



## Brain Evidence in Nursing Research: EEG Methodology

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### ABSTRACT

This aim of the mini-review paper is to introduction the bio-physiologic measures of resting state EEG for nursing scientist. Article specifically addresses the emotional domain as clarified by concepts of brain evidence-based nursing research reviewed that the emotion aspect documented a strong link to frontal brain alpha activities asymmetry. Extensive nursing research has been performed in emotional, behavioral, and/or psychological matters for healthy and unhealthy populations. Evidence-based nursing can transform the way that data is used to improve health and healthcare. One core role of nursing practice is to promote healthy behaviors. Previous researches have shown out that the brain is the main ambassador of behavioral change. The electroencephalogram (EEG) is an efficient tool to study brain-behavior relations. Evidences show that frontal alpha asymmetry is an important marker suggests that EEG is beneficial for assessment emotional capacities and appraises nursing efficiency. The basic resting alpha frontal asymmetry provides a reliable instrument in conducting nursing researches in order to strengthen the quality of nursing. Furthermore, we provide a viewpoint to show progress in the novel research issue probably for clinical applications. To integrate biological measures in order to gain highly accurate and precise advantages of EEG and beneficial assessment of the emotional capacities are suggested. Nursing promotes healthy behaviors including emotional health. Human behavior changes originate in the brain. EEG enables objective and biological insights into the cognitive process. As a foundation, the neuroscience research requires profound knowledge and tools to analyze bio-physiological data. Creating Cross-disciplinary cooperation must be inevitable alliances to advance nursing research.

**Keywords:** Electroencephalogram (EEG); Brain; Emotion; Nursing research

### 1 Introduction

One aim of nursing is to promote healthy behaviors that increase the patients' overall sense of well-being as well as protection from diseases and chronic illnesses [1, 2]. Trends in nursing research are aimed toward an increased use of biological measures that assess the adequacy of nursing interventions. The indicators are usually observed in the heart rate variability (HRV), respiration rate (RR), body mass index (BMI), or blood biochemistry data [3, 4]. Extensive nursing studies have investigated subjective emotional experiences with maintenance of positive health behavior. Alterations in brain functions are bases

connected to human behavioral changes [5-7]. Knowledge of neuroplasticity has been shown to be essential in understanding behavioral changes. The 21<sup>st</sup> Century is known as the Century of the Brain, and the popularity of brain science and its applications in healthcare teaching/learning is considered as an urgent task. This paper provides an opinion and brief introduction to electroencephalographic (EEG) bio-physiologic measures. It specifically addresses the emotional domain as clarified by concepts of brain evidence-based nursing research.

Brain imaging has been a breakthrough technology for cognitive neuroscience that builds on decades of cognitive psychology, behavioral conditioning,



psychophysics, and brain science. Recently, Atalla (2020) demonstrated that few neuroimaging research programs developed by nurse scientists [8]. They reviewed ten neuroimaging methods for nursing science. From my perspective, the EEG technology is easier to use and more accessible than positron emission tomography (PET) and functional magnetic resonance imaging (fMRI). The EEG is a non-invasive and painless procedure with fewer restrictions, time-efficient, and has lower costs. Furthermore, EEG data can be relatively easy to interpret and is more fitting for nursing-related researches.

The EEG is a recording of the electrical activity of the brain from the scalp. The recorded waveforms reflect the cortical electrical activity. Brain waves have been categorized into five basic frequencies: gamma (>29 Hz), beta (13-29 Hz), alpha (8-13 Hz) and theta (4-8 Hz), delta (0.5-4 Hz) bands. Our brainwaves change according to our actions and feeling. Slower brainwaves are dominant when a person feels tired, relaxed, sluggish, or dreamy. Higher frequencies are dominant in hyper-alert people. The signal exquisite temporal is sensitive. Mounting evidences indicate that resting-state EEG activity is related to various cognitive functions [9]. One of the well-known and most extensively studied rhythms of the human brain is the normal alpha rhythm. The alpha is also the most significant among the posterior and central regions versus other regions with typical amplitude of about 50  $\mu$ V (peak-peak). The alpha activity is induced by closing the eyes and relaxing oneself. It is ended by opening the eyes or by thinking or calculating. EEGs are most often collected in the resting state (e.g., listening to music, relaxing, or meditating). To our knowledge, the alpha neurofeedback has been adapted in evaluating the effectiveness of intervention for nursing scientists [10]. The article elucidated the advantage of EEG in beneficial assessment of the emotional capacities by profound theories in simple description.

## **2 Frontal alpha asymmetry and emotion**

Clinical nursing care objectives are alleviating subject unpleasantness and increasing positive emotional behaviors for healthy and unhealthy populations through a productive useful care strategy. An effective intervention enables patients'

emotional benefits, such as resolving their depression, anxiety or pain, etc. The emotional domains had documented a strong link to frontal brain alpha activities asymmetry [11]. The frontal asymmetry refers to the average difference in brain activities between the left and right frontal areas, measured as hemispheric differences in alpha power in EEG recordings across resting several minutes. The concept of frontal alpha asymmetry has been widely used to measure individual variances of emotional and motivational processes [12]. Resting activity in the left-frontal hemisphere has been linked to an approach system that is activated when an individual is moving towards goals or experiencing positive emotions. Conversely, a right lateralized withdrawal system is involved in negative reactions or the motivations to move away from potentially dangerous situations or stimuli [13]. Frontal asymmetry is also characteristic of good mental health and stress adaptation [14]. The basic resting alpha frontal asymmetry provides a reliable instrument in conducting nursing researches in order to explore or evaluate the intervention.

EEG signals contain rich information about the activities of the brain. They can reliably enable us to estimate emotions. Robust data has shown that the alpha frontal asymmetry is a bio-physiology indication that relates to negative/positive emotional states or the approach/withdrawal behavior [15]. The line of frontal asymmetry score (right minus left EEG alpha power) serves as a biological marker of dispositional affect [12, 16]; this score plays a crucial role in probing emotional regulation[15]. For instance, greater left-sided frontal activity at rest was found to predict greater emotional flexibility, better emotion regulation, and more positive and decreased negative affect [17]. The alpha power is inversely related to regional cortical activity using hemodynamic measures[18]. The roles of frontal-subcortical neural circuits involve emotional modulation and include alterations in cognitive function [19]. Such reciprocity in neural connectivity with that left frontal activity plays a possible compensatory mechanism in emotional regulation or affective manifestation [20] [19]. Individual EEG frontal alpha asymmetry accompanied by neurofeedback training is related to a reduction in the negative

affectivity and anxiety has been used in a variety of healthcare fields [21]. These are breakthroughs in single or superficial observations of the alpha-relax/beta-worry via interventions (meditation, music, yoga et.al). In addition, EEG patterns could be modified by biochemical, metabolic, circulatory, hormonal, and personality variables. Although the concept of alpha asymmetry seems clear, it contributes quite profoundly to neural mechanism elucidation including behavior manifestation.

Evidence-based nursing is an approach to promote health by evaluating various cognitive, behavioral, and psychological operations (emotion, stress, pain, perception, music, learning, movement, attention, fitness, relaxation or exercise, etc.) [22]. The nursing science must conduct or develop useful practice tools which can be specific and sensitive in evaluating nursing process and the nursing care outcomes [23]. EEG can utilize mixed methods along with observation reports, psychometric scores, or galvanic skin response. Evidences of brain signal as accelerator can be facilitated at the evidence level if the nursing experiment/research is well-designed. Effective intervention enables patients to approach positive emotion such as sorrow-transforming from negative affective state and trait. EEG data is an objective, sensitive and reliable tool in elucidating the brain-behavior relations thus reinforce appraisal in nursing efficiency. With the progress of electronic products in recent years, many modern portable EEG have become available for automatic analysis of brain waves [24, 25]. They have been utilized in applications in a variety of scientific and academic research fields. Utilizing the EEG approach to nursing practice helps us in providing the highest quality and most cost-efficient patient care possible.

### 3 Implication

We can continue this concept and the application of EEG methodology with respect to the current medical phenomenon to create a new issue for nursing research. It is noteworthy to mention that nowadays the trend of aging, mental deficit; coma and aphasia which are caused by various illnesses or long term care population is increasing. Whenever people are unable to express their sensation of the physical or affective discomfort even induced from innate or external stimulus. The

EEG asymmetry serves as a biomarker that can be assessed in their logistical needs by the automated brain wave detector. Brain-based evidences provide the patient's clinical safety by promoting quality in nursing care. If you are planning to conduct a study of simple alpha asymmetry score toward more in-depth deliberations in behavioral brain science by illustrating the effectiveness of nursing care, some challenges will be formulated. The challenges in academic nursing research, theory, and practice integrate many basic disciplines such as biology, physiology, behavioral/cognitive psychology as well as social sciences. However, brain data can be translated into new innovations for nursing. These insights can elucidate behavior elements from brain science leading to a variety of interdisciplinary education. We believe that constructive interdisciplinary learning can lead to nurses' profound thinking and deep comprehension of patients' emotions and behavior.

### 4 Conclusion

Nursing promotes healthy behaviors including emotional health. Human behavior changes originate in the brain. Nurse researchers have been working hard to integrate biological measures into their research in order to gain highly accurate and precise manner. EEG enables objective and biological insights into the cognitive process.

### 5 Declarations

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#### 5.2 Competing Interests

The authors declare there are no competing interests.

#### How to Cite this Article:

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