0.7418	0.5149/0.9687	.3478	.0021
		Other	12	0.8401	0.5989/1.0813	.3873	.0140
Dep Var	.2236	Beh Mgmt	13	0.7131	0.5060/0.9202	.3358	.0049
		Social-Emotional	05	1.0193	0.7045/1.3340	.4541	.0038
		Cognitive	03	0.6034	0.0444/1.1624	.2889	.7592
Dep Var	.23991	Beh Mgmt	13	0.7131	0.5060/0.9202	.3358	.0049
		Other	08	0.9192	0.6449/1.1934	.4176	.0096

51.485, $p = .0001$. Categorical model testing of the study characteristics that we included did not determine the cause of variability between studies. Specifically, homogeneity analyses revealed no significant differences. That is, no effect size inconsistencies were detected when studies were subdivided according to active versus passive treatment, live versus taped music, professional music therapist versus other professional, or type of dependent variable assessed (all ps $> .1$). See Table 2 for average ds and confidence intervals, ns and respective p values for each level of each moderating variable. The type of dependent variable did not account for effect size differences between studies whether the analysis was run with all three types (behavioral, social, or cognitive) or with the variables collapsed into two categories (behavior management versus other), as one study included both cognitive and social assessments (Smith-Marchese, 1994). Treatment length was not significantly correlated with study effect size for the 16 reports that specified the amount of treatment ($r = -.185$; $p = .5$).

Discussion

Although the overall results of this meta-analysis corroborate Brotons et al.'s (1997) suggestion that music/music therapy is an effective intervention when dealing with patients with dementia, we were unable to determine the relative efficacy of different methodological protocols within the existing literature. The symptoms that are responsive to treatment with music are apparently di-

verse. Specifically, improvement in social behaviors included participation in group singing (Olderog-Millard & Smith, 1989), socializing, and vocalizing (Pollack & Namazi, 1992). Overt behaviors such as wandering (Groene, 1993; Olderog-Millard & Smith, 1989) and restlessness during meals (Ragneskog, Kihlgren, Karlsson, & Norberg, 1996) were demonstrated to decrease in occurrence, although Denney's (1997) reported trend toward improvement did not attain statistical significance in our calculation of an effect size. Several studies reported reductions in agitated behaviors. (Brotons & Pickett-Cooper, 1996; Gerdner & Swanson, 1993; Goddaer & Abraham, 1994; Tabloski, McKinnon-Howe, & Remington, 1995); however, Thomas, Heitman, and Alexander (1997) found significant differences only in aggressive behavior and not other measures of agitated behavior with music during bathing. While overall levels of food consumption were not affected by music played during meals, dessert eating increased and measures of irritability and mood reportedly improved (Ragneskog, Brane, Karlsson, & Kihlgren, 1996). Amelioration of cognitive deficits were observed by way of reality orientation (Smith-Marchese, 1994) and face recognition (Carruth, 1997), although the effect size calculation limited to the four demented patients in Carruth's study failed to reach statistical significance.

It is not clear whether our inability to elucidate the source of effect size inconsistencies among the studies is because we did not include the correct methodological variables or if one of our hypothesized variables is exerting a moderating effect that is not detectable due to insufficient power. With only 21 studies being subjected to categorical model testing, we may be failing to detect an influential factor.

The overall lack of relationship between length of treatment and its effectiveness may be attributable to the relative immediacy of evaluation following exposure to treatment. That is, length of treatment may not matter in the short run, with improvement evident so long as treatment is available. The potential benefits of music therapy are clinically significant, as this treatment may represent a noninvasive mechanism for improving the quality of life for patients and may also have utility for caregivers (see also Hanser & Clair, 1995). Questions regarding treatment implementation and underlying mechanisms remain unanswered.

Suggestions for Future Research

We are hopeful that this review will stimulate empirical studies to systematically address some of the methodological issues currently limiting interpretation of this literature. For example:

1. Although within-subjects designs provide appropriate control for individual differences, the majority of the studies reviewed do not prevent against Hawthorne effects, also called experimenter expectancy biases (Rosenthal & Rosnow, 1991), as they generally lack "blind" observers or data-coders. There may also be an effect of therapeutic intervention that is not attributable to the use of music therapy, but to the social interaction between the patient and therapist.
2. Direct, experimental comparisons of potential moderating variables would provide clarification of the most effective approach to administering music therapy, including relative efficacy of active involvement or passive exposure to live versus taped music, the intervening professional's training—music therapy versus nursing, for example, length of treatment, and whether a cognitive, social or behavioral assessment tool is used. It should be noted, however, that measures of different abilities may differ widely in terms of their reliability. Thus, the observation of a change in specific symptoms following an intervention does not *necessarily* indicate specificity of the effect; it may simply reflect differential measurement sensitivity or reliability.
3. It remains unclear what underlying mechanisms might account for the apparent universality of symptoms amenable to treatment with music, such that the specific implementation protocol used, or even the musical genre selected as a range of musical styles were included, may not be relevant. Perhaps *all* humans, regardless of dysfunction or lack thereof are responsive to interactions involving music (e.g., Ragneskog et al., 1996).
4. It should be noted that we treated "the demented population" as a whole. However, differences in responsiveness to treatment may be observed depending on the severity and cause of the illness. Most of the studies contained in this analysis were conducted on probable Alzheimer's patients manifesting moderate

to severe impairment as assessed by diagnostic tools including the Mini-Mental Status Examination (MMSE), the Clinical Dementia Rating (CDR) and the Global Deterioration Scale (Reisberg, Ferris, & DeLeon, 1982). However, several studies lacked diagnostic specification and patient performance varied widely on diagnostic scales *within* single studies, thus precluding the inclusion of disease severity as a potential moderating variable *between* studies. While it seems that the overall effectiveness of musical intervention is not restricted to a subpopulation of patients suffering from dementia, future investigations might correlate severity of dementia with responsiveness to treatment.

5. Finally, the literature reviewed assessed symptom manifestation during or immediately following intervention. Long-term follow up is necessary to determine if the effects are lasting. The potential therapeutic implications of such lines of research should not be underestimated.

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Appendix

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