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## **The Effect of Background Stimulative Music on Behavior in Alzheimer's Patients**

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*Previous studies have demonstrated the benefits of music therapy in Alzheimer's patients, focusing either on improvement of healthy cognitive and social skills, or reduction of agitation symptoms. The present study examined the effect of background music on both positive and negative behaviors, during a time in which patients were not occupied with any structured activity. Twenty eight participants were observed both with and without stimulative, familiar background music. Results showed both a significant increase in positive social behaviors and a significant decrease in negative behaviors related to agitation when music is played. Results demonstrate the contribution of music to enhancing general positive functioning in elderly patients with dementia, and reducing negative behaviors typical of their condition.*

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Alzheimer's disease is the most common form of dementia among the elderly (Monczor, 2005). It is a neurological, progressive disease, characterized by a gradual deterioration of cognitive and mental functioning. Its symptoms include a decline in memory and other cognitive and mental functions, physiological deterioration, loss of social skills, and changes in personality (Cevasco & Grant, 2003). Throughout the course of the disease, the individual in fact gradually loses her "self." The difficulties facing Alzheimer's patients and caregivers are related both to the loss of healthy social, cognitive and emotional capacities, and to the appearance of negative symptoms, notably agitation, related to the progression of the

disease. Antipsychotic drugs can produce a modest improvement in some behavioral symptoms in dementia. However, nonpharmacological interventions have the advantage of taking into account the interaction between patient, caregiver, environment and system of care in the treatment design. These interventions may enhance cognition, affect, and performance in activities of daily living, as well as reduce agitation and behavior problems (Cohen-Mansfield, 2005).

Among these interventions, music therapy and music related activities have generally been shown to have clear local and temporary positive effects on a variety of behaviors and symptoms in Alzheimer's patients (for a review see Sherratt, Thornton, & Hatton, 2004). Within the body of existing studies, two global approaches may be distinguished. On the one hand, several studies address the amelioration of different aspects of healthy social, emotional, and cognitive functions through music therapy and activities. Within the second approach, other studies concentrate on the reduction of negative symptoms related to agitation, typical to Alzheimer's patients. The aim of the present study was to combine measures of these two facets: improved positive indications and reduced negative symptoms of agitation, through the use of background music.

The first category of studies involves measurements of the effect of music on the enhancement of healthy abilities, diminished as a result of the disease. One aspect of reduced competence due to Alzheimer's disease is the gradual loss of general cognitive functions. One of the first symptoms of the disease is loss of memory. Music has been found to improve memory and reminiscence (Foster & Valentine, 2001; Sambandham & Schirm, 1995) and help recollections from autobiographical memory (Lord & Garner, 1993). Preferred music related to patients' past, has been shown to help retrieval techniques on face-name recognition (Carruth, 1997). Other cognitive capacities were shown to improve through the use of music: attention and alert responses, such as head and eye movements, limb movements, changes in facial expression, and vocalizations (Clair, 1996; Gregory, 2002; Thompson, Moulin, Hayre, & Jones, 2005), and performance in a visual-spatial task (Johnson, Shaw, Vuong, Vuong, & Cotman, 2002). Language skills, as measured by the Mini-Mental State Examination "fluency" subtest were improved in sessions involving physical exercise with background

music (Van de Winckel, Feys, De Weerd, & Dom, 2004), and speech fluency and content in the spontaneous speech subscale of the Western Aphasia Battery (WAB) were improved after music therapy sessions (Brotons & Koger, 2000).

A second aspect of reduced abilities in Alzheimer's disease relates to social skills. The diminishing capacities for communication and social relations in dementia patients are a source of grief and frustration for the patient, family members, and caregivers. Music is a cultural product, and its enjoyment is essentially social (Crozier, 1997). It plays an important role in everyday life (Rentfrow & Gosling, 2003) and people intuitively choose music appropriate to their activities (North, Hargreaves, & Hargreaves, 2004). However, the opportunities to experience music are extremely limited for dementia patients in residential facilities (Chavin, 2002). Activities involving music can have a positive effect on mood, social interaction and behavior in dementia patients (Aldridge, 1994; Chavin, 2002), and aid in improving quality of life and relationships with people, when adapting to living in a long term care facility (Kydd, 2001). Participation in social and other activities, such as exercise, was enhanced when background rhythmic music was played (Groene, 2001; Mathews, Clair, & Kosloski, 2001). Background music and caregiver's singing has been shown to improve interaction between severely demented patients and their caregiver (Gottel, Brown, & Ekman, 2002). In a study conducted with 15 couples in which one member was a dementia patient, Clair and Ebberts (1997) showed that music therapy involving singing, dancing, and rhythmic play, in which both partners took part, improved interaction between the two members, in comparison with sessions including conversation. Communication and understanding seemed to work better with music, even though the caregiver, while singing, used less verbal explanations for his activity. In other words, the mere presence of music strengthened social interaction.

The studies mentioned above thus show clear improvements, albeit temporary, in healthy cognitive and social functions, through the use of music as background and through music therapy activities. The second category of studies addresses the reduction of symptoms related to agitation.

Agitation is a general term which refers to a range of behavioral disturbances, including aggression, combativeness, shouting, hyperactivity and disinhibition. Cohen-Mansfield and Billing (1986)

define agitation as inappropriate behavior, verbal or physical, manifested in repetitious behaviors, abusive or aggressive behaviors, and behavior which is inappropriate to social standards. As many as 50 % of all dementia patients exhibit agitation, particularly in the middle and later stages of the disease.

The calming effects of music therapy have been demonstrated for example by improving sleeping patterns in dementia patients (Lindenmuth, Patel, & Chang, 1992). Physiological measures in blood samples have shown immediate and long-term effects of up to 6 weeks after music therapy sessions in melatonin levels in Alzheimer's patients, thus contributing to patients' improved and relaxed mood (Kumar et al., 1999). Music therapy has also been shown to reduce levels of salivary chromogranin A (CgA), a protein related to psychosomatic stress (Suzuki et al., 2004).

A number of studies specifically refer to the effect of music therapy and music-related activities on symptoms of agitation and restlessness (see Lou, 2001, for a review). Of these, several studies examined the effect of background music on agitation in specific activities, such as bathing and eating. Thus, for example, preferred music was found to delay the appearance of agitation symptoms and to increase cooperation with caregiver while bathing (Clark, Lipe, & Bilbrey, 1998; Thomas, Alexander, & Heitman, 1997). Background relaxing music reduced agitation during meal times (Denny, 1997; Goddaer & Abraham, 1994), and influenced food intake and symptoms common in dementia (Ragneskog, Brane, Karlsson, & Kihlgren, 1996). Patients spent more time at the dinner table, and ate more calmly when relaxing music was played in the background (Ragneskog, Kihlgren, Karlsson, & Norberg, 1996).

Other studies examined the mere effect of background music on agitation symptoms. Ragneskog, Asplund, Kihlgren, and Norberg (2001) found reduced agitation in four patients with dementia after individualized sessions of music. Groene (1993) found individual sessions of music attention reduced wandering behavior. Gerdner and Swanson (1993) showed that individualized sessions of 30 min listening to preferred music, chosen by patients' family members, significantly reduced symptoms of agitation in five demented patients. Relaxing classical music and preferred music were shown to help reduce repetitive disruptive vocalizations in Alzheimer's patients (Casby & Holm, 1994). Clair and Bernstein (1994), however, did not find any effect of stimulative, sedative, or no background music

on agitation. The authors suggest that perhaps the choice of music, which was not patients' preferred music, explain the lack of effect.

With the exception of Clair and Bernstein (1994), all studies on the effects of music on agitation show a reduction of symptoms. However, these studies use very small samples and report descriptive data. Moreover, none of the studies reviewed contains a systematic attempt to measure and quantify the relationship between agitation symptoms and social interaction and mood.

The present study aims to examine the effect of background music on a combination of measures of both positive behavior related to emotional and social aspects, and negative symptoms related to agitation, within each patient. Although both the gradual loss of healthy positive behaviors and the appearance of agitation are symptoms of Alzheimer, they are in fact not identical, and understanding the effect of music on both aspects may lead to a greater comprehension of music's effects, which in turn may lead to improved methods of music therapy for Alzheimer's patients. In addition, the present study focuses on a time period in which participants are in a group setting, but which is not directly related to any therapeutic or other activity. Finally, the number of participants in the reported study is larger than most other studies, thus allowing greater possible generalization of results.

## Method

### *Participants*

Twenty-eight participants took part in the study, 3 males and 25 females (mean age = 82.6,  $SD = 4.89$ ). Participants were Alzheimer's patients in a medium-advanced state, with a mini-mental score of less than 11 (11/30), residing in the The Sophie & Abram Stuchynski Alzheimer Research & Treatment Center in Ramat-Gan. All participants had normal hearing. Participants were randomly chosen from the elderly who were present at the time of the study in the Center's lobby.

### *Material*

*Music.* After consultation with the center's music therapist, a disc including six very well-known popular songs from 1964, assumed to be familiar to all participants, was chosen for the study. The songs are all characterized by an upbeat rhythm and gay lyrics. The total duration of the six songs was 16:48 min.

*Observation form.* Prior to running the study, the researchers conducted an observation session in order to compile a list of behaviors manifested by patients during a one hour period following lunch. The study itself was conducted during 4 consecutive weeks at the same time period. The final list of behaviors was based on the initial observation, an adaptation of the conceptual framework for the study of agitation in the elderly proposed by Cohen-Mansfield and Billing (1986), and an unpublished observation form developed in the Center for study purposes.

Three types of behaviors were defined. Positive behavior included attempts at making contact, talking, laughing, smiling, attempts to calm another patient, humming, singing, drumming with the hand/foot to the rhythm of the music, rocking the body or a part of the body to the rhythm of the music, shaking hands, caressing, touching. Negative behavior included behavior attesting to agitation and aggression. These included vocal repetitions: repeating words, sentences, questions, complaints or demands and repetitive behaviors: rising from a chair and sitting down again immediately, repetitive manipulation of an object (shirt button, shoe, etc.), wandering, trying to break free of chair restraints, pushing, throwing objects, holding on to people by force, trying to catch another's seat, shouting, crying, hurting oneself or others, harassing other patients. The "neutral" behavior category was defined as any behavior which did not clearly enter into the positive or negative category, such as dozing, sleeping, staring into space.

The observation form included three columns, one for each type of behavior. Each column was divided into 11 rows corresponding to the 11 intervals of observation in each session.

### *Design*

A one-factor within-subject design was used for the study. The independent variable was "exposure to music," and included two levels (with/ without exposure to music). The dependent variable was "frequency of observed behavior" and was measured for the three behavior categories: "positive," "negative," and "neutral."

### *Interrater reliability*

Before conducting the study, and after establishing the observation form, two of the researchers conducted an observation session of the same randomly-chosen four patients, who were later in-

cluded in the study sample. These participants were first observed without background music for 17 min, followed by 17 min of observation with background music. The observed behaviors were noted by each researcher on an observation form. Inter-rater agreement in categorizing observed behaviors was high, ranging from 91% to 100% in all conditions, except for the without music/negative behavior category, in which agreement was 80%. Based on the high interrater agreement each researcher observed different patients during the study itself.

### *Procedure*

The study was conducted on three consecutive Wednesdays, not including the first session in which interrater reliability was established. Two observation sessions were conducted on each Wednesday, in two different wards of the Center. Observation sessions were conducted in the Center's lobby, during the hour after lunch (between 13:15 and 14:25). This time-period was chosen since, according to nurses and staff, this period is characterized by unrest. Additionally, this period does not include any organized or structured activity.

In each session, each of the two researchers observed two different patients in each ward. The order of conditions (with and without exposure to music) was alternated during the three weeks of the study. Sixteen of the participants, observed in the first and third week, were observed first while the music was played in the background for a period of 17 min, followed by another period of 17 min in which no music was played. Twelve participants (8 observed during the second week, and 4 during the session in which reliability was measured), were first observed for 17 min without background music, followed by 17 min with background music.

The observations were conducted using the momentary time sampling technique (MTS), a procedure commonly used in social science studies, and in studies on music therapy and dementia (e.g., Casby & Holm, 1994; Groene, Zapchenk, Marble, & Kantar, 1998; Lord & Garner, 1993). Each observer sat with a tape connected to ear-phones and listened to instructions regarding when to observe patients and when to write down the observed behavior. Within each session of 17 min, researchers were required to observe the patients for 1 minute at a time, followed by a period of 30 s in which they were to write down and categorize the observed

behavior. The observer decided how to categorize the behavior for each minute of observation, and placed a mark at the appropriate cell in the form. In most cases, the same behavior repeated within the whole minute of observation. In cases where the researcher had doubts concerning the appropriate categorization of the observed behavior, a decision was made through consulting a staff member. This occurred only in two cases: one which was categorized as neutral, and one which was categorized as negative. Only one observed behavior was noted for each minute of observation.

### Results

In order to examine a possible effect of order of presentation, independent sample *t* tests were conducted comparing positive, negative and neutral behaviors between participants exposed to the two different orders of study conditions: those observed first with background music playing and then without music, and those observed first without background music and then with music playing. *No significant differences were found between the groups.*

Differences in positive, negative, and neutral behaviors with and without background music were analyzed by paired-sample *t* tests. As can be seen in Table 1, significant differences were found for both positive and negative behaviors, showing more positive and less negative behaviors when background music was played. No significant difference was found in neutral behavior between the two conditions.

Table 1 gives a global picture of music's influence on positive and negative behavior. In order to get a deeper understanding of music's effect within each participant, behaviors in the positive category were divided into behaviors directly related to the music (e.g., moving to the rhythm, singing, etc.), and social positive behaviors (conversing with another person, smiling to another person, etc.). Music-related behaviors were eliminated from the following analyses, since these obviously only appeared in the music exposure condition. Behaviors in the negative category were divided into two types: repetitive behaviors (physical, such as fidgeting, wandering, etc., and verbal, such as repeating the words or sentences), and aggressive and socially inadequate behaviors (such as screaming, cursing, attacking others, addressing one person as another, crying). Two participants were excluded from this analysis, since they only showed behaviors categorized as neutral, in both conditions. For each participant, the number of behaviors ob-



TABLE 1

T tests comparing positive, negative, and neutral behaviors with and without background music

Behavior type	Exposure to music (n = 28)		t	p
	With music Mean (SD)	Without music Mean (SD)		
Positive	5.18 (3.62)	1.36 (2.08)	6.73	.001
Negative	2.43 (3.2)	5.96 (4.13)	-5.05	.001
Neutral	4.39 (3.61)	4.68 (3.61)	-0.37	ns

served for each new category was compared between the two experimental conditions. The difference between occurrence of behaviors of the various types with and without music, for each participant, were rated in the following manner: for positive behavior, a rating of 0 was given if this behavior appeared only without music, or if it was less frequent with music than without. A rating of 1 was given if there was no difference in the frequency of the behavior with or without music. A rating of 2 was given if the behavior was more frequent with music. A rating of 3 was given if the behavior appeared only with music. Thus, the higher the rating, the stronger the positive effect of background music. Ratings for negative behaviors were calculated in the same manner, but reversed, so that here, the higher the rating, the stronger the effect of background music on the reduction of negative behaviors. Table 2 shows differences within participants, between behaviors in each of the new categories, with and without background music.

As Table 2 shows, most pronounced differences within participants were found in the "positive social" behavior category. Ten participants showed positive behavior only in the presence of music, 6 participants showed more positive behavior in the presence of music than in its absence, and 9 participants did not show any differences in the amount of positive social behavior with or without music. No participants showed more positive social behavior without music than with music.

As for the negative behaviors, most behaviors in this category were classified as repetitive. Aggressive and negative social behaviors were less frequent in general. In the "negative repetitive" behavior category, symptoms disappeared with music in nine partici-

TABLE 2

*Differences between "with" and "without" background music within each participant*

Participant	Positive: social*	Negative: Repetitions**	Negative: Aggression+ social**
1	3	2	3
2	2	2	2
3	1	1	
4	2	0	
5	3	1	2
6	3	2	
7	1	3	
8	3	3	
9	1	3	
10	1	3	2
11	3	3	3
12	2	3	
13	1	3	
14	3	2	3
15	2		3
16	2	3	
17	1	1	
18	3	2	
19	3	0	
20	2	2	
21	3	2	
22	1	2	
23	2	2	
24	1		2
25	1	1	
26	3	3	
Total	53	49	20

\*0 = behavior was less frequent with music, or appeared only without music, 1 = no difference in frequency of behavior with or without music, 2 = behavior was more frequent with music, 3 = behavior appeared only with music.

\*\* 0 = behavior appeared only with music, 1 = no difference in frequency of behavior with or without music, 2 = behavior was less frequent with music, 3 = behavior disappeared with music.

pants, and the amount of negative repetitive behavior was reduced when background music was played in eight participants. Four participants did not show a difference in amount of negative repetitive behavior with and without music. Two participants showed repetitive behavior only in the presence of music.

Aggressive and socially inadequate behavior appeared only without music, and disappeared with music, in four participants. In

four other participants, this type of behavior was less frequent with music than without music. None of the participants showed aggressive or socially inadequate behavior only when music was played.

The results suggest that music's most pronounced effect was on the enhancement of positive social behavior. It also had a very strong effect on the reduction of repetitive agitated behavior, although in general, its effect was positive in all cases.

#### Discussion

The symptoms of Alzheimer's disease include both a reduction in healthy cognitive and social capacities, and the appearance of negative symptoms related to agitation. Previous studies on the effect of music related activities and music therapy have traditionally concentrated on one aspect of these symptoms at a time. Studies generally tend to show a clear positive effect of music both on cognitive (Brotons & Koger, 2000; Clair, 1996) and social capacities (Aldridge, 1994; Clair & Ebberts, 1997), as well as a reduction in agitation symptoms in general (Gerdner & Swanson, 1993) and during specific activities (Denny, 1997; Ragneskog, Kihlgren, Karlsson, & Norberg, 1996).

However, the decrease in positive behaviors and the increase in negative symptoms are not two facets of the same phenomenon. Although both are characteristic of Alzheimer's disease, they are qualitatively different. The present study was designed to explore the effect of background music simultaneously on both positive and negative behaviors in Alzheimer's patients, in an attempt to gain deeper understanding of music's influence on patients' symptoms.

Participants' behavior was observed under two conditions: with background music, and without music. Behavior was at first categorized into positive and negative types. Primary results show a clear increase in positive behaviors, such as conversation, smiling, or moving to the rhythm, and a reduction in negative behavior such as wandering, fidgeting and showing aggression towards others.

A deeper analysis of different types of positive and negative behavior within each participant showed that music's most pronounced effect was in reinforcing positive social behavior. Sixteen of the 26 participants included in this analysis showed more positive social behavior in the presence of music than in its absence. Indeed, over a third of participants showed positive social behavior only in the presence of music, and none in its absence. For 9 par-

ticipants, music had no effect. Most importantly perhaps, none of the participants showed more positive behavior in the absence of music than in its presence. These results thus confirm previous findings regarding music's role in promoting social interaction (Groene, 2001; Koger, Chapin, & Brotons, 1999).

Background music also had a strong effect on the reduction of repetitive negative behaviors. Over a half of participants showed less repetitive behavior with background music than without, in nine of these, repetitive behavior disappeared completely with background music. These findings are in line with other findings on the calming effect of music on agitated behavior (Casby & Holm, 1994; Denny, 1997). It is interesting to note that, in this category, repetitive negative behavior appeared only with music in 2 patients. This effect may have been the result of the upbeat music used in this study, which may have stimulated certain participants, creating more agitation. However, these two cases are an exception. For the majority of participants, music's effect was positive.

Aggressive and negative social behaviors were less frequent in general in the sample of participants taking part in the study, and the effect of background music on these types of behaviors was weaker. Nevertheless, as in the other behavior categories, the effect of music was positive.

Apart from combining measurements of positive and negative behavior, the present study presents a novel approach to investigating the effects of music in Alzheimer's patients in a number of other parameters: first, the time-period chosen for the study was a period in which participants were in a group situation, but which did not include any structured activity. Investigating this time interval, which is characterized by increased agitated behavior, thus affords data which are directly relevant to participant's well-being, rather than to improving performance on various tests, or facilitating caregivers' task. Second, the music used was upbeat, familiar music, whose aim and effect was to stimulate participants into healthy behavior, rather than simply to tranquilize or calm them. Finally, although the number of participants was not large, it was larger than many studies, thus suggesting the possibility of more generalization.

The present study thus confirms and enhances previous findings regarding the effect of music on Alzheimer's patients. Since music has such a clear and immediate effect, and since integrating music

into hospital facilities is technically very easy to implement, results of the present study suggest that incorporating music in living facilities could be beneficial in improving patients' quality of life.

### References

- Aldridge, D. (1994). Alzheimer's disease: Rhythm, timing and music as therapy. *Bio-medical Pharmacotherapy*, 48(7), 275-81.
- Brotons, M., & Koger, S. (2000). The impact of music therapy on language functioning in dementia. *Journal of Music Therapy*, 37, 183-195.
- Carruth, E. K. (1997). The effects of singing and the spaced retrieval technique on improving face-name recognition in nursing home residents with memory loss. *Journal of Music Therapy*, 34, 165-185.
- Casby, J. A., & Holm, M. B. (1994). The effect of music on repetitive disruptive vocalizations of persons with dementia. *The American Journal of Occupational Therapy*, 48(10), 883-889.
- Cevasco, A. M., & Grant, R. E. (2003). Comparison of different methods for eliciting exercise-to-music for clients with Alzheimer's disease. *Journal of Music Therapy*, 40, 41-56.
- Chavin, M. (2002). Music as communication. *Alzheimer's Care Quarterly*, 3(2), 145-156.
- Clair, A. A. (1996). The effect of singing on alert responses in persons with late stage dementia. *Journal of Music Therapy*, 33, 234-247.
- Clair, A. A., & Bernstein, B. (1994). The effect of no music, stimulative background music and sedative background music on agitated behaviors in persons with severe dementia. *Activities, Adaptation and Aging*, 19(1), 61-70.
- Clair, A. A., & Ebberts, G. (1997). The effects of music therapy on interaction between family caregivers and their care receivers with late stage dementia. *Journal of Music Therapy*, 34, 148-164.
- Clarke, M. E., Lipe, A. W., & Bilbrey, M. (1998). Use of music to decrease aggressive behaviors in people with dementia. *Journal of Gerontological Nursing*, 24(7), 10-17.
- Cohen-Mansfield, J. (2005). Nonpharmacological interventions for persons with dementia. *Alzheimer's Care Quarterly*, 6(2), 129-145.
- Cohen-Mansfield, J., & Billing, N. (1986). Agitated behaviors in the elderly: A conceptual review. *Journal of the American Geriatric Society*, 34, 711-721.
- Crozier, W. R. (1997). Music and social influence. In D. J. Hargreaves & A. C. North (Eds.), *The Social Psychology of Music* (pp. 67-83). Oxford: Oxford University Press.
- Denny, A. (1997). Quiet music: An intervention for meal-time agitation. *Gerontological Nursing*, 23, 16-23.
- Foster, N. A., & Valentine, E. R. (2001). The effect of auditory stimulation on autobiographical recall in dementia. *Experimental Aging Research*, 27, 215-228.
- Gerdner, L. A., & Swanson, E. A. (1993). Effects of individualized music on elderly patients who are confused and agitated. *Archives of Psychiatric Nursing*, 7(5), 282-291.
- Goddaer, J., & Abraham, I. L. (1994). Effects of relaxing music on agitation during meals among nursing home residents with severe cognitive impairment. *Archives of Psychiatric Nursing*, 8, 150-158.

- Gottel, E., Brown, S., & Ekman, S. L. (2002). Caregiver singing and background music in dementia care. *Western Journal of Nursing Research, 24*(2), 195–117.
- Gregory, D. (2002). Music listening for maintaining attention of older adults with cognitive impairments. *Journal of Music Therapy, 39*, 244–64.
- Groene, R. (1993). Effectiveness of music therapy 1:1. Intervention with individuals having senile dementia of the Alzheimer type. *Journal of Music Therapy, 30*, 138–157.
- Groene, R. (2001). The effect of presentation and accompaniment style on attentional and responsive behaviors of participants with dementia diagnoses. *Journal of Music Therapy, 38*, 36–50.
- Groene, R., Zapchenk, S., Marble, G., & Kantar, S. (1998). The effect of therapist and activity characteristics on the purposeful responses of probably Alzheimer's disease participants. *Journal of Music Therapy, 35*, 119–136.
- Johnson, J. K., Shaw, G. L., Vuong, M., Vuong, S., & Cotman, C. W. (2002). Short-term improvement on a visual-spatial task after music listening in Alzheimer's disease: a group study. *Activities, Adaptation and Aging, 26*(3), 37–50.
- Koger, S. M., Chapin, K., & Brotons, M. (1999). Is music therapy an effective intervention for dementia? A meta-analytic review of literature. *Journal of Music Therapy, 36*, 2–15.
- Kumar, A. M., Tims, F., Cruess, D. G., Mintzer, M. J., Ironson, G., Loewenstein, D., Cattan, R., Frenandez, J. B., Eisdorfer, C., & Kumar, M. (1999). Music therapy increases serum melatonin levels in patients with Alzheimer's disease. *Alternative Therapy in Health and Medicine, 5*(6), 49–57.
- Kydd, P. (2001). Using music therapy to help a client with Alzheimer's disease adapt to long-term care. *American Journal of Alzheimer's Disease and Other Dementias, 16*(2), 103–108.
- Lindenmuth, G. F., Patel, M., & Chang, P. (1992). Effects of music on sleep in healthy elderly and subjects with senile dementia of the Alzheimer type. *American Journal of Alzheimer's Care and Related Disorders and Research, 2*, 13–20.
- Lord, T. R., & Garner, J. E. (1993). Effects of music on Alzheimer patients. *Perceptual and Motor Skills, 76*, 451–455.
- Lou, M. F. (2001). The use of music to decrease agitated behaviour of the demented elderly: The state of the science. *Scandinavian Journal of Caring Sciences, 15*, 165–173.
- Mathews, R. M., Clair, A. A., & Kosloski, K. (2001). Keeping the beat: use of rhythmic music during exercise activities for the elderly with dementia. *American Journal of Alzheimer's Disease and Other Dementias, 16*(6), 377–380.
- Monczor, M. (2005). Diagnosis and treatment of Alzheimer's disease. *Current Medicinal Chemistry – Central Nervous System Agents, 5*(1), 13–22.
- North, A. C., Hargreaves, D. J., & Hargreaves, J. J. (2004). Uses of music in everyday life. *Music Perception, 22*(1), 41–77.
- Ragneskog, H., Brane, G., Karlsson, I., & Kihlgren, M. (1996). Influence of dinner music on food intake and symptoms common in dementia. *Scandinavian Journal of Caring Sciences, 10*, 11–17.
- Ragneskog, H., Kihlgren, M., Karlsson, I., & Norberg, A. (1996). Dinner music for demented patients: analysis of video-recorded observations. *Clinical Nursing Research, 5*, 262–77.

- Ragneskog, H., Asplund, K., Kihlgren, M., & Norberg, A. (2001). Individualized music played for agitated patients with dementia: Analysis of video-recorded sessions. *International Journal of Nursing Practice*, 7, 146-155.
- Rentfrow, P. J., & Gosling, S. D. (2003). The do re mi's of everyday life: The structure and personality correlates of music preferences. *Journal of Personality and Social Psychology*, 84(6), 1236-1256.
- Sambandham, M., & Schirm, V. (1995). Music as a nursing intervention for residents with Alzheimer's disease in long-term care. *Geriatric Nursing*, 16, 79-83.
- Sherratt, K., Thornton, A., & Hatton, C. (2004). Music interventions for people with dementia. A review of the literature. *Aging & Mental Health*, 8(1), 2-12.
- Suzuki, M., Kanamori, M., Watanabe, M., Nagasawa, S., Kojima, E., Ooshiro, H., & Nakahara, D. (2004). Research Article Behavioral and endocrinological evaluation of music therapy for elderly patients with dementia. *Nursing and Health Sciences*, 6(1), 11-19.
- Thomas, D., Alexander, T., & Heitman, R. (1997). The effects of music on bathing cooperation for residents with dementia. *Journal of Music Therapy*, 34, 246-259.
- Thompson, R. G., Moulin, C. J. A., Hayre, S., & Jones, R. W. (2005). Music enhances category fluency in healthy older adults and Alzheimer's disease patients. *Experimental Aging Research*, 31(1), 91-99.
- Van de Winckel, A., Feys, H., De Weerd, W., & Dom, R. (2004). Cognitive and behavioral effects of music-based exercises in patients with dementia. *Clinical Rehabilitation*, 18(3), 253-260.