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Increasing Attention and Mood of Post-Stroke Clients using Natural Restorative Environment Tri Suraning Wulandari¹, Muhamad Thohar Arifin^{2*}, Suhartini Ismail¹ 1. Master Student of Nursing Department, Faculty of Medicine, Diponegoro University, Indonesia 2. Department of Neurosurgery, Faculty of Medicine, Diponegoro University, Indonesia 3. Nursing Department, Faculty of Medicine, Diponegoro University, Indonesia
 ABSTRACT Purpose: The objective of this study was to analyse the impact of the natural restorative environment on the attention and mood of post-stroke clients. Methods: A quasi-experimental design was followed, with pre- and post-tests on a control group. Purposive sampling procedure was used to select 76 post- stroke clients – 38 each for the treatment group and the control group. The treatment group received natural restorative environment intervention, twice a day for three days, while the control group was managed in accordance with the medical protocol. Before and after the intervention, clients in both groups were assessed for attention and mood. Results: Increasing level of attention and mood was found in the intervention group, verified by p-value= 0.000. Conclusion: Exposure to the natural restorative environment could increase the attention and improve the mood of post-stroke clients. The natural restorative environment helps in restoring the ability to focus and creates a positive mood. Key words: Attention, mood, natural restorative environment, post-stroke clients
 INTRODUCTION Stroke is a condition caused by a disruption in the blood flow of the brain. This contributes to structural damage that causes physical and psychological issues. According to the American Health Association (AHA), the challenges with physical disability in stroke clients have been a major problem over the last decade. To date, 3.8 million women and 3 million men have been diagnosed with *
 Corresponding Author: Muhamad Thohar Arifin, Department of Neurosurgery, Faculty of Medicine, Diponegoro University, Indonesia. Email: thohar@gmail.com conditions directly resulting from a stroke. Psychological problems, including attention decline and post-stroke

depression, had increased remarkably (Davis, 2016). Attention and mood are important aspects of the post-stroke recovery process. The focus rate falls to 42-92% at the early post-stroke stage, while attenuation declines to 20-42% at the end of the sixth week after the individual is sent home (Hyndman et al, 2008). Attention problems in stroke are characterised by difficulty in focusing and disappointment in answering questions. The rate of mood loss of post-stroke clients for six months is 69.9%, while the frequency of life-long depression mood disorder is 89.3% (Hackett & Anderson, 2006). Stroke is often characterised by irritability syndrome, lack of appetite, difficulties in focusing which often lead to depression (Donnellan et al, 2010). Lee et al (2017) propose that post-stroke mood shift is referred to as post-stroke mood decrease. Extended concentration and lack of mood in post-stroke clients will have an effect on recovery from depression and decline in work performance. Hyndman et al (2008) noticed that there was a correlation between the ability to perform day-to-day activities and the focus and sustained concentration of post-stroke clients. Robertson (1997) also suggested that the benefit of good attention, lasting at least two months after the stroke, may lead to successful rehabilitation over two years. Post-stroke concentration deficiencies impair cognitive performance, including the ability to perform day-to-day activities

METHOD Study Design This was a quantitative survey, with quasi-experimental pre- and post-tests with a control group. The non-probability sampling technique was used. **Study Sample** The study involved 76 post-stroke clients. They were divided into two groups of 38 each. One group was the intervention group and one was the control group. The inclusion criteria were: • Post-stroke clients admitted to hospital with compos-mentis awareness, • Stroke clients who had undergone an acute phase (48 hours), and • Stroke survivors with good mental function (MMSE - without copyright permission - score ≥ 24). The exclusion criteria were: • Clients with serious illnesses during this research, and • Clients with hemodynamic disorders. **Study Tools** The natural restorative environment group was stimulated by natural landscape videos, accompanied by natural sounds, involving the role of the auditory and visual systems. This affects physiological and psychological functions by restoring the ability to focus and improving the mood. The intervention was done twice a day for three days. The A and B trials, which included 25 studies, were the instruments for determining the focus of attention. The higher the quality of the A and B trials, the lower would be the attention of those subjects. Mood was graded with the Brunel of Mood Scale (BRUMS) consisting of six items, i.e., anger, confusion, depression, fatigue, anxiety and spirit, to assess mood through 24 queries. The higher the value of anger, confusion, depression, and fatigue of the BRUMS, the poorer would be the mood of the participants. The higher the spirit value after the test, the higher would be the mood of the participant. **RESULTS** The pre-test results revealed a maximum mean with a standard deviation of $M=123.89$; $SD=15.8$. Post-test results in the intervention group reported the maximum mean and standard deviations of $M=129.45$; $SD=13.65$. Pre-test results of anger mood in the intervention group reported the maximum mean and standard deviation $M=8.66$; $SD=3.87$. The intervention group post-test results showed the highest mean and standard deviation of $M=5.61$; $SD=4.27$. Pre-test spirit tests in the intervention group recorded the maximum mean and standard deviation of $M=7.86$; $SD=3.76$, while post-test results found $M=11.16$; $SD=2.52$. Attention and mood shifts before and after treatment are illustrated in Table 1.

Table 1: Characteristics of Attention and Mood Level of Clients before and after the Natural Restorative Environment Treatment in Intervention and Control Groups (N = 76)

Group	Variable	Pre-test Mean	Pre-test SD	Post-test Mean	Post-test SD
Intervention Group	Focused attention	123.89	15.86	129.45	13.65
	Divided attention	139.39	36.56	150.76	10.71
	Mood (anger)	8.66	3.87	5.61	4.27
Control Group	Focused attention	72.66	5.98	72.66	5.98
	Divided attention	193.78	10.46	184.21	10.71
	Mood (anger)	16.55	185.05	14.65	10.39

3.08 Mood (confusion) 8.46 4.05 5.25 3.63 9.50 3.27 9.89 2.59 Mood (depression) 8.37 4.16 5.05 3.78 9.42 3.19 9.39 2.56 Mood (fatigue) 7.53 4.29 4.79 3.70 9.26 2.72 9.03 2.76 Mood (anxiety) 7.63 3.76 4.55 2.99 9.13 3.02 9.08 3.14 Mood (spirit) 7.86 3.76 11.16 2.52 9.92 3.04 9.97 3.63 The results of this study revealed that the concentration and mood of the intervention group provided p-value= 0,00 ($< 0,05$) before and after intervention with the natural restorative environment. Overall, the test for each parameter was $p < 0.05$. The results are presented in Tables 2 and 3.

Table 2: Wilcoxon Analysis of Natural Restorative Environment Effect on Attention and Mood of Post-stroke Clients in Intervention and Control Groups (N = 76)

Variable	Mean	SD	Min-Max	Z	P
Intervention Group Attention Focused Pre-test	123.89	15.86	102-126	-5.67a	0.00
Post- test	72.66	5.98	59-78	Divided Pre-test	193.78
10.46	138-156	-5.37a	0.00		
Post- test	150.78	10.71	121-124	Mood Anger Pre-test	8.66
3.87	4-12	-5.30a	0.00		
Post- test	5.61	4.27	4-8	Confusion Pre-test	8.46
4.05	4-10	-5.23a	0.00		
Post- test	5.25	3.63	4-8	Depression Pre-test	8.37
4.16	4-12	-4.97a	0.00		
Post- test	5.05	4.29	3-7	Fatigue Pre-test	7.53
4.29	4-8	-5.16a	0.00		
Post- test	4.79	3.70	3-7	Spirit Pre-test	7.86
3.71	0-8	-4.98a	0.00		
Post- test	11.16	2.52	7-10	Control Group Attention Focused Pre-test	129.45
13.65	111-172	-1.38a	0.15		
Post-test	139.39	36.56	Divided Pre-test	184.21	
16.55	134-180	-0.13a	0.89		
Post-test	185.05	14.65	Mood Anger Pre-test	9.34	
3.13	9-14	-1.71a	0.08		
Post-test	10.39	3.88	9-16		
Confusion Pre-test	9.50	3.27	9-12	-1.40a	
0.15	Post-test	9.89	2.59		
Depression Pre-test	9.42	3.19	10-12	-0.15b	
0.87	Post-test	9.39	2.56		
12-16	Fatigue Pre-test	9.26	2.72	9-14	
-0.70b	0.47	Post-test	9.33	2.70	
12-16	Spirit Pre-test	9.92	3.04	0-6	
-0.41b	0.67	Post-test	9.97	3.67	
0-6	Table 3: Paired t-test Analysis of Natural Restorative Environment Effect on Attention and Mood of Post-stroke Clients in Intervention and Control Groups (N = 76)				
Variable	Mean	SD	Min	T	p
Intervention Group Mood Anxiety Pre-test	9.13	3.02	9-11	8.94	0.00
Post-test	9.08	3.14	4-8		
Control Group Mood Anxiety Pre-test	9.13	3.02	12-14	0.15	0.87
Post-test	9.08	3.14	10-16		

The combination of t-test and Wilcoxon revealed that the intervention of the natural restorative environment was more effective than the normal medical care, with p-value < 0.05 . The statistical results for clients who did not have the natural restorative environment intervention during their stay revealed a negligible impact on attention and mood, as shown by a p-value of > 0.05 . Total p-value > 0.05 indicated that regular medical care had no impact on the attention and mood of post-stroke clients. Attention and mood decline among clients in the intervention group were significantly higher than in the control group. From the mean gap, the difference of focus and attitude can be seen. The overall focus and split attention in the intervention group declined by 51.23 points and 43.02 points, while the control group reported just 9.94 points and 0.84 points, respectively. Mood loss (anger, frustration, stress, nausea, and anxiety) declined comparatively at 3.05 points, 3.21 points, 3.32 points, 3.74 points, and 3.08 points, respectively, while the clients' post-stroke spirit improved by 3.3 points. Contrarily, the average mood change in the control group (anger, frustration, depression, fatigue) showed an increase of 1.05 points, 0.39 points, 0.03 points, while anxiety and spirit declined by 0.05 points and 0.05 points respectively. The evaluation of the impact [of the natural restorative environment intervention](#) on the concentration [and mood](#) of clients with $p=0.00$ ($p < 0.05$), demonstrated a more significant increase in the intervention group than in the control group.

DISCUSSION In stroke, attention is classified as divided attention, shifted attention and sustained attention. Divided attention is the ability to focus or concentrate on a number of activities simultaneously. Switching attention is the ability to switch or immediately transfer focus or concentration after stimulus (McDowd et al, 2003). Sustained attention is the ability to maintain focus or concentration over a prolonged period of time by exposing the individual to repeated action or activity (Pearce et al, 2016). There is some indication that

training improves alertness and sustained attention, but there is no evidence to support or refute use (Loetscher et al, 2019). This study's findings reveal that there was a significant effect of the natural restorative environment on the attention and mood of the intervention group. There is evidence at level 1b that self-regulated music therapy may have a positive effect on verbal memory and focus in individuals with left hemisphere stroke (Teasell et al, 2018). The result of the current study is more interesting, namely that the natural restorative environment intervention effectively increases attention and mood, as demonstrated by decreased attention value. This study was supported by the results of Jung et al (2017), which stated that the attention of clients with heart failure who had been treated with a natural restorative environment seemed to increase, especially sustained attention, compared to those without intervention. Clients treated with a natural restorative environment have completed their tasks correctly and have been able to focus and concentrate on completing the tasks they have been given (Jung et al, 2017). This has shown that the attention of clients with chronic diseases may increase even after pathophysiological changes have led to decrease in attention. However, the rate of increase may be lower than for those without heart failure. Interaction with the natural environment, such as forests, can also be beneficial to health. Research shows that compared to the urban environment, it has contributed to the well-being of students in South Korea in the form of relaxation, calmness, comfort, happiness and joy. The forest environment was able to reduce the negative impact of anxiety and provide space for reflection on the individual's personal issues. Other than that, the mood of the participants changed to positive when they took a stroll in the woods (Shin et al, 2011). According to previous report engaging in natural scenery, such as looking at trees outside, can reduce diastolic blood pressure more quickly and reduce stress faster than sitting in a room (Staats et al, 2016). Nature has a calming advantage over any other setting, especially in restoring the ability to direct attention. The natural environment will focus attention on the stimulus, either in the form of direct nature or by watching videos of natural landscapes. Calm emotions and increased peace of mind are not the only benefits, as nature will also affect cognitive control and thus increase the performance of daily tasks. Nature is full of exciting stimuli and can simply attract attention in a down-to-earth way that creates a chance to release stress and gain a feeling of renewed interest in life (Berman et al, 2008). Exposure to natural environment stimuli such as plants, posters, slides, videos, and natural environment landscapes can improve mood by mediating negative stress effects, reducing negative moods and at the same time increasing positive emotions. Previous report concluded that clients with shorter duration of post-operative hospital stay reported better recovery and reduced risks, and that high dose analgesics are not actually needed in this situation. Exposure to the natural environment also has a direct effect on blood cortisol levels, a stress-related hormone. The natural environment triggers calm physiological reactions relative to the urban environment (Berto, 2014). It is worth mentioning the possibility of using music for stroke-associated recovery. Music is a multimodal stimulation; it stimulates different brain structures relevant to sensory processing, awareness, and memory, and can stimulate complex thinking and multisensory integration. Listening to self-chosen music every day can improve memory and verbal attention after stroke. The brain has a high capacity for automatic simultaneous processing and integration of sensory information. Music training has a significant impact on the brain. One of the aspects that may be relevant to stroke rehabilitation is listening to relaxing music that can activate the interconnected subcortical and cortical tissues of the brain (Strzemecka, 2013). Natural sounds music intervention in the field of medicine has also been shown to be beneficial. It is an innovative therapy that has shown satisfactory results, such as growing stimulation, enhancing the physical and psychological health of

people of all ages, and reducing anxiety in post-coronary angioplasty clients. Such treatment on 50 surgical ICU clients demonstrated increased sleep and had a positive effect on their melatonin and cortisol levels (Wijayanti et al,2016). Another experiment using a mixture of bird- sound audio, which was provided 2 x 30 minutes in the morning (08.00-midday) and in the evening (20.00-22.00) for three days, found that there was a significant difference in depression between the intervention group and the placebo group (Hu et al,2015). **CONCLUSION** The results of this study show that stroke is still the most prevalent health problem in the world, impacting on physical ability in particular. The disability can cause problems in the attention and mood of post-stroke clients. Various physical and psychological impacts of stroke attack require multidimensional treatment, both pharmacological and non-pharmacological, if a holistic client recovery is sought. The study also showed that natural restorative environment treatment had a significant effect on the attention and attitude of the intervention group as compared to the control group which was provided regular medical care. **ACKNOWLEDGEMENT** [The authors received no financial support for the research, authorship, and/or publication of this article.](#) **REFERENCES** Berman MG, Jonides J, Kaplan S (2008). The cognitive benefits of interacting with nature. *Psychol Sci*; 19(12): 1207-12. <https://doi.org/10.1111/j.1467-9280.2008.02225.x> PMID:19121124 Berto R (2014). The role of nature in coping with psychophysiological stress: A literature review on restorativeness. *Behav Sci (Basel)*; 4(4): 394-409. <https://doi.org/10.3390/bs4040394> PMID:25431444 PMCid:PMC4287696 Davis BC (2016). Update: Stroke guidelines. *Nurs Manage.*; 47(2):24-33. <https://doi.org/10.1097/01.NUMA.0000479442.68020.46> PMID:26771272 Donnellan C, Hickey A, Hevey D, O'Neill D (2010). Effect of mood symptoms on recovery one year after stroke. *Int J Geriatr Psychiatry*; 25(12): 1288-95. <https://doi.org/10.1002/gps.2482> PMID:21086539 Hackett ML, Anderson CS (2006). Frequency, management, and predictors of abnormal mood after stroke: The Auckland Regional Community Stroke (ARCOS) study, 2002 to 2003. *Stroke*; 37(8): 2123-8. <https://doi.org/10.1161/01.STR.0000231387.58943.1f> PMID:16794206 Hu RF, Jiang XY, Hegadoren KM, Zhang YH (2015). Effects of earplugs and eye masks combined with relaxing music on sleep, melatonin and cortisol levels in ICU patients: A randomised controlled trial. *Crit Care*; 19(1): 1-9. <https://doi.org/10.1186/s13054-015-0855-3> PMID:25881268 PMCid:PMC4391192 Hyndman D, Pickering RM, Ashburn A (2008). The influence of attention deficits on functional recovery post stroke during the first 12 months after discharge from hospital. *J Neurol Neurosurg Psychiatry*; 79(6): 656-63. <https://doi.org/10.1136/jnnp.2007.125609> PMID:17872979 Jung M, Jonides J, Northouse L, Berman MG, Koelling TM, Pressler SJ (2017). Randomised crossover study of the natural restorative environment intervention to improve attention and mood in heart failure. *J Cardiovasc Nurs*; 32(5): 464-79. <https://doi.org/10.1097/JCN.0000000000000368> PMID:27755225 Lee JH, Seo EK, Shim JS, Chung SP (2017). The effects of aroma massage and foot bath on psychophysiological response in stroke patients. *J Phys Ther Sci*; 29(8): 1292-6. <https://doi.org/10.1589/jpts.29.1292> PMID:28878450 PMCid:PMC5574341 Loetscher T, Potter KJ, Wong D, das Nair R (2019). Cognitive rehabilitation for attention deficits following stroke. *Cochrane database Syst Rev*; 2019(11). <https://doi.org/10.1002/14651858.CD002842.pub3> PMID:31706263 McDowd JM, Filion DL, Pohl PS, Richards LG, Stiers W (2003). Attentional abilities and functional outcomes following stroke. *Journals Gerontol - Ser B Psychol Sci Soc Sci*; 58(1): 45- 53. <https://doi.org/10.1093/geronb/58.1.P45> PMID:12496301 Pearce SC, Stolwyk RJ, New PW, Anderson C (2016). Sleep disturbance and deficits of sustained attention following stroke. *J Clin Exp Neuropsychol*; 38(1): 1-11. <https://doi.org/10.1080/13803395.2015.1078295> PMID:26593225 Robertson IH (1997). Motor recovery after stroke depends on intact

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