Introduction:

Sleeping difficulties among children with autism.

There is nothing more peaceful than a child that sleeps well at night... and nothing more exhausting than a child that fails to do so. Autism and sleep disorders are often linked. Sleep disorders take many forms, but regardless of how sleep is disturbed, the problem has a major impact on the child's life. Poor sleep over a prolonged period can influence a child's mental and physical wellbeing, potentially leading to a lower tolerance threshold, reduced learning capacity, and a weaker immune system. When a child has problems sleeping, this often directly affects his or her environment as well.

Having worked with children with autism for many years, it is my experience that the problem, when it exists, is one of the major challenges a family faces. The child's sleep deprivation can also influence how well he or she handles daily challenges in the education/care setting.

In 2006, the opportunity arose to conduct a pilot study to investigate whether music could be a useful supplement in helping children fall asleep. The following article is an extract from a longer report which describes the project in more detail.

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Article:

Music intervention among children with autism spectrum disorder and sleeping difficulties.

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Background to the project

Children diagnosed as having autism spectrum disorders (ASD) have difficulties in three primary areas: communication, social interaction and social perception. Comorbid conditions may also be present, such as OCD, Tourette syndrome, epilepsy, a flawed sense of reality, and sensory integration disorders, etc. (1)

Sleep disorders appear to be a commonly reported problem among children with ASD (2). A small survey conducted at two special schools in North Jutland in December 2005, involving a total of 60 children, found that parents of 26 children (or over 40 per cent of the participating group) reported that their child had difficulty sleeping. Difficulty sleeping is described in this survey as difficulty relaxing and resting during the first phase of sleep, leading to the child taking a long time to fall asleep.

This result is supported by an American study in which a group of children with extreme developmental disorders were compared with a group of normal, healthy children. The study reported a significantly higher incidence of sleep disorders in the group of children with extreme developmental disorders (3).

A Danish study currently underway aims to clarify whether the sleep disorders frequently reported in children with ADHD (a diagnosis which overlaps with ASD in certain respects) are due to specific problems among the children, or a reduced tolerance by parents due to the effects of the day-to-day stress they are under (4).

Numerous studies carried out by the Musica Humana project organisation (5) indicate that specially-designed MusiCure music, composed and produced by Niels Eje, has a relaxing and stress-reducing effect on patients with various health problems. This includes patients with psychiatric disorders. A very broad group of people have also reported that they find MusiCure to be relaxing in a wide range of situations. Musica Humana has wanted to investigate, for some time, whether some of these positive results can be applied to children with autism spectrum disorders, and thereby counteract the sleep disorders they experience.

Against this background, a pilot project was carried out between 13 March and 15 May 2006, involving 19 children with ASD. The aim of the project was to determine whether specially-composed MusiCure music could reduce the time taken to fall asleep in children with ASD, and to investigate how children with ASD react to the administration of MusiCure via audio pillows. The study was conducted in the children's homes, with their parents responsible for recording data in the journals.

The pilot study was carried out with economic support from the Sofie Foundation.

Problem formulation

Is MusiCure a useful and effective tool for reducing the time taken for children with ASD to fall asleep.
A quantitative study based on times recorded in a journal.

How do children with ASD react to MusiCure and audio pillows?
A qualitative study based on questions and answers from parents.

Target group
The study's target group was children with autism spectrum disorders who *also* reported sleeping difficulties. The children were students from two special schools for children with autism in Aalborg, Denmark, and were aged between 7–17 years.

Method
19 children were involved in the project. The children were selected based on the criteria that they had been diagnosed as having ASD, and that their parents reported they had difficulties falling asleep. In other words, they had difficulty settling down and going off to sleep.

The project was conducted as a "cross-over" study, divided into two phases. Phase 1 was *without music* during sleep, and phase 2 was *with music* during sleep. Each phase was 14 days in duration, and the project was carried out with no break between the two phases.

The trial period was carefully chosen based on the criteria that it must contain no holidays that might vary significantly from the normal daily routine and potentially impact on the study results. A few children were in respite care during the trial period, but this "change" was accepted in the results, as respite care is part of the children's familiar routine.

The study was conducted in the children's homes, with parents responsible for recording data. During days in respite care, institution staff were responsible for journal entries.

MusiCure was administered via audio pillows (6). The MusiCure music programme was two hours in duration, without a break. If the child would not accept the audio pillow, the music programme was 70 minutes on CD. The music was supplied by the composer, Niels Eje.

Project implementation
The project was implemented using inclusion and exclusion criteria, status descriptions, written instructions to parents, telephone support and journal records.

At the end of the trial period, parents were given a question sheet to gather feedback on the child's reaction to MusiCure and the audio pillow, in relation to behaviour, sleep patterns and general experience. This question sheet represented the qualitative study.

Summary of data from the quantitative study

Is MusiCure a useful and effective tool for reducing the time taken for children with ASD to fall asleep.
A quantitative study based on times recorded in a journal.

19 children participated in the quantitative study.
Three children were excluded due to inadequate journal data. In reality, therefore, the study involved 16 children in the quantitative component. For these 16 children, the results were as follows:

- For six children, the time taken to fall asleep was reduced during the 14-day period *with music* compared to the period *without music*. The amount of the reduction varied, and the total time was as follows for the 14-day period:

Child A: 1 hour
Child B: 1½ hours
Child C: 2½ hours
Child D: 7½ hours
Child E: 2 hours
Child F: 5½ hours

- Two children demonstrated no measurable effect and have therefore been regarded as neutral.
- For 3 children, the time taken to fall asleep was increased during the period *with music* compared to the period *without music* (two of these children showed positive results in relation to behaviour in the qualitative component of the study). The total amount of the increase over the 14-day period *with music* was as follows:

Child G: ½ hour
Child H: ½ hour
Child I: 2 hours

- Five children abandoned the intervention due to discomfort with the audio pillow/MusiCure *(four children due to discomfort with the MusiCure music, one child due to the audio pillow as a foreign and unacceptable intervention)*

Summary of sound administration – reaction to audio pillow/MusiCure via sound system:

Of the 11 children who completed the entire period of the project:

- seven used audio pillows
- four children migrated from audio pillows to a CD playing on a sound system

For the five children who abandoned the project, four withdrew at the audio pillow stage, but verbally reported discomfort with the music. In the case of the last child, it is not possible to determine whether the audio pillow intervention influenced the later rejection of the MusiCure music.

Summary of data from the qualitative study

How do children with ASD react to MusiCure and audio pillows?
A qualitative study based on questions and answers from parents.

13 out of a total of 19 parents participated in this qualitative study. There were no exclusion criteria used in determining the results for this part of the project. Responses have therefore also been included from parents who were excluded from the quantitative component of the project due to inadequate journal data.

The received responses were read and categorised by two impartial control persons. The control persons were asked to categorise the parents' statements as being *positive, neutral* or *negative*.

Conclusions for the qualitative study:

Behaviour: Parents predominantly perceived that their child's behaviour around bedtime was improved.

Sleep patterns: Parents predominantly perceived that their child's sleep patterns had improved.

Reaction to the music: Parents predominantly perceived that their child's reaction to the music was positive.

Reaction to the audio pillow: A narrow majority of parents experienced that their child reacted negatively to the audio pillow.

Discussion
Traditionally, in the area of autism, the focus for music has primarily been as a therapeutic intervention – **music therapy**. The definition of music therapy is, according to Munro & Mount (1978): *"the controlled use of music, its elements and its influences on human beings to aid the physiological, psychological and emotional integration during treatment of an illness or disability".*

Musica Humana defines the use of MusiCure as **music intervention**, with the following definition: *"a supportive tool in creating a sound environment with the intent to stimulate and maintain relaxation, well-being and comfort; as well as reducing or controlling distress by a self-management technique."*

In other words, music intervention using MusiCure should be understood as a musical supplement to the existing sound environment. A musical supplement aimed at *stimulating* or *maintaining* relaxation, well-being and comfort.

The authors have been unable to find any other studies which have investigated correlations between ASD, sleep disorders and music intervention. However, a study from Taiwan involving 86 healthy primary school students found that background music at bedtime, measured over a three week period, had a significantly positive effect on sleep quality (7).

What detrimental factors may have existed for the project?

- One issue which it is relevant to discuss in relation to this study is whether it is even possible to carry out a study of this type among children with ASD. The main pedagogical and psychological approach to children with ASD in Denmark emphasises the importance of creating a predictable framework, clear structures, and familiar routines, to help counter the child's difficulties. This approach is a central element at the two special schools from which this pilot study drew participants (8). This study has taken a different approach. In order to obtain the most scientifically accurate result possible, the children were not systematically prepared for the music intervention, in stark contrast to the normal daily practices in their surroundings. We must ask ourselves whether this lack of preparation, predictability and familiarity with audio pillows and music, may have been detrimental to the study results. As one of the parents commented at the end of the study: "This music is so different to all the other music my child is familiar with. I think it would have had a big impact if he had been familiar with the music beforehand – for example, via an introduction at the school."

- The study group consisted of children with ASD. ASD/Autism Spectrum Disorders or the Autistic Continuum is a concept created in an attempt to graduate the autistic state. Despite a certain broad similarity in the main problems among children with ASD, there can be major individual differences across the spectrum, and from child to child. There is also the added possibility of comorbidity (1,9). This pilot study did not take into account the major differences that can exist between children. The participation criteria has simply been children classified as having ASD. It is recommended that any further studies of this type further divide the participants to gain a clearer picture of whether the positive or negative responses are linked to specific problems within the area of ASD.

- When one compares the results of the quantitative study against the results of the qualitative study, they appear to be very different. The qualitative study shows a predominantly positive result, in terms of the child's reaction, changed behaviour and experience of listening to MusiCure. We must therefore consider whether the quantitative study might also have produced a more positive result if we had chosen to focus on different parameters. The value of being able to calm down and rest, for example at bed time, as was the case for several children in this study, can be assumed to be significant to both children and parents.

Conclusion

The pilot study shows that music intervention using MusiCure for some children with ASD can reduce the time taken to fall asleep – but this effect is variable and very individual. The study was too small to relate the effects to the severity and type of the diagnosis, or the age or other characteristics of the children. The study was also too small to prove the effect is statistically significant, but serves to demonstrate that music intervention may be a useful tool (among others) for reducing the time it takes children with ASD to fall asleep.

The qualitative component of the study suggests that parents had very positive perceptions of music intervention and its effects. The generally positive attitude seen in the parent's qualitative responses appears to exceed the demonstrated positive quantitative effect on time taken to fall asleep. However, the use of audio pillows appears to have been linked to a number of negative reactions in children with ASD, with the result that the way of administering the music intervention should be considered.

The results of the pilot study should be followed-up by larger studies to produce final documentation.