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Prediction of Subjective Well-Being based on Mindfulness and Cognitive Flexibility in Nurses of Psychiatric Wards Using an Artificial Neural Network

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Abstract

Introduction: The mental health of the nurses is of utmost importance to accomplish the ideal goals of communities in terms of reducing financial and spiritual costs. The present study aimed to investigate the relationship between subjective well-being with mindfulness and cognitive flexibility in nurses of psychiatric wards of hospitals in Ahvaz city using an artificial neural network (ANN).

Methods: This was a descriptive and correlational study. The statistical population of this study comprises all nurses of the psychiatric ward of hospitals in Ahvaz city, Iran, in 2022. Accordingly, 200 nurses were selected through convenience sampling. The research instruments included the Kentucky Inventory of Mindfulness Skills, the Subjective Well-being Scale, and the Cognitive Flexibility Inventory. The data were analyzed using descriptive and inferential statistics, Pearson correlation coefficient and simultaneous regression, and ANN.

Results: The results suggested a positive and significant relationship between mindfulness and subjective well-being, and between cognitive flexibility and subjective well-being ($P<0.001$). Furthermore, the subjective well-being of nurses had multiple relationships with mindfulness and cognitive flexibility ($P<0.001$). Following the results of the ANN, cognitive flexibility demonstrated the highest estimation in predicting subjective well-being.

Conclusions: Mindfulness and cognitive flexibility of nurses had a significant relationship with their subjective well-being. The results suggested the necessity to emphasize the appropriate methods of mindfulness and cognitive flexibility, which can be obtained by holding proper workshops and training programs.

INTRODUCTION

One of the most important fields in health development in societies is the healthcare sector, which is directly related to human health [1]. Nurses working in hospitals, particularly hospitals with psychiatric wards are regarded as stressful job groups [2, 3]. The mental health of the hospital staff has been of little concern and very few studies have been carried out in this regard [4]. Subjective well-being is included in the field of behavioral sciences, in which people's share of evaluation of their own lives is studied [5].

Subjective well-being is a multifaceted concept that includes physical and mental health, achieving independence and freedom, and the ability to participate in different aspects of life. Subjective well-being has two cognitive and emotional components. The cognitive dimension means evaluating people's level of satisfaction with life, and the emotional dimension of well-being means having maximum positive emotions and minimum negative emotions [6]. In general, subjective well-being is defined as emotional self-evaluation and personal cognition. People with a high sense of subjective well-being, while having a positive self-evaluation of the events around them, have a higher rate of success and peace. Subjective well-being constituents various concepts ranging from current mood to overall judgment of life satisfaction, and from depression to euphoria [7]. One of the most basic concepts of a good life is the concept of happiness. Happiness can be regarded as pleasant affects, life satisfaction, positive emotions, meaningful life, or a

feeling of accomplishment [8]. People with high levels of well-being experience more positive emotions than the ones with lower levels of well-being, they enjoy higher levels of creativity and control, evaluate events more positively, and have a stronger immune system and greater levels of life satisfaction [9].

One of the psychological characteristics of a healthy human is consciousness and attention to the present time [10]. Mindfulness refers to targeted attention and consciousness in the present time and without judgment. On the other hand, mindfulness can boost humans' mental capabilities to facilitate their thoughts and strengthen their affects, and assists them to employ them to achieve the best results for themselves, as well as others [11]. This moment-to-moment awareness enables an individual to perceive their affects in various moments, having being aware of these affects [12]. Ramachandran et al. [13] reported that mindfulness can effectively reduce psychological distress, stress, depression, and some dimensions of burnout in nurses. Green and Kinchen [14] reported that mindfulness meditation has the potential to decrease stress and psychological distress in nurses by decreasing self-judgment and overidentification with experience, and by increasing resiliency, compassion, and emotional regulation. Having acknowledged their affects and their causes, they seek to enhance their positive affects by expanding their social relationships through establishing relationships with others. On the other hand, the rational responsibility-based behavioral orientation instead of automatic reactivity, help an individual to regulate their behavior [14, 15]. Consequently, the individuals take the responsibility for their behaviors and seek to resolve problems to fix their conflicts with others. Given the high levels of job stress, the employees of the health sectors are prone to low levels of mental health and well-being. Accordingly, it affects their physical health and neural system [15].

One of the factors that can enhance individuals' abilities to cope with abnormalities is cognitive flexibility, which refers to an individual's openness to external and internal experiences. In other words, cognitive flexibility is the ability to make changes in the cognitive sets to adjust to varying environmental stimuli [16]. Different individuals demonstrate various levels of this personality trait and show individuals' reactions to new experiences. Flexible individuals are curious about the internal and external experiences in their world and are in search of new experiences [17]. Consequently, higher levels of flexibility can improve the level of psychological well-being, quality of life, as well as mental function, and individual performance. A study revealed that cognitive flexibility has a direct relationship with functional flexibility [18].

Manpower is one of the most crucial assets of the official and health centers of every country. In case the manpower, i.e., the human capital of that country enjoys a high and desirable quality of life, the success, survival rate, and the chance of development of that organization increments as well. Workplace, especially hospitals and health centers comprise numerous stimuli, each of which can cause stress in the employees [19]. Members of a health care team from the beginning of the treatment process up to the recovery and even, post-treatment care include individuals who experience high levels of stress, fatigue, and burnout in the workplace [20]. Taking into account that the care team in hospitals and psychiatric wards consists of psychologists, psychiatrists, nurses, and even service staff of these wards, the stressful factors can be regarded as psychological or even socio-psychological threats for them. Similar studies have not been conducted in examining subjective well-being based on mindfulness and cognitive flexibility in nurses of psychiatric wards. Also, examining the psychological aspects of nurses in psychiatric wards using ANN is one of the most important innovations of the present study. Therefore, based on the presented materials, the purpose of this research was to predict subjective well-being based on mindfulness and cognitive flexibility in nurses of psychiatric wards using an ANN.

METHODS

This was a descriptive and correlational study that uses ANN. The statistical population includes all nurses of psychiatric wards of public and private hospitals of Ahvaz city in 2022. Accordingly, 200 participants were selected through convenient sampling from five public and private hospitals in Ahvaz city. Having visited the hospitals and explained the conditions of the research to the hospital administrators, their consent to collaborate was obtained and the questionnaires were handed over to the nurses of the psychiatric wards. Based on Thomson's [21] model (15 participants for each observed variable), and given that there were 11 observable variables in this research, a total of 220 participants were selected as a sample considering outlier data and incomplete questionnaires. Finally, the distorted and incomplete questionnaires were eliminated and 200 complete questionnaires were included in the research. In order to comply with ethical considerations, informed consent was obtained from the nurses participating in the present study.

Instruments

Subjective Well-being Scale (SWS): This scale is used to measure emotional, psychological, and social well-being. It comprises 45 questions. The first 12 questions are concerned with emotional well-being, 18 subsequent questions with psychological well-being, and the final 15 questions with social well-being [22]. The face validity, internal reliability, and reliability of the SWS were also considered acceptable [23]. Ebrahimi et al. [23] reported that Cronbach's alpha coefficient for

the scale was 0.80. In this study, Cronbach's alpha was used to determine the reliability of the scale, which was 0.83.

The Kentucky Inventory of Mindfulness Skills: This is a self-report scale including 39 items developed by Baer et al. [24]. The respondent should express the level of their agreement or disagreement within a 5-point Likert scale ranging from 1 (never) to 5 (always). The scores of this scale range between 39 to 195. A higher score indicates a higher level of mindfulness. Heydarinasab [25] confirmed the validity of the Persian version of this instrument. Cronbach's alpha coefficient for the scale was 0.86 [25]. In this study, Cronbach's alpha was used to determine the reliability of the scale, which was 0.87.

The Cognitive Flexibility Inventory (CFI): CFI was designed by Dennis and Vander Wal [26]. This inventory consists of 20 items. It measures an individual's progress in their clinical and non-clinical work to assess their progress in developing flexible thoughts in the cognitive behavioral treatment of depression and other psychological diseases. This inventory is scored based on a 5-point Likert scale ranging from strongly disagree=1 to strongly agree=7. The internal consistency and Cronbach's alpha coefficients of the CFI indicate that this questionnaire has high reliability and validity for the Iranian population. Cronbach's alpha coefficient for the scale was 0.83 [27]. In this study, Cronbach's alpha was used to determine the reliability of the scale, which was 0.81.

Statistical Analyses

The data were analyzed using SPSS-27 and MATLAB-2019. The mean and standard deviation were used at the descriptive level, the Pearson correlation coefficient and simultaneous regression at the inferential level, and ANN was used to examine the prediction of subjective well-being in accordance with mindfulness and cognitive flexibility.

RESULTS

According to the results of demographic data, a total of 200 nurses of the psychiatric ward of hospitals in Ahvaz aged 28.19±6.75 years old participated in this research. The demographic characteristics of the nurses participating in the present study are presented in Table 1. Table 2 shows the mean, standard deviation (SD), and Pearson correlation coefficients of the research variables. Following the results, mindfulness (r= 0.366) had a positive and significant relationship with subjective well-being, and cognitive flexibility has a positive and significant relationship with subjective well-being (r= 0.481).

Table 1. Demographic Variables of the Nurses Participating in the Present Study

Variables	n	%
Age (years)		
25-30	71	35.50
30-35	65	32.50
35-40	38	19.00
40-45	26	13.00
Gender		
Female	139	69.50
Male	61	30.50
Marital status		
Single	58	29.00
Married	142	71.00

Table 2. Mean, standard deviation (SD), and Pearson correlation coefficients of the research variables

Variables	Mean ± SD	Pearson correlation coefficients
Subjective well-being	164.78 ± 26.83	1
Mindfulness	121.12 ± 23.36	0.366**
Cognitive flexibility	82.76 ± 7.14	-0.481**

**: P <0.01

Table 3. Results of simultaneous regression analysis

Predictor variable	R	R^2	F	P	B	β	P
Mindfulness	0.49	0.26	23.91	0.001	0.16	0.14	0.001
Cognitive flexibility	0.49	0.26	23.91	0.001	1.51	0.40	0.001
Constant	0.49	0.26	23.91	0.001	19.95	-	0.378

Simultaneous regression was used to figure out which variable was more influential in the prediction of subjective well-being. Accordingly, mindfulness and cognitive flexibility variables were included in the equation as the predictor variables and subjective well-being as the independent variable. According to Table 3, the results of simultaneous regression revealed that the multiple correctional relationships of mindfulness and cognitive flexibility variables with subjective well-being were significant (R= 0.49, P= 0.001). In addition, mindfulness (β= 0.14, P= 0.001) and cognitive flexibility (β= 0.40, P= 0.001) had a significant relationship with subjective well-being.

In this research, a neural network was designed and constructed with MATLAB. The research question included: To what extent the subjective well-being can

be predicted in psychiatric ward nurses using mindfulness and cognitive flexibility? First, the data were divided as follows to be included in the network: 70% as the training set, 15% as the evaluation set, and 15% as the experimental set. Given that, two inputs and one output were included in the network in an Excel file as a matrix. With respect to the results, the best result was obtained using two hidden layers in which the first layer contained 9 neurons and the second layer contained 1 neuron. Figure 1 shows the structure of an ANN with the best possible estimation.

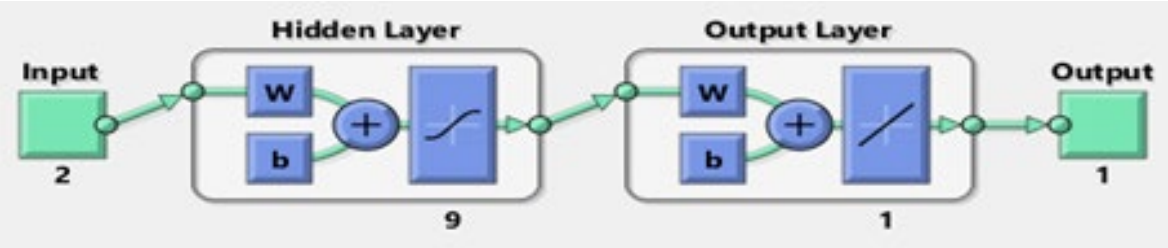

Figure 1. The structure of the artificial neural network with the best possible estimate

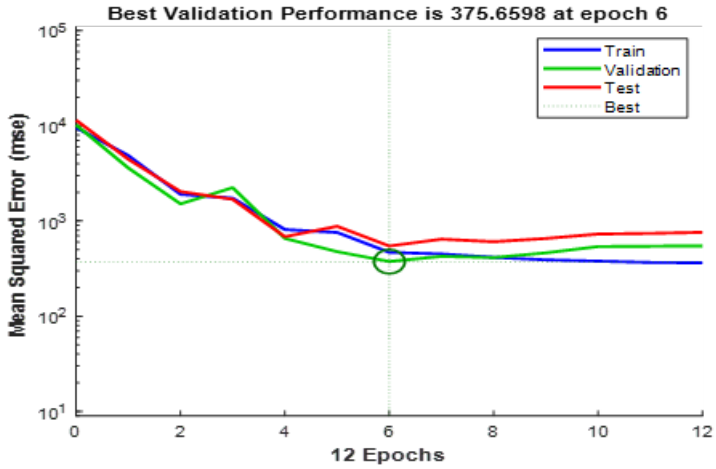

Figure 2. Diagram of the network efficiency

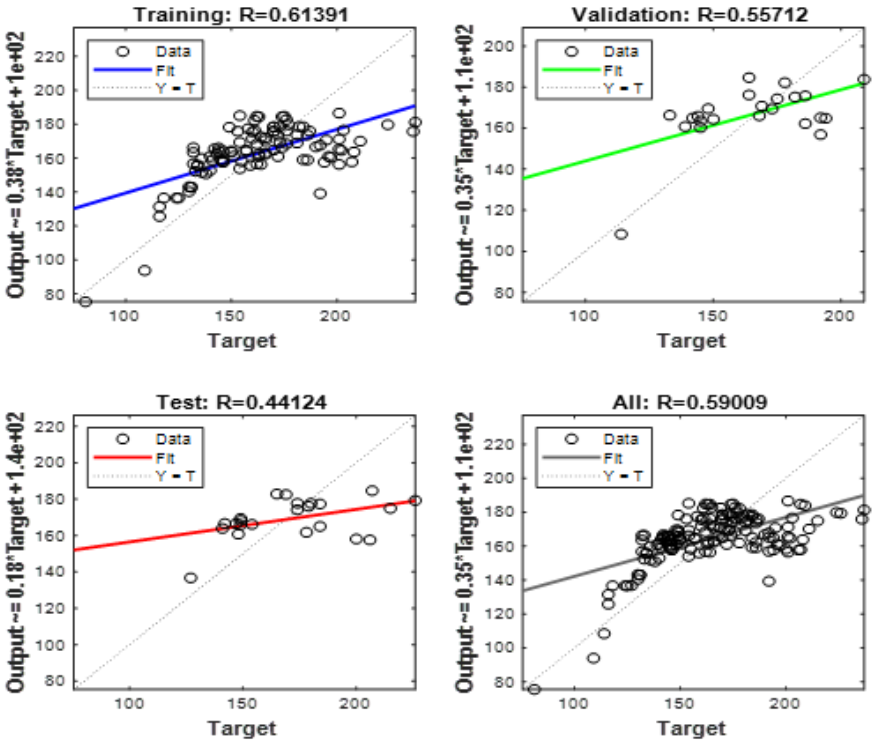

Figure 3. The regression equation between the mean values of subjective well-being and the estimated amount

Considering that the optimal number of training repetitions is unknown, per the early shopping method, the data of network weight optimization and training sets are included in the network at the same time as presenting the data of the evaluation set to achieve prediction. In light of that, training repetition will continue until the error improvement has reached a low level. Finally, the best repetition number is selected and approved per the minimum number of the datasets of the training set. Figure 2 shows how the process of training a neural network using input data proceeds. Taking into account the setting, the network has stopped after 6 consecutive errors in the evaluation set. This cessation occurred in the 12th repetition. Figure 2 shows that: 1) The amount of error of the final square is small; 2) The error of the training set enjoys approximately similar behaviors and characteristics to the errors of the evaluation set; 3) No overfitting has occurred until the 6th repetition (in which the best efficiency regarding the evaluation set occurs).

Figure 3 indicates the level of precision of the network in predicting subjective well-being, which is demonstrated in four segments, i.e., training, evaluation, experimental, and overall. This figure shows how close the network outputs were to the real numbers. As the points get closer to the diametric axis of the diagram, it aggregates, and the output amounts get closer to the real number. Figure 3 presents the diagrams related to prediction equations at training, evaluation, experimental, and overall stages.

Following the above Figures, at the training stage, the neural network predicted subjective well-being with a precision of 0.61. In this stage, the prediction equation was as follows: Output= 0.38 × Target + 1.1e+0.2. In addition, in the evaluation stage, the neural network predicted well-being with a precision of 0.55. In this stage, the prediction equation was as follows: Output= 0.35 × Target + 1.1e+0.2. In the experimental stage, it predicted subjective well-being with a precision of 0.44. In this stage, the prediction equation was as follows: Output= 0.18 × Target + 1.4e+0.2. In the overall stage, it predicted subjective well-being with a precision of 0.59. In this stage, the prediction equation was as follows: Output= 0.35 × Target + 1.1e+0.2. The results of ANN suggested that cognitive flexibility best predicted subjective well-being.

DISCUSSION

The present study aimed to investigate the relationship between subjective well-being with mindfulness and cognitive flexibility in nurses of psychiatric wards of hospitals in Ahvaz city using an ANN. Mindfulness and cognitive flexibility predicted 24% of subjective well-being variance. The first finding indicated that mindfulness has a positive and significant relationship with the subjective well-being of nurses in a psychiatric ward. In line with the results of the present study, Veigh et al. [11] reported that nurses perceived that a mindfulness program had the potential to increase well-being and future clinical performance. Penque [12] reported that Mindfulness can be an effective method to improve several psychosocial aspects of health and nurses' well-being, which can help retain nurses at the bedside. In addition, Marotta et al. [28] showed that there is a positive relationship between mindfulness and reducing distress in healthcare professionals during the COVID-19 pandemic. It can be argued that mindfulness enhances nurses' consciousness regarding the physical and psychological affects and helps them truly accept life incidents using mechanisms such as acceptance, being free of judgment, description, awareness, and observation, as well as using techniques such as meditation, relaxing, and self-awareness. Consequently, they achieve the ability to fully focus on every incident occurring at this moment, and break the loop of automatic negative thoughts (ANT), and choose their thoughts and affects consciously [28]. In addition, they are less influenced by unpleasant affects and the amygdala, which leads to the increase of positive symptoms and reduction and improvement of negative symptoms of psychological health in them. Mindfulness-based training and techniques enable an individual to become aware of daily activities, as well as the automatic function of the mind in the past and present world. In addition, with the moment-to-moment awareness of thoughts, affects, and physical states, they can control them and emancipate themselves from the mind that is stuck in the everyday life and focus on the past and future [29].

Another finding revealed that cognitive flexibility has a positive and significant relationship with the subjective well-being of nurses. In line with the results of the present study, Kruczek et al. [17] reported that cognitive flexibility is positively correlated with the psychological adjustment of nurses. In light of that, in regard to the relationship of cognitive flexibility with subjective well-being and health it appears that due to their flexible viewpoint regarding the incidents and surrounding world, flexible individuals can easily adjust to the problems and solve them. Consequently, they are more optimistic toward life and mostly emphasize its positive points [16]. When faced with problems, they can observe the problem with purpose and from different angles. They can make plans and endeavors to overcome problems and take responsibility for their actions. These individuals enjoy a good level of personal growth and deal with problems in a more efficient manner [16]. Therefore, they are less likely to face communication problems as others do since cognitive flexibility is concerned with the ability to control environmental conditions. Thus, these individuals enjoy

higher social adjustment and responsibility. Furthermore, cognitive flexibility can be referred to as the changes in thoughts and minds of individuals to better adjust to the varying stimuli in the environment. These abilities include the ability to change viewpoints or adjustment to the rules and conditions of the new environment [18].

This research faced a few limitations and it is only reasonable to identify them to facilitate conducting the subsequent studies and the effort to reduce or remove them. Taking into account that this research was carried out on the nurses of the psychiatric ward of hospitals of Ahvaz city, the results might not be generalized to nurses of other regions with different cultures and personal-cultural characteristics. Another limitation of this study was the failure to control the personal, cultural, social, and economic differences of the participants.

CONCLUSION

The results indicated that the mindfulness and cognitive flexibility of nurses in the psychiatric ward of Ahvaz city had a significant relationship with their subjective well-being. The results suggested the necessity to emphasize the appropriate methods of mindfulness and cognitive flexibility, which can be obtained by holding proper workshops and training programs. It is recommended to conduct the same research in other regions of Iran and compare the results.

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ETHICS CONSIDERATION

The study protocol was approved by the Ethics Committee of Islamic Azad University, Ahvaz branch (code: IR.IAU.AHVAZ.REC.1401.015).

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AUTHORS' CONTRIBUTIONS

Authors had equal contribution to designing study, collecting data, revising the initial draft, and approving the final draft.

CONFLICTS OF INTERESTS

The authors declared no conflict of interest.

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