

## Psychological Study Report

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### Student Name:

**Study:** Music listening enhances cognitive recovery and mood after middle cerebral artery stroke.

*Please answer each of the following items in detail. Note that some items are worth 10 points – these must include detailed information and analyses. Please ask if you have questions.*

1. Summarize the purpose of the study. What did the researcher want to find out? (3 pts)

At the time of this study, prior research on animals had demonstrated how a stimulating environment can improve recovery after a stroke; however, there was very limited research that showed how a specific type of stimulating environment, in this case, enhanced sound stimulation, plays a role in recovery from neural damage. The lack of research in that area led to the purpose of this study, which was to determine whether everyday music listening can aid in the recovery of cognitive functions and mood after a middle cerebral artery (MCA) stroke.

The specific cognitive functions that were examined included verbal memory, short-term and working memory, language, visuospatial cognition, focused attention, sustained attention, music cognition and executive functions. The specific behavioral characteristics that were examined to determine mood included tension, depression, irritability, vigor, fatigue, inertia, confusion and forgetfulness.

2. Discuss the research methods used and explain how the study was conducted. Identify what type of study it was (e.g., experiment, survey, naturalistic observation, correlational study, etc...). Also, explain step-by-step how the study was conducted. (10 pts – answer should be at least two or more detailed paragraphs)

The study was conducted by following the experimental research method, where the purpose is to explore cause and effect relationships between dependent and independent variables. It was setup as a single-blind, randomized and controlled trial. A single-blind study implies that the study is designed without the subject's knowledge of the anticipated results. This is done in an effort to minimize the placebo effect. Randomized means that subjects are assigned to experimental and control groups based on chance and all members have an equal chance of being assigned to any group. This eliminates potential biases in selecting subjects for specific groups. In this specific study, randomization was performed with a random number generator by a researcher not involved in patient enrollment.

Subjects were assigned to one of three groups. There were two experimental groups and one control group. The experimental groups included a music group and a language group. In the control group, subjects were not exposed to music or language. The music and language group subjects listened daily to music or audio books, respectively, while the control group did not have any listening material. The only difference between the three groups was the presence or absence of music and/or audio books. Baseline research was conducted at the beginning of the study to ensure that there were no statistically significant differences between the three groups.

Patients in the music and language group were given instructions to listen to their music or audio books by themselves at least one hour per day for a two month period after they suffered their stroke. The subjects were also asked to keep a listening diary.

In an experimental study, a theory and hypothesis are formulated to define the study. Specifically, a theory is a large-picture explanation that integrates principles and organizes and predicts behavior or events. In this study, the theory was that auditory stimulation enhances the recovery of stroke patients. A hypothesis is more specific and is a testable prediction of the study, which allows the researcher to accept, reject or revise the theory. In this study, the hypothesis was that enhanced sound stimulation aids in the recovery of cognitive functions and mood after a MCA stroke.

To test the hypothesis, research was conducted and data was analyzed in order to accept, reject or revise the theory. In terms of research, all subjects underwent an extensive neuropsychological assessment that included a wide range of cognitive tests as well as mood and quality of life questionnaires. These items were conducted one week from stroke onset, which was used as a baseline, and were completed at three months and six months after stroke. The researchers involved in these studies were blinded to the group allocation of the patients, in an effort to eliminate experimenter bias.

The neuropsychological assessment included a battery of tests that are highly credible in the psychology field and evaluated specific cognitive functions in detail. Mood assessment and quality of life were also analyzed by using highly reliable questionnaires.

All patients also endured Magnetic Resonance Imaging, or an MRI, within two weeks after their stroke and six months after their stroke. The first MRI was utilized to verify the stroke diagnosis and the second to evaluate the size and location of the lesion on the brain.

In addition to the neuropsychological assessment, the questionnaires and the MRI, subjects were interviewed by music therapists about their pre-stroke leisure activities. They were also interviewed about this at the two month intervention and followed up at six months after stroke.

The data collected from the research above was analyzed using a variety of tests, including ANOVAs, t-tests and chi-square tests.

3. Describe the subjects in detail (demographics, how they were chosen, etc...). (3 pts)

Sixty stroke patients were recruited as subjects between March 2004 and May 2006 from the Department of Neurology of the Helsinki University Central Hospital (HUCH). Each subject had been admitted to the hospital for treatment of acute stroke. Several criteria were used to identify the subjects. Each subject in the study met the following requirements:

1. Suffered an acute ischaemic MCA stroke in the right or left temporal, frontal, parietal or subcortical brain regions
2. No history of neurological or psychiatric disease
3. No alcohol or drug abuse problems
4. No hearing deficit
5. Right-handed
6. Less than or equal to 75 years of age
7. Finnish-speaking
8. Able to cooperate

The subjects were randomly assigned to a music group, a language group, or a control group. Twenty subjects were assigned to each group at the onset of the study.

Fifty-five of the 60 subjects originally included in the experiment completed the study up to the six-month follow-up. At that time, there were 19 in the music group, 19 in the language group and 17 in the control group. Of those that did not complete the study, one was due to a false diagnosis, one was due to a new stroke, one was due to dementia, and two subjects refused to continue. Before the six-month follow-up, one additional subject was removed from the study due to death from a myocardial infarction.

In conclusion, data for 54 subjects was utilized for analysis. This included 18 from the music group, 19 from the language group and 17 from the control group.

4. Identify and describe the independent and dependent variables for the experiment. Provide operational definitions for the variables. (4 pts)

Independent variable(s): **Presence of music, presence of audio books or absence of music and audio books.**

Operational Definition(s):

**Presence of music – subjects instructed to listen to self-selected music by themselves for at least one hour per day for two months post-stroke.**

**Presence of audio books – subjects instructed to listen to self-selected audio books for at least one hour per day for two months post-stroke.**

**Absence of music and audio books – subjects instructed to abstain from listening to music and audio books for two months post-stroke.**

Dependent variable(s): **Cognitive functions and mood**

Operational Definition(s):

**Cognitive functions – Results of a neuropsychological assessment, which assess eight specific cognitive functions, one week from stroke onset, three months post-stroke and six months post-stroke.**

**Mood – Results of mood and quality of life questionnaires one week from stroke onset, three months post-stroke and six months post-stroke.**

5. Provide a detailed summary and analysis of the results. Report specific details from the results AND your analysis of what the results mean. (10 pts – answer should be at least two or more detailed paragraphs)

It's important to note that there were no statistically significant differences between the experimental groups and the control group in the baseline demographic or clinical variables, relevant leisure activities, cognitive performance and mood prior to stroke. This is important because it provides a good baseline to measure against.

The emotional response to and preference for music and verbal material were also comparable at baseline; however, as expected, highly significant differences between the groups in the frequency of listening to music and audio books at the three month and six month post-stroke stage were present. The music group listened to more music than the language group or the control group and the language group listened to more audio books than the music or control group. This illustrates that the study protocol worked well and the subjects in the study followed their instructions. With this information, the differences observed in cognitive recovery can be directly attributed to listening to music.

In terms of cognitive function improvement, there were several statistically significant results to report. The effect of time was significant in the following cognitive areas studied: verbal memory (average score 5 points higher), short-term and working memory (average score 12 points higher), language (average score 10 points higher), visuospatial cognition (average score 7 points higher), and focused attention (7 more correct responses).

Furthermore, post hoc tests, which looked at data after the experiment concluded, exposed several patterns among the three groups. For example, at the three month stage, verbal memory recovery was significantly better in the music group than in the control group or in the language group. Focused attention recovery was also significantly better in the music group than in the control group and marginally better in the music group than in the language group.

At the six month stage, verbal memory recovery was significantly better in the music group than in the language group and focused attention recovery was significantly better in the music group than in the control group or in the language group. Furthermore, the correlation between the focused attention (correct responses) score the verbal memory score was significant at baseline as well as at the three and six month post-stroke stages.

Overall, the music group showed better recovery than the language or control groups in several cognitive areas, including: verbal memory recovery, focused attention, short-term and working memory, language and sustained attention (correct responses); however, only verbal memory and focused attention (correct responses) showed statistically significant patterns.

Tests of the change scores also showed that in left hemisphere-lesioned patients, focused attention recovery was significantly better in the music group than in the language group and also marginally better in the music group than in the control group at the three month stage. At the six month stage, recovery was significantly better in the music group than in the language group or in the control group. This is an important finding because it shows the effect of audio stimulation after a stroke to the language-dominant brain hemisphere.

In contrast to the significant improvements in cognitive functions of the music group, the study did not induce systematic changes on mood from the baseline to the three and six month stages; however, the variability of the data may largely be due to the variability in patient emotions in the acute stage following a stroke. For this reason, researchers analyzed group differences in mood cross-sectionally from the three and six month post-stroke POMS scores. In terms of statistically significant results, here were the findings:

- At the three month stage, there were significant group differences in depression and confusion scores.
- Post hoc tests showed that depression score was significantly lower in the music group than in the control group. Also, the confusion score was marginally lower in the music group than in the control group.
- At the 6-month stage, the group differences in depression and confusion were still marginally significant with post hoc tests, showing a tendency for the music group to experience less depressed and confused mood than the control group.

Overall, the results of the study *failed to reject* the hypothesis. It provided evidence that daily, self-selected music during the early post-stroke stage can enhance cognitive recovery and prevent negative mood. In terms of cognitive functions, music listening has the greatest impact on verbal memory and focused attention. In terms of mood, music listening can help patients feel less depressed and confused following a stroke.

6. Discuss whether or not ethical principles were followed in the study and any *possible* ethical dilemmas related to the study. If so, what did they do to ensure subjects were protected? If not, what ethical principles were breached? This

is normally not found in the study reading – you have to use what you learned from the ethics lesson and apply that information to the study. (10 pts - answer should be at least two or more detailed paragraphs)

One of the most important ethical principles, informed consent, was followed in this study. All patients signed an informed consent. According to the American Psychological Association, informed consent informs participants about several things, including the purpose, benefits and risks of the research. Without an informed consent document, there could have been many ethical dilemmas. An informed consent document supports the ethical principle of respect for people's rights and dignity. This ensures several things, including the subject's right to participate or not participate in the study, and ensures their privacy and that their name, address, etc. are not included in the study.

None of the test involved invasive procedures that could potentially harm subjects so the researchers would just need to list those in the informed consent document. The neuropsychological assessment was not invasive and the questionnaire had no potential of harm for the subjects. I can't think of any physical harm that could come to subjects by participating in the study. However, the researchers still need to ensure the subjects complete informed consent forms. The forms should discuss any negative effects the subjects might be exposed to such as problems for subjects who may have sensitivity to certain sounds (loudness or high pitch sensitivity) or subjects who may have hearing problems this could aggravate.

Subjects might also experience stress during the study and that should be explained to them as well in the informed consent document. They were studying the effects on conditions such as depression and fatigue and that might raise some ethical issues....for example, is it ethical to put people in a study condition that might cause them to become depressed? I didn't read about any support services that were provided but in this study, they should make treatment services available to any subject who experiences depression as a result of this study.

No minors or animals were used in the experiment, so subjects could give their own consent to participate since they were adults of sound mind.

7. Provide a detailed analysis of why this study was important. Discuss how the findings "make a difference" in the lives of people. Consider how professionals might use this information to help people (e.g., psychologists, teachers, counselors, doctors, nurses, etc...). Also discuss how non-professionals (e.g., students, parents, employees, etc...) might use this information in their daily lives. Consider how you would use these findings in your personal or professional life. Provide detailed examples and explanations. [This information is not found in the study information/materials...you need to come up with your own original ideas here.] (10 pts – answer should be at least two or more detailed paragraphs)

This study was important for several reasons. First, at a general level, it provides a better understanding of the brain. Specifically, it provides research into the brain's neural networks and how everything is integrated. It also illustrates the important concept of brain plasticity. Plasticity refers to the brain's ability to modify itself after some types of injury or illness.

This study is also important because there are many other areas where this research could be applied. For instance, this study was limited to stroke patients with a specific brain lesion; however, this study could help support the idea of sound stimulation for other types of conditions that cause brain lesions or specific neural damage. This is particularly important for neurobiologists, neuropsychologists and rehabilitation psychologists.

The study results on music and mood are also very important. This study could help aid many people who suffer or work with people who suffer from anxiety, depression and pain. This could help many clinical or school psychologists who work with patients or students that suffer from these conditions. Specifically, it may be able to help soldiers that are coping with emotional stress when returning from war.

This study showed that music can enhance a variety of cognitive functions. This knowledge could help many individuals and supports other research that shows the effect of music in patients with conditions such as dyslexia, autism, schizophrenia and dementia.

On a personal level, I plan to apply the results to my studying habits. The results showed that music can have a positive impact on verbal memory. If I can apply the information I need to study to some type of music or create some type of song, it may aid in remembering it for test day.

On a professional level, I work as a patient care tech in the Cardiac/Stroke Center of a local hospital. On a daily basis, I interact with patients that have suffered strokes. Providing results of this study to the physicians, nurses and patients that I work with could be very helpful in patient recovery. Professionals such as teachers could also use this information. They might want to incorporate music into their instruction or play music during student's study time to enhance their learning. Daycare providers could incorporate music into children's play time or creative activities.