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An Investigation into the Short-Term Effects of Music Therapy for Patients with Probable Alzheimer's Disease or Another form of Dementia

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This study aimed to address the question: to what extent are weekly music therapy sessions able to improve social interaction and heighten moods in patients suffering from different stages of Alzheimer's disease? The study examined the progress of four participants from the O'Neill Centre in Toronto, Canada during 11 music therapy sessions over the course of six weeks. Results were measured using standardized tests prominent in the field: The Bristol Activities of Daily Living Scale (BADLS), and Global Deterioration Scale (GDS). Although both scales showed no improvement amongst participants, positive patterns were observed by the lead researcher.

Keywords: Alzheimer's Disease, dementia, music therapy, Bristol Activities of Daily Living Scale, Global Deterioration Scale

The study was approved by a Research Ethics Board.

Alzheimer's disease is the most common form of dementia, a general term for memory loss and other intellectual abilities serious enough to interfere with the daily life (Alzheimer's Association, 2016). It is described by scholars as, "a devastating neurological disorder primarily affecting the elderly. The disease manifests with progressive deterioration in cognitive functions, leading to loss of autonomy" (Lambert et al., 2013, p. 1452). Since it is a progressive disease, this means it deteriorates over time and is ultimately responsible for death. Currently, there is no cure for Alzheimer's, and it is unknown if any precautions can be taken to prevent Alzheimer's (Alzheimer's Association, 2016). Although there is no cure, there are some methods of treatment that can improve quality of life for those suffering with Alzheimer's and other forms of dementia. One treatment method being explored is music therapy. The suffering caused by Alzheimer's can often be noticed from first symptoms which include: changes in mood, withdrawal from activities, confusion with time or place, and new problems with words or writing (Alzheimer's Association, 2016). Early stages of Alzheimer's can generally be recognized by negative symptoms such as, "little interest in self-care, work and household tasks, social and family activities, and emotional needs of others" (Reichman, Coyne, Amirneni, Molino, & Egan, 1996, p. 424).

Alzheimer's has also been linked to lead to other forms of mental illness, and vice versa. As Levy, Cummings, Fairbanks, and Bravi (1996) describe, "In addition to the intellectual abnormalities of Alzheimer's disease, most patients exhibit neuropsychiatric disturbances at some time during the course of the illness. Depression, psychosis, and agitation are among the most common neuropsychiatric abnormalities of the disorder" (p. 1438). In a study conducted by Ropacki and Jeste (2005), they found that psychotic symptoms are quite common amongst patients with Alzheimer's disease. After examining 55 studies in the field, they concluded that "psychosis was reported in 41% of patients with Alzheimer's disease, including delusions in 36% and hallucinations in 18%" (Ropacki & Jeste, 2005, p. 2022). Similarly, a one-year study conducted by Levy, et al. with 181 probable Alzheimer's patients found that "recurrence rates of neuropsychi-

atric symptoms during the 1-year period were 85% for depression, 93% for agitation, and 95% for psychosis" (Levy et al., 1996, p. 1438). The link between Alzheimer's and other mental illness' progression is interesting to note as many of the symptoms listed previously are mutual. The negative effects of Alzheimer's are abundant and severe, and treatment for relief is desperately needed. The hope of this study was to provide a form of relief for some patients with Alzheimer's disease, through group based music therapy sessions.

This study was designed to test the extent to which weekly music therapy sessions could improve social interaction and heighten moods in patients suffering from different stages of Alzheimer's disease. This study was conducted in accordance with the O'Neill Centre Seniors Home in Toronto, Canada and collected both qualitative and quantitative data from four patients suffering from Alzheimer's or another similar form of dementia. The data in this case study was largely collected by a caregiver who reported on patients' improvement or decline in quality of life based on patient's conversations and social interactions. The caregiver also administered assessment tests that are already prominent in similar literature: the Bristol Activities of Daily Living Scale (Bucks, Ashworth, Wilcock, Siegfried, 1996) and Global Deterioration Scale (Reisberg, Ferris, de Leon, & Crook, 1982). The caregiver was the same for all participants. The literature review ahead provides a closer look at other studies in the related field and their differences and similarities to the current study.

Literature Review

This review of literature will examine multiple studies that hypothesize social improvement and interaction amongst participants with forms of dementia, in addition to some studies with different intended outcomes. Many studies do not take the exact approach of the current study. Examples of studies in the field with different goals or approaches include: Hanser, Butterfield-Whitcomb, Kawata, and Collins, (2011) who examined the effects and tolls of caregiving more closely than the actual effects of music therapy for patients with Alzheimer's (Hanser et al., 2011); Takahashi and Matsushita, (2006) who examined cortisol levels in the different participants saliva and blood pressures in order to draw conclusions over a two-year period of music therapy (Takahashi & Matsushita, 2006); and Ledger and Baker, (2007) who examined the effects of group music therapy over the course of one year on, "agitation manifested by nursing home residents with Alzheimer's disease where a non-randomised experimental design was employed with one group receiving weekly music therapy and another group receiving standard nursing home care" (Ledger & Baker, 2007, p. 330). All of these studies are slightly different from the current study and therefore the gap in research is revealed.

Therefore regardless of success amongst certain other studies, one reason the current study addressed a gap in that it offered new data in a unique case study form. The current study examined if improvement in social behaviour could occur in a small sample size, in an isolated population. Although certainly limited, this study's small sample size and short-term therapy with residents at the O'Neill Centre is new research consisting of a modified method and adds something new to the academic conversation of previous literature. Even though this study differentiated in some ways from past literature, it also closely emulated some of the procedure carried out by other leading researchers (Brotons & Marti, 2003; Hanser et al., 2011; Levy et al., 1996; and Gregory, 2002)

In past studies, unrelated from dementia, music therapy has been examined as a possible treatment for heart disease, certain types of cancer, and other terminal illnesses. It is described as successfully lowering anxiety and stress in a study done by Clark et al., (2006) examining the effects of music to reduce emotional distress during radiation therapy (p. 247). It is also described as being successful in a study by Mandel, Hanser, Secic, and Davis looking at the effects of music therapy on health-related outcomes in cardiac rehabilitation (2007, p. 176). As Mandel et al. (2007) describes, "The control group's mean systolic blood pressure increased, while that of the music therapy group decreased from pre to post-treatment" (p. 188). Music therapy has proven to be successful in many clinical trials, although there are also areas in which it has failed. Although music therapy was helpful in lowering stress in radiation therapy patients in the study conducted by Clark et al. (2006) it was found that "depression, fatigue, and pain were not appreciably affected by music therapy" (p. 247). This shows

that if the current study provides positive results, then the music therapy would be acting on other cognitive factors besides depression. Music therapy is not usually able to help with any physical pain and is not a cure, only a treatment. It can act as treatment for symptoms like irritability and anxiety, which are common symptoms of dementia. According to a study conducted in the Journal of Music Therapy by Lipe, York, and Jensen, it concluded that over the past two decades, many research studies have discovered music therapy to be beneficial to participants, and the effects especially positive on those with dementia (Lipe, York, & Jensen, 2007).

For the most part, the results of music therapy studies in patients with dementia seem to have been successful. Success was noted in many studies, (Gregory, 2002; Brotons & Marti, 2003; Hanser et al., 2011; Larkin, 2001; Takahashi, & Matsushita, 2006; Bruer, Spitznagel, & Cloninger, 2007; and Zare, Ebrahimi, & Birashk, 2010) as well as others in the field. Silverman (2006) analyzed, "all the case studies published in the Journal of Music Therapy, Music Therapy, and Music Therapy Perspectives from 1964-2003" (p. 4). Silverman (2006) reviewed the results of 123 studies and he concludes that published case studies within the examined literature reveal that music therapy interventions have been successful in many different populations with a diversity of clinical techniques addressing each population's individual needs. These studies that noted success in their treatments have improved patient's ability to cooperate socially and integrate into society (Silverman, 2006).

Gregory (2002) examined the differences between a group of elderly adults with cognitive impairments and a group of college students and older adults in an Alzheimer's caregivers group. She had each group listen to three chosen music pieces separated by silent pauses. At each new song and at each pause, participants were asked to move a dial with a pointer to rest on either the name of the song or the word 'wait' (Gregory, 2002). These results indicated no differences between the college students and Alzheimer's caregiver group but noted significant decline in reaction time and correctness in the older adults group (Gregory, 2002). The rationale behind this study was to test the effectiveness of listening activities for older adults. The results of the college students and caregivers were combined since their results yielded no differences. Two groups were then formed (college combined with caregiver and elderly adults with cognitive impairments) and their results were compared using a one-way analysis of variance (ANOVA) test. The current study also uses an ANOVA to compare early and later test scores for participants. Another study published in the field that used multiple ANOVA tests was conducted by Levy et al., (1996).

In a study conducted by Brotons and Marti (2003), 14 participants with a probable Alzheimer's diagnosis underwent music therapy with a personal caregiver who administered standardized testing (Brotons & Marti , 2003). The caregivers were also tested in order to record their emotional state and to see if their social interaction improved or declined during the course of the study (Brotons & Marti, 2003). The relatively small sample size used by Brotons and Marti (2003) is one aspect that is also used in the current study. The current study uses a sample size of four participants. Although a small sample size is a limitation to the findings, it is important to still be examined in order to minimize a gap in research.

In a study conducted by Hanser, et al., (2011), she examines the impacts of music therapy for participants and their caregivers. This study is similar to Brotons and Marti method in that it analyzes impacts on participants with Alzheimer's as well as caregivers. Hanser's study also involved 14 participants just like Brotons and Marti (2003). The methodology of these two studies was to use standardized testing methods to benchmark the participants' progress. This process is similar to the current study and this study uses some of the same standardized tests; the Bristol Activities of Daily Living Scale, and the Global Deterioration Scale (Bucks et al., 1996); (Reisberg et al., 1982).

Another study conducted in the related field - yet very different from Brotons and Marti (2003) and Hanser et al., (2011) - is by Takahashi and Matsushita (2006). Takahashi and Matsushita (2006) explored the long-term effects of music therapy on patients with dementia over a two year period. They monitored changes by measuring cortisol levels in the different participant's saliva and blood pressures (Takahashi & Matsushita 2006). The study had a music therapy group and non-music therapy group that was also monitored and there was a significantly lower systolic blood pressure shown in the group participating in the music therapy (Taka-

hashi, & Matsushita 2006). The rationale behind this study was to see if long-term therapy could be a factor in improving heart health and well being amongst elderly patients with dementia (Takahashi, & Matsushita 2006).

It is also worthy of mention that some studies have found music therapy to show no improvement or little improvement for those with dementia. In a study by Sim and Chung, they concluded that although music therapy is an effective means of improving the emotional state of elderly people suffering from dementia, "the effect of music therapy on the cognitive function and behavior of elderly dementia patients is not significant statistically" (Sim & Chung, 2001, p. 1). Sim and Chung conducted their study over the course of one month approximately and met with their participants for sessions 6 times per week (Sim & Chung, 2001). Sim and Chung had three original hypotheses and their first hypothesis which had assumed the recipients of music therapy would have had a higher cognitive function level than the other was rejected because it was not significant statistically (Sim & Chung, 2001). The second hypothesis was also rejected and it had assumed the group receiving music therapy would have had a higher behaviour level than the control group (Sim & Chung, 2001). Sim and Chung's third original hypothesis was supported and was that the music therapy recipients would have a higher emotion level than the control group (Sim & Chung, 2001). Acknowledging the original hypotheses sometimes failing is an important part of research as it still provides important literature and closes gaps in the field.

Lots of research has been done on music therapy and its relation to dementia and Alzheimer's disease; however, the current study furthers the academic discussion and also provides newfound research. Factors such as study population size, study location, study duration, and study content and data collection all differ from previous research and therefore address a gap and provide new research. The method will be further discussed in the next section of this study, as there are further differences and multiple other sources of data collection.

The findings above indicate that research has been done in this field yet many gaps exist within. This current study will help to narrow those gaps and broaden the academic understanding of Alzheimer's disease and how its effects on patients can be improved through the uses of music therapy.

Method

Subjects

Four participants formed the group of patients being tested. All four participants were women and their average age was 90.5 years old, comprised of individual ages: 84, 90, 92, and 96. All of the participants are residents of the O'Neill Centre in Toronto, Canada. Each participant was from a different floor of the residence and they did not know each other well to begin with.

The research team was made up of one head researcher (the author), the head caregiver at the O'Neill Centre, and support from additional caregivers at the O'Neill Centre.

Instruments

Standardized testing was administered at two points over the course of the study. After a few initial meetings between the lead researchers and the participants, musical preferences were established and the first tests were then completed after a few listening sessions. The same caregiver completed all the tests for all of the participants. The tests used to collect information on the participants were:

Bristol Activities of Daily Living Scale (Bucks, Ashworth, Wilcock, Siegfried, 1996) ("Designed to reveal the everyday ability of people who have memory difficulties of one form or another" (Bucks et al., 1996, p. 1).)

Global Deterioration Scale (Reisberg, Ferris, de Leon, & Crook, 1982) ("Provides caregivers an overview of the stages of cognitive function for those suffering from a primary degenerative dementia such as Alzheimer's disease" (Reisberg et al., 1982, p. 1).)

In addition to the series of tests above, an analysis of variance (ANOVA) test was to be conducted afterwards to analyze changes in results, but the results yielded were too similar to conduct the ANOVA (this is explained in the results section below). A one-way ANOVA test would have compared the results between participants first and second test scores. Two ANOVA tests were to be completed to analyze differences between Bristol Activities of Daily Living Scale results and separately to analyze Global Deterioration Scale beginning and end results. As well, the head re-

searcher made notes on patients' response, comments, feedback, and participation in sessions.

The tests and scales chosen for this study were partially based on past credible studies conducted in the field. Credit to these scales and their uses is provided by Sheehan (2012) when he describes, "These scales are used to reduce uncertainty in decision-making, for example in screening for cognitive impairment, making diagnoses of dementia and monitoring change" (Sheehan, 2012). Sheehan reviews over thirty existing scales and standardized tests relating to the field of study of dementia and cognitive decline (Sheehan, 2012). The use of these particular scales is also justified by their frequency of appearance in other peer-reviewed studies in the field. Studies conducted by Levy et al., (1996), and Gregory, (2002) both use analysis of variance (ANOVA) tests to compare their results.

Procedure

The principal researchers met with the four participants chosen to be involved in the therapy one week before beginning the sessions. The participants' musical interests were discussed and input was given on how they would like sessions to run. It was decided that the therapy sessions should consist of a mixture of recorded music, live music, and dance/movement. This input was given by the head caregiver as well as the four participants. The participants' initial input suggested an overwhelming popularity for country music, however later suggestion found interest in Italian Opera, violin symphonies, and music by The Beatles.

The study took place at the O'Neill Centre in Toronto, Ontario, Canada in accordance with O'Neill Centre residents. The O'Neill Centre is situated in an urban environment and the home's stages of care range from retirement care to intensive care. The facility provided a quiet room for all sessions to take place. All of the music therapy sessions were completed in a group format. Even though some of the participants' musical preferences differed, the study was carried through in this format and a wide variety of musical genres were played and performed. The study consisted of a total of 11 music therapy sessions. The sessions took place twice weekly for 6 weeks and for the most part consisted of participants listening to music played off an iPhone, recorded music from a computer, listening to live violin music, and moving to rhythmic beats. Three out of the four participants were in a wheelchair, and the fourth required a walker, so their dance and movement was restricted.

Results

Table 1 shows the levels each participant was first evaluated at and then re-evaluated at on the Global Deterioration Scale (GDS). Each participant's evaluation remained the same over the course of the study. The GDS was developed by Dr. Barry Reisberg and it provides caregivers with an overview of the stages of cognitive function of those suffering from a type of primary degenerative dementia such as Alzheimer's disease (Reisberg et al., 1982). The evaluation guideline is laid out in the form of a table and broken down into 7 stages (Reisberg et al., 1982). Stages 1-3 are generally recognized as the pre-dementia stages or early stages (Reisberg et al., 1982). Stages 4-7 are considered varying stages of dementia (Reisberg et al., 1982). Each stage comes with a description and list of characteristics that an individual in each respective stage might be showing (Reisberg et al., 1982). The results above in Table 1 show that participants in the

Table 1
The Global Deterioration Scale for Assessment of Primary Degenerative Dementia

	Participant I	Participant II	Participant III	Participant IV
First Evaluation	Level 2	Level 5	Level 3	Level 3
Second Evaluation	Level 2	Level 5	Level 3	Level 3
Improvement Y/N?	Same	Same	Same	Same

current study were measured in a range of levels 2-5, with participant 1 receiving a level 2, participant 2 receiving a level 5, and participants 3 and 4 receiving level 3s.

Since participants in the current study only received evaluations relevant to levels 2, 3, and 5, this section will lay out a description for those sections only. Level 2 is described as "very mild cognitive decline (age associated memory impairment)" and lists some characteristics which include, "(a) forgetting where one has placed familiar objects; (b) forgetting names one formerly knew well" (Reisberg et al., 1982, p. 1). Level 3 is described as, "mild cognitive decline (cognitive impairment)" and lists some characteristics which include, "(a) patient may have gotten lost when traveling to an unfamiliar location; (c) word and name finding deficit becomes evident to intimates; (d) patient may read a passage or a book and retain relatively little material; (e) patient may demonstrate decreased facility in remembering names upon introduction to new people; (f) patient may have lost or misplaced an object of value; (g) concentration deficit may be evident on clinical testing" (Reisberg et al., 1982, p. 1). Level 5 is described as, "moderately severe cognitive decline (moderate dementia), the patient can no longer survive without some assistance" (Reisberg et al., 1982, p. 2). Level 5 of the GDS describes characteristics of a patient in this category as, "unable during interview to recall a major relevant aspect of their current lives, eg., an address or telephone number of many years, the names of close family members, the name of the high school or college from which they graduated" (Reisberg et al., 1982, p.2).

Table 2 shows the results of each participant's evaluation on the Bristol Activities of Daily Living Scale (Bucks et al., 1996). The questionnaire was completed by the head caregiver overseeing the study and is designed to reveal the everyday ability of people suffering from memory difficulties in one form or another (Bucks et al., 1996). As the table reveals, similar to Table 1, there are no changes in the participants' test scores from first evaluation to second evaluation. The scale consists of 20 questions and is designed to reveal the abilities of people with different kinds of memory difficulties. There is no final addition to give a score at the end of the scale but each question is ranked as level a) to e), a) being the best scenario and e) being "not applicable" (Bucks et al., 1996). The lead researcher designed a system allocating 1 point to answer e) all the way up to 5 points for answer a). Therefore a score for each participant's 20 questions could be assigned out of 100. These percentages are what is represented above in Table 2.

Analysis of Variance

This study was originally going to incorporate an analysis of variance in order to compare differences noticed between original and later test results. The analysis is not necessary and cannot be completed since the tables above (Table 1 and Table 2) show no differences in participants' first and second evaluations. Therefore, an analysis of variance would reveal nothing. Although there were no changes in test scores, changes were observed in participants' moods and involvement in the therapy.

Observations

The standardized test results outlined above give some indication of quantitative evidence and result. The lead researcher also noted and documented some

Table 2
Bristol Activities of Daily Living Scale

	Participant I	Participant II	Participant III	Participant IV
First Evaluation	78%	43%	78%	83%
Second Evaluation	78%	43%	78%	83%
Improvement Y/N?	Same	Same	Same	Same

commentary from observing the participants and their mood and changes throughout the duration of the study. After the first therapy session, the feedback from participants was: happier songs and better songs to dance to or move along to. This feedback was provided after listening to a mix of country music, choral music, and jazz piano. Most of the participants appeared to enjoy the session (although comparable to later sessions the first session was not very successful).

During some sessions, participants would ask an opera or song's title multiple times, or the singer's name multiple times. These participants' forgetfulness was obvious, yet their asking and interest does provide some reason and evidence to believe their social interaction may have improved. It is important to remember that Alzheimer's has no cure and its horrible effects were present, but the mood of participants improved dramatically from session to session most times. While the general trend of the therapy was progress (based on researcher observations), some sessions had a less positive outcome than others.

The sessions tended to improve when participants voiced their opinions more often. There was a cycle of progress where; the participants would provide feedback, the lead researcher would listen and act, and the participants would better enjoy the next session and then want to give more feedback. The difference from start to finish is quite noticeable and some of this must be accredited to the lead researcher becoming closer with the participants over the course of the study. Being able to laugh and have fun and discuss the music provided a more open atmosphere that had the participants thanking the lead researcher at the end of each session and often asking when he would be back and with what new music.

Other than verbal feedback and conversation progressing to become more positive and more often, the lead researcher also observed as the sessions went on and the music choice became more suited to the participants' likings, they began to move their feet and legs and arms and began to tap the beat or dance along more often. This involvement and awareness from the participants was encouraging as it shows their enjoyment and suggests possible minor improvement in mood.

By the end of the 11 sessions, participants seemed more engaged and excited for sessions. They would look forward to a new section of La Traviata Opera or new songs from the Beatles. The involvement and social interaction amongst these participants visibly improved over the period of the sessions. Of course, there are many other factors in the participants' daily lives and many limits exist in the study. The greater impact and explanation of these results as well as their limitations are discussed more fully below in the discussion section.

Discussion

This study holds merit for multiple reasons. First, regardless of any findings and results stated above, this process provided lots of entertainment to four elderly women suffering in different states of dementia. The second reason this study holds merit is that research in this specific field has now grown and the gap has decreased. The discussion section will give an overview of the findings importance and their relation to other studies, discuss the studies limits, and give a direction for future research.

Importance of Results

The results of this study confirm some of what has already been conducted in the field of music therapy for Alzheimer's and other forms of dementia. The results confirm some positive improvement in participants' social interaction and mood during sessions; however, the results of the assessment tests indicate no improvement in physical abilities or cognitive decline. This result was generally expected. There was no expectation for music therapy to improve cognitive decline shown in participants, since Alzheimer's is progressive, but the hope was to see improvement in mood and social interaction. Improvement in physical characteristics laid out in the Bristol Activities of Daily Living Scale was not shown, most likely due to the tool not being sensitive enough. It would be interesting to see if participants' scores and evaluations in the Bristol Activities of Daily Living Scale would have improved or changed with one or two more months added to the study's duration. It is interesting, however, to note that the participants' scores compared from Table 1 and Table 2 align with what each test suggested. Participant 1 scored the best on both standard-

ized tests (level 2 on the GDS and 78% on the Bristol Activities of Daily Living Scale). A lower level on the GDS is best and a higher percentage on the Bristol Activities of Daily Living Scale is best. Juxtaposed to participant 1, participant 2 scored the worst on both tests with a level 5 on the GDS and a 43% on the Bristol Activities of Daily Living Scale. Participants 3 and 4 both scored similarly on the GDS and the Bristol Activities of Daily Living Scale. Consistency for the participants between the two different tests is reassuring that the two scores are accurate and similar.

Limits

One of the most significant limits of this study was sample size. With only four participants this study is unable to accurately comment on an entire population of patients suffering from Alzheimer's disease and other forms of dementia. This study can however comment on a small population at the O'Neill Centre in Toronto, Canada.

Another limitation of the current study was its duration. Although this study was short term, it probably would have been advantageous for the therapy to be continued for a longer period. The therapy consisted of 11 sessions over the course of almost 6 weeks. Most weeks had two therapy sessions per week although one week due to scheduling conflicts could only consist of one therapy session.

This study also had unforeseen limitations that must be accounted for. During multiple sessions there was a sick participant and as a result not all participants attended all therapy sessions. This could affect the individual's data and if the study had occurred over a longer period of time this would become less of a limit perhaps since one missed session would equate to a smaller percentage of therapy sessions missed.

Another limit is in the study design. With minimal time and resources, a control group was not able to be incorporated in the study. A non-music control group would have been able to magnify any changes recorded by the music therapy group.

Directions for Future Research

As discussed in the limitations, this study consisted of a small sample size over a relatively short period. It would be beneficial for future research to carry out similar styles in design and method but with a larger sample size over a longer period of time. Although the results of the current study were fairly inconclusive, the observations provide a positive outlook for any study that would emulate a similar research design over an extended period. Another interesting direction for future research could be to examine the capacity of music therapy to enhance the mood of elderly people in general and not just those with cognitive decline such as dementia. The observations of this study suggest that positive boosts in mood and social engagement could occur in any population that carried out a similar procedure.

Conclusion

Although no significant results were discovered and no revolutionary findings occurred, there were improvements seen over the course of the study in the participants' moods, social interaction, and engagement. Returning to the original research question of this study, to what extent are weekly music therapy sessions able to improve social interaction and heighten moods in patients suffering from different stages of Alzheimer's disease? Improvement was seen in respects to the research question, and weekly music therapy sessions are a factor in somewhat improving the moods and social interactions of participants at the O'Neill Centre in Toronto, Canada. Due to the limits of this study improvement cannot be noted in any large-scale conclusions, but the sample size of this study did see some improvement.

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