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## Association of Nurses' Self-Reported Empathy and Mu Suppression with Patients' Satisfaction

Nasser Goodarzi<sup>1</sup>, Kamran Azma<sup>2</sup>, Ehsan Tavakolian<sup>\*</sup>, Pedram Peyvand<sup>1</sup>

<sup>1</sup>Department of Clinical Psychology, AJA University of Medical Sciences, Tehran, Iran

<sup>2</sup>Department of Physical Medicine and Rehabilitation, AJA University of Medical Sciences, Tehran, Iran

### ARTICLE INFO

#### Article Type:

Original Article

#### Article History:

Received: 30 Dec. 2014

Accepted: 5 Apr. 2015

ePublished: 1 Sep. 2015

#### Keywords:

Nurses

Mirror neurons

Patient satisfaction

### ABSTRACT

**Introduction:** The aim of this study is to explore the association between mu suppression and self-reported empathy in nurses with patients' satisfaction.

**Methods:** For this correlational study, 30 male nurses, as well as 30 patients took care by these nurses during the week before data gathering, were selected via accessible and random sampling method, respectively. The tools included Jefferson's Scale of Empathy-health professionals, and patient's satisfaction scale of La Monica-Oberst. Activation of Mirror Neurons System (MNS) was investigated by mu suppression. For this purpose, electroencephalography (EEG) was recorded in three phases: 1) Watching the video of a non-moving hand, 2) Watching the video of a hand being open and closed, and 3) Opening and closing one-self's hand. EEG recordings were analyzed using Matlab R 2014a software. Data were analyzed by Pearson's correlation coefficients and multiple regression analyses.

**Results:** There was no significant correlation between mu suppression in nurses with nurses' self-reported empathy and patients' satisfaction, however, a significant correlation was found between nurses' self-reported empathy and patients' satisfaction. Regression analysis outcomes showed that nurses' self-reported empathy could predict 18.5% (nearly one fifth) of patients' satisfaction variance while mu suppression did not forecast patients' satisfaction significantly.

**Conclusion:** These findings suggested that mu rhythm was a good biomarker neither for nurses' self-reported empathy nor for patients' satisfaction. In addition, it was manifested that patients' satisfaction, at least partly, depended on skills that nurses could learn, since showing empathy is highly learnable.

## Introduction

Since patients' satisfaction is an important marker for determining caring service quality, it should be attended carefully.<sup>1</sup> Another aspect of patients' satisfaction is that the experience of illness and the necessity of following treatment cause some problems for patients that in turn, increase their vulnerabilities and their need to receive multidimensional support. Patients' expectations have been increased in recent years and they include various factors. One of these factors is the current condition and services offered by health care practitioners.

In other words, the quality of nursing has a great impact on patients' satisfaction from offered services.<sup>1-3</sup>

Nursing is a science as well as an art. In fact, in addition of having the knowledge of nursing, nurses should have its art, too. Empathy is one of the most important parts of nursing art.<sup>4-7</sup> Numerous studies have confirmed that empathy of the treatment personnel is effective in increasing the treatment efficiency and improvement of important aspects of the treatment including reduction of patients' nervous stress, anxiety, and depression as well as, decrease of physical symptoms like blood pressure, and

\* Corresponding Author: Ehsan Tavakolian (MSc), email: Etavakoli87@yahoo.com.

diagnostic error; it is also influential in probability accession of following the treatment and finally, patients' satisfaction.<sup>8-15</sup>

Although there is no all-agreed definition of empathy, many researchers have defined it as the ability to "put one in the place of others". Empathy means that one be able to feel and comprehend others' feelings and experiences and respond to them appropriately.<sup>16,17</sup> Empathy is consisted of two parts: cognitive and emotional. Cognitive part of empathy refers to the ability of perspective taking or understanding mental states of others (Theory of Mind), while its emotional part shows the ability to feel others' feelings and comprehending their emotional states.<sup>18,19</sup>

The neurological base of empathy is the mirror neurons system (MNS). The location of mirror neurons is in pre-motor part of the brain and they hot up both when doing an action (e.g., opening and closing the hand, taking an object) and watching someone else doing an action. In fact, these neurons represent others' actions in our minds.<sup>20-22</sup> Although empathy has a specialized brain system, many investigators emphasize the role of learning in empathy skills, specifically for health care providers, and believe that training these skills can enhance empathy in these staff.<sup>23,24</sup>

A reliable way for studying activation of mirror neurons in human is to investigate mu rhythm, that is an 8 to 13 Hz rhythm created by synchronous firing of neurons in sensory-motor part of the cortex in baseline state. This gives mu rhythm the maximum power. When an individual performs an action or watches someone else doing it, the activation of these neurons becomes asynchronous, and it leads to reduction of mu rhythm amplitude. In this state, mu rhythm suppression occurs. Many researches, including those used EEG and FMRI, have confirmed the validity of mu suppression as a marker of mirror neurons performance, especially when the individual watches and does the action of moving hands.<sup>25,26</sup>

As it has been reported by Hooker<sup>27</sup> and Zaki,<sup>28</sup> self-reported empathy is associated with activity in the MNS. Besides, mu suppression is a reliable index of MNS activity. So it can be hypothesized that mu suppression is associated with self-reported empathy. However, the relationship between mu suppression and reported empathy is not well studied and the results of previous studies are not determined. For instance, Perry, using Interpersonal Reactivity Scale (IRI), found no significant correlation between mu suppression and self-reported empathy.<sup>29</sup> Similarly, Yang found no correlation between event-related mu suppression and the IRI subscale scores of male participants, while in female participants, mu suppression was correlated with personal distress.<sup>30</sup> In addition, self-reported empathy in nurses has been repeatedly shown to be correlated with patient satisfaction. Thus, it can be hypothesized that if mu suppression is correlated with self-reported empathy it can also be correlated with patient satisfaction.

Considering all that was said above this study was conducted with two aims: illustrating the relationship between mu suppression and nurses' self-reported empathy, and determining the ability of mu suppression in predicting patients' satisfaction.

## Materials and methods

This correlational study was conducted during September, October and November 2014, in AJA University of medical sciences, Tehran, and Kashani hospital, Shahrekord, Iran. The population size (including nurses that met inclusion criteria) was 50. So, given Morgan sampling table 45 male nurses were selected via accessible method, however, only 30 ones agreed to participate in EEG recording. Inclusion criteria for nurses were being male, age between 25 to 50 years of old, and not suffering from psychological as well as neurological disorders. Since previous

studies had reported different relationships between mu suppression and self-reported empathy in males and females, only male nurses were recruited for this study, in order to control the effect of gender differences.

These nurses were recruited regardless of the hospital ward they were providing health care services. After assuring the nurses to participate in the study, for each of them, one patient was randomly selected among those they had took care during the last week and were discharged at the time of the study. Inclusion criteria for the patients included lack of history of hospitalization in the psychiatric section, being hospitalized at least for one week, having reading ability, and enough visual and auditory health. One patient was removed from the study because of poor judgment and another patient, selected randomly, replaced him.

Jefferson's Scale of Empathy-Health Professionals was used to assess nurses' empathy. In this scale, empathy is considered as an effective cognitive attribute for understating patients' experiences and perspectives and conveying this understanding to them. This scale can be applied to determine empathy in a special group of health care professionals. It has 20 questions (e.g. I believe that emotion has no place in treatment of medical illnesses) and subjects are asked to indicate the extent to which they agree with each item using a seven-point scale (1= strongly disagree, 7= strongly agree). The total score stands between 20 to 140. The more the score, the higher is the level of nurses' empathy.

Previous studies have reported the internal consistency of this scale using Cronbach's alpha 0.78 its reliability coefficient by test-retest with a 3 month s interval, 0.58.<sup>31-35</sup>

A 21-item version of La Monica-Oberst's Patient Satisfaction Scale was used to evaluate patients' satisfaction from nursing services. In this scale, the subject determines his/her satisfaction from quality of nursing services (e.g. The nurse is gentle in caring for me) on a 5-poin scale (1= strongly disagree,

7= strongly agree). The alpha coefficient has been reported 0.97.<sup>36-38</sup>

Before applying, these scales were translated from English to Persian and again translated to English in order to remove translation errors. Three nurses checked face validity of the scales.

Matlab R 2014 a software was used in order to calculate mu power in each electrode. SPSS software version 13 was applied to analyze the data. Pearson correlation coefficient and multiple regression analysis were performed to determine the correlation between mu suppression, nurses' empathy and patients satisfaction. P value for all tests was 0.05.

EEG was recorded by one of the researchers in three states: 1) Moving own hand: the subject, holding his hand on an appropriate visual distance with straight thumb and fingers, opening and closing it with 1 Hz frequency; 2) Watching the video of a moving hand: the subject would watch the video of the examiner's right hand being opened and closed while hand movement was the same as the subject's one. The distance between the monitor and the subject was 1 meter. 3) Watching the video of a motionless hand: this video was exactly like the pervious one with this difference that this time the hand was firm and totally motionless; This state was considered as the baseline.

Each of the mentioned states took long for 80 seconds. First, the subject would watch the video of the motionless hand, then, the video of the examiner's hand being opened and closed, and finally, did the performing the act of opening and closing his own hand.

Locating the electrodes was done based on 10/20 international standard. Since, according to former investigations, obtained information from electrodes corresponding to sensory-motor cortex (C3,Cz and C4) was sign of mu suppression and therefore, the marker of mirror neurons activation, only information obtained from these electrodes was analyzed.<sup>26,39,40</sup> The sampling frequency was 500 Hz.

Two measures were computed for mu suppression. The first one was the logarithm of power ratio of the first state (moving own hand) into the baseline state (watching the motionless hand). The second one was the logarithm of power ratio of the second state (the examiner opening and closing his hand) into the baseline state.

In the current review, like former ones<sup>41</sup> mu power is defined as the mean mu power measured over sensorimotor cortex (C3, Cz, and C4). Mu suppression is also defined as the ratio of mu power in each state into the baseline.

## Results

Demographic parameters have been presented in Table 1. As it can be seen, the mean (standard deviation) of nurses' ages and their working history were 29.2 (4.3) and 6.37 (2.3), respectively. Most of these nurses (70%) were married and 80% of them had nursing BSc. The mean standard deviation of patients' ages and their education levels were 35.1 (5.9) and 8.7 (3.1), respectively; 84% of them were married.

The mean standard deviation of nurses' scores in Jefferson scale of empathy-health professionals, and patients' scores in Patient's Satisfaction Scale of La Monika-Oberst were 96.16 (8.41), 117.83 (5.14), respectively.

Table 2 shows the mean and standard deviation of logarithm of mu power ratio in

watching video of the examiner's hand movement and the subject's own hand movement into the baseline state, in electrodes of sensory-motor part (C3, Cz, and C4). As it is obvious, mu power in the state of moving one's own hand is less than the state of watching another one's hand movement.

In other words, mu suppression is more intense when the subject does an action compared to the watching state. In addition, findings revealed stronger mu suppression in C3 and C4 electrodes in comparison to Cz.

Correlation coefficients between mu suppression, nurses' empathy and patients' satisfaction have been shown in Table 3. It is inferred from this table that the correlation size between mu suppression in the state of watching another one's moving hand and nurses' empathy is not significant.

Two other findings of Table 3 are that mu suppression is not significantly related to patients' satisfaction and there is a significant correlation between nurses' empathy and patients' satisfaction. To determine if each of mu suppression variables and nurses' empathy could predict patients' satisfaction, linear regression analysis was applied. The results manifested that nurses' mu suppression ( $B=-0.016$ ,  $t=-0.086$ ) could not predict patients' satisfaction significantly, however, nurses' empathy ( $B=0.435$ ,  $t=2.316$ ) could forecast 18.5% of patients' satisfaction variance.

**Table 1.** Demographic characteristics of participants

	Nurses Mean(SD)	Patients Mean(SD)
Age	29.2 (4.3)	35.1 (5.9)
Job experience	6.37 ( 2.3)	-
Marital status		
Single	30%	16%
Married	70%	84%
Education in year	14.3 (1.1)	8.7 (3.1)
Jefferson scale of empathy-health professionals	96.16 (8.41)	-
Lamonica-Oberest patient satisfaction scale	-	117.83 (5.14)
Job status		
Employed	-	73.34%
Unemployed	-	26.66%

**Table 2.** Log of mu power in sensorimotor cortex electrodes for each condition

	Execution condition	Observation condition
C3	-0.531 (0.362)	-0.397 (0.273)
Cz	-0.462 (0.223)	-0.318 (0.201)
C4	-0.546 (0.360)	-0.371 (0.294)

**Table 3.** Correlation coefficients

	Mu suppression in nurses	Empathy in nurses	Patients satisfaction
<b>Mu suppression in nurses</b>	1	-0.339	-0.284
<b>Empathy in nurses</b>	-0.339	1	0.442*
<b>Patients satisfaction</b>	-0.248	0.442*	1

\*\* P<0.01, \* P<0.05

## Discussion

The goal of this study was to investigate the association between mu suppression and nurses' empathy with patients' satisfaction.

Results of correlation test and regression analysis showed respectively that through mu suppression was the activation biomarker of MNS, it was not significantly correlated with nurses' self-reported empathy and patients' satisfaction, and could not predict these variables appropriately. This finding is consistent with those confirming no significant correlation between mu suppression and subjects' scores in empathy measurements.

For example, Yung reported that mu suppression in women was just correlated with personal distress subscale of IRI while in men, it was correlated with none of the subscales.<sup>29</sup> Also, Perry, using the same index, corroborated this finding; however, in their study mu suppression was not significantly related with any of the IRI subscales. This result can be explained by the fact that mu suppression does not show MNS activation directly and is just an index of MNS activation.<sup>30</sup>

To comprehend the association between self-reported empathy and MNS activation in nurses more precisely, direct measures of MNS activation, obtained from functional

Magnetic resonance Imaging (fMRI), must be used.<sup>26,27</sup>

Although the scale used in the present study -Jefferson's Scale of Empathy-Health Professionals- to assess nurses' empathy was different from those of the former ones, its result was similar to findings of Yung's and Perry's investigations.<sup>29,30</sup> This finding implied that although mu suppression was a marker for mirror neurons activation, it could not be used as a proper criterion to assess nurses' empathy.

A concept derived from these outcomes was that mu suppression served only as a criterion for MNS activation in neurophysiological level and could not predict external expressions of MNS. Another reason for lack of correlation between mu suppression and self-reported empathy in nurses in this study might be attributed to the fact that nurses may had not reported their empathy levels precisely, for any reason.

Results of previous studies revealed a significant correlation between nurses' empathy and patients' satisfaction. The finding of this research is in line with those that have confirmed empathy ability in improving quality of healthcare services as well as patients' satisfaction.<sup>8</sup>

Regression analysis showed that empathy could predict nearly one fifth of patients'

satisfaction variance. According to some scholars, the therapeutic relationship between a patient and a health specialist is the core stone of medical care. In fact, empathy is considered as one of the most important components of any therapeutic relationship, and many patients define it the key factor of care services quality. In other words, patients expect to be understood and if this need is met, improvement of both psychological and physical signs like depression, anxiety, anger, blood pressure and pain is not far from expectation. This in turn leads to elevation of patients' satisfaction and treatment outcomes.<sup>9-15</sup>

Moreover, some investigators believe that making a therapeutic relationship based on empathy of health care practitioners with patients creates an interpersonal supportive interaction which perceives patients' needs and perspectives, and enable them to use more adaptive ways of adjusting with the new situation.

In a review, Johansson studied factors influencing patients' satisfaction. He identified the nurse-patient relationship, communicating with, and giving information to the patient (all being related to empathy ability) as some of the most important factors. Other parameters affecting patients' satisfaction included patients' socioeconomic backgrounds, their expectations from treatment, physical environment, nurses' medical-technical ability, and the influence of health care organization.<sup>5</sup> These variables were probably those that contributed in predicting satisfaction variance of 81.5% of the patients.

It is noteworthy that Ancel confirmed the possibility of improving nurses' empathy through training programs.<sup>24</sup> In addition, as Hojat states, the difference between empathy and sympathy is that the key components of empathy are emotion and feeling, both inherent and change-resistant, while those of sympathy are recognition and understanding, both learnable and

acquisitive. Therefore, nearly one fifth of patients' satisfaction from offered services depends on nurses' ability to empathy with them that, as Hojjat implies, is acquisitive.<sup>8</sup>

The present study had several limitations that restrict its findings generalization. First, instead of direct measuring of mirror neurons activation, mu suppression was used. Second, only male patients and nurses participated in the study. Samples of future investigations should include patients and nurses from both genders. Third, three important factors affecting patients' satisfaction including socioeconomic backgrounds, education levels, and patients' expectations were not assessed. It is suggested to consider these factors in later research. Finally, patients were not selected from the same department. We propose to choose patients from the same section to control interfering variables.

## Conclusion

Given the results of this study, it can be inferred that finding ways of improving nurses' empathy with patients, such as adding training empathy skills in nurses curriculum, may improve patients' satisfaction and treatment outcomes

## Acknowledgments

We would like to thank nurses and patients that participate in this study.

## Ethical issues

None to be declared.

## Conflict of interest

The authors declare no conflict of interest in this study.

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