Introduction
Cardiovascular diseases (CVDs) are the leading cause of death worldwide, affecting human health. Abnormal heart rhythms or arrhythmias are a type of CVDs that occur following structural and coronary disease of the heart or complicated conditions of the other organs.\(^1\)

According to the report of the American Heart Association (2018), in the United States, the occurrence of life-threatening arrhythmias was the primary cause of death in 53,895 people.\(^2\) Among the dangerous arrhythmias, ventricular tachycardia (V-Tach) and ventricular fibrillation (VF) are the causes of hemodynamic instabilities or even death of patients.\(^3\)

Placement of an implantable cardioverter-defibrillator (ICD) is the only effective method for rapid diagnosis and treatment of life-threatening ventricular arrhythmias.\(^4\) However, the implantation of ICDs is associated with a reduced quality of life\(^5\) and the development of mood disorders.\(^6\) Therefore, patients living with ICD experience a high rate of insomnia,\(^7\) depression and anxiety,\(^8\) and stress.\(^9\) Furthermore, patients life-threatening arrhythmias was the primary cause of death in 53,895 people.\(^2\) Among the dangerous arrhythmias, ventricular tachycardia (V-Tach) and ventricular fibrillation (VF) are the causes of hemodynamic instabilities or even death of patients.\(^3\)

Abstract

Introduction: An implantable cardioverter-defibrillator (ICD) is the only approach to treat patients with life-threatening ventricular arrhythmias. Adaptation and acceptance of ICD play an important role in the optimal treatment of the patients. The aim of this study was to determine adaptation status and related factors in patients living with ICDs. Methods and Materials: In this descriptive-analytical study, 148 patients referred to Kowsar Hospital in Shiraz and Farshchian Hospital in Hamedan city between July 2020 and September 2021 were included in the study. Patients' adjustment status was measured based on the mode of the Roy nursing model and using the Baecke physical activity questionnaire, Pittsburgh sleep quality, mini nutritional assessment (MNA) nutrition questionnaire, constipation scoring questionnaire, self-concept scale, and multidimensional scale of perceived social support (MSPSS). Results: Patients had low physical activity and poor sleep quality. Negative self-concept in relation to the disease and adherence to physicians' recommendations was observed among patients. In addition, patients did not have optimal interpersonal communication. Multivariate regression findings showed that the number of years of device implantation and the number of shock discharges are effective factors in the incidence of insomnia and the negative self-concept of patients. Conclusion: Patients living with ICD did not adjust to the new conditions after placement of the device. Low level of physical activity and sleep disturbance and also negative self-concept about the disease and adherence to treatment was observed among the patients. Shock discharges and duration of the device implantation were associated with impaired self-concept and insomnia in the patients.

Keywords: Adaptation, implantable cardioverter defibrillator, nursing, patient
after ICD placement may show fear, feelings of loneliness and lack of support, self-restrictions on physical activity, feeling of an involuntary job move, worries about their future, communication restrictions, and the unpleasant feeling when the shock is discharged. However, the occurrence of mood disorders is a risk factor for CVD, recurrence of cardiac events, and non-adherence to treatment.

Sert et al. (2021) found that individuals with experienced restrictive behaviors and concerns and fear of death especial after receiving a shock. Also, Montesinos et al. (2020) concluded that the patients with an ICD show negative emotional responses including anxiety, fear of shocks, discomfort, and also sleeping disorders. Moreover, inserting ICD into patients affects both patients’ and partners’ psychological adjustment in the first year after ICD implantation.

Considering that ICD placement is the only approach to treating patients with ventricular arrhythmias, identification of its consequences and applying appropriate program care could be of particular importance to improve patients’ adaptation to the conditions after implantation of the device.

In this regard, nursing models play an important role in recognizing and assessing patients with non-adjusting behaviors. Hence, the Roy adaptation model (RAM) of nursing plans nursing care from the patient’s adjustment perspective. According to this model, patients show adaptation to the new conditions such as after implantable defibrillator implantation through physiological, self-conception, role function, and independence and dependence dimensions.

The aim of this study was to evaluate the adjustment status based on RAM and related factors in patients living with ICD.

### Methods and Materials

In this descriptive–analytical study, patients referring to heart clinics of Farshchian hospitals in Hamedan and Kosar Hospital in Shiraz city were included in the study between July 2020 and September 2021. This study was approved by the Ethics Committee of the Hamedan University of Medical Sciences and was part of a clinical trial study, which was registered at the Iranian Clinical Trial Registration Center at www.ictir.ir with the code of IRCT2018082604040874N1.

Inclusion criteria included patients living with ICD at least 6 months after implanting the device, patients with ≤80 years of age, ability to speak Persian, no mental illness, and able to cooperate to complete the assessment and recognition form. Also, patients were excluded from the study due to unwillingness to continue participating in the study, failure to complete the assessment and recognition form, the need for surgery, and those who had advanced underlying diseases such as severe heart failure, renal failure, and cancer.

After selecting patients, patients’ information was collected through eight tools. The demographic and clinical questionnaire included patients’ information including age, gender, body mass index, level of education, history of smoking and opium addiction, history of hypertension and diabetes, time of ICD implantation, reasons for ICD implantation, and frequency of ICD shock delivery.

The assessment and recognition form based on the RNM was designed. This form included four modes of physiologic, self-conception, role function, and dependency. The form was extracted based on reliable scientific sources and then was prepared according to a pilot study that was performed on 20 patients. After preparing the final version, this questionnaire was given to 10 experts to confirm the face and content validity. The reliability of this questionnaire was confirmed using the test–retest method (r = 0.92).

Baecke physical activity questionnaire was used for measuring physical activity. This questionnaire examines patients’ physical activity through three indicators of work, exercise, and leisure. The total score is between 2 and 15, which higher scores showing a better physical activity level.

The Pittsburgh questionnaire was used to assess patients’ sleep quality. This questionnaire examines patients’ sleep quality in 7 dimensions and 18 phrases. These dimensions include subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. The scores for each dimension are between 0 and 3, and the total score is between 0 and 21, and lower scores are associated with enhanced quality of sleep.

The constipation Scoring Questionnaire (CSQ) was used to assess patients’ constipation. This questionnaire was designed by Wexner et al. and modified by Agachan et al. (1996). CSQ consists of eight items that score the severity of constipation from 0 to 30. As scores increase, the severity of constipation increases.

The MNA nutrition questionnaire was used to score patients’ nutritional status. This questionnaire includes two parts: screening (6 questions) and assessment (12 questions). Scores 12–14 indicate the normal nutritional status of patients and scores higher than 14 show the poor nutritional status. This questionnaire has been used extensively in Persian studies and its validity and reliability have been confirmed.

Self-concept questionnaires were designed by Thomas et al. (2004) to assess the self-conception status of cardiovascular patients based on the RNM. This questionnaire consists of two parts: threat and challenge. In the threat section, the range of scores was 31–124, with lower scores indicating better patients’ self-concept. In the challenge section, the range of scores is 30–120, and with increasing scores, the patients’ self-concept improves.
The Multidimensional Scale of Perceived Social Support (MSPSS) was designed by Zimet et al.[23] (1988) and was used in this study for assessing the independence and dependence status of the patients. This questionnaire has 12 questions and a 7-point Likert scale. The range of scores is between 12 and 60 and higher scores indicate a better condition of patients.

A checklist was used to assess the status of patients in the role function mode. Patients who performed their primary and secondary roles received a score of 4, patients who performed only one of these roles received a score of 2, and patients with poor performance in their roles received a score of 0.

All questionnaires were completed after obtaining informed consent from patients. A nursing personnel was assisted to prevent errors in data collection. In this way, the researcher read the items related to the questionnaires for the patients and their family members, and then the nursing personnel and the researcher gave a score. In case of significant differences between the scores, the patients was questioned again.

Study data were analyzed by SPSS version 18 and using multivariate regression to determine the relationship between variables.

### Results

A total of 148 patients with ICDs participated in this study. The mean age of the patients was 73.48 ± 6.7 years old. The majority (58.2%, n = 86) of the patients were men and the level of education of most of them (62.2%, n = 92) was illiterate. Also, among the patients, 35.2% (n = 52) had a history of smoking and 16.9% (n = 25) had a history of opium addiction. Underlying diseases of hypertension and diabetes were reported in 25% (n = 37) and 39.2% (n = 58) of patients, respectively. Most (85.2%, n = 126) patients lived with their family (spouse or children). The mean body mass index of patients was 24.2 ± 1.7 and the mean duration of implanting ICD was 8.3 ± 5.25 years. In addition, 45.2% (n = 67) of patients had at least one shock discharge monthly and ICD delivered one shock every few months in 41.2% (n = 61) of the patients. The most common cause of ICD placement was heart failure (80.4%, n = 119). Table 1 shows the details of patient information.

Data analysis showed that in the physiological mode, patients had lower than the mean scores in the field of activity and mobility, which indicated the low level of activity and mobility of patients living with ICD. In terms of sleep and rest, sleep latency, habitual sleep efficiency, and sleep disturbances were the most common sleep disorders. In addition, the lowest dimension of the Pittsburgh Questionnaire was related to the use of sleeping medication. In other words, these patients did not take sleeping pills.

Patients’ scores in the field of nutrition and excretion were normal and only 6 (4.5%) patients in the field of nutrition and 12 (9%) patients in the field of excretion had abnormal status. Table 2 shows the scores of patients in the physiological mode.

In the self-conception mode, part of the threat, the findings indicated that patients’ scores in all areas (subscals) and total scores were higher than the average. Because higher scores in the threat score indicate the worse condition of patients, the threat score

![Table 1: Demographic data of patients](image)

| Age in year | Frequency (n) | Percentage (%) |
|------------|--------------|----------------|
| ≤50 year   | 23           | 15.5           |
| 51-65      | 33           | 22.3           |
| 66-80      | 92           | 62.2           |
| Male, n (%) | 86           | 58.2           |
| Level of education, n (%) | | |
| Primary education or below | 113 | 76.5 |
| Secondary education | 22 | 15 |
| Higher education | 13 | 8.5 |
| Living with others, n (%) | 126 | 85.2 |
| Smoking, n (%) | 52 | 35.2 |
| Opium addicted, n (%) | 25 | 16.9 |
| Underlying disease | | |
| Hypertension | 37 | 25 |
| Diabetes | 58 | 39.2 |
| Time of ICD implantation | | |
| 6 months to 5 years | 38 | 25.7 |
| 6 to 10 years | 84 | 56.7 |
| Above 10 years | 26 | 17.6 |
| Reasons for ICD implantation | | |
| Heart failure | 119 | 80.4 |
| Congenital heart disease | 17 | 11.5 |
| Cardiomyopathy | 12 | 8.1 |
| Frequency of ICD shock delivery | | |
| Daily | 7 | 4.7 |
| Weekly | 13 | 8.8 |
| Monthly | 67 | 45.3 |
| Every few months | 61 | 41.2 |

![Table 2: Adjustment status of patients living with ICD in the physiological mode](image)

| Physiological Mode | (mean±SD) |
|--------------------|-----------|
| Activity | Baecke physical activity questionnaire (2-15) | 5.53±1.8 |
| Rest and Sleep (mean±SD) | | |
| Subjective sleep quality | 1.7±0.89 |
| Sleep latency | 2.81±1.21 |
| Sleep duration | 1.7±0.92 |
| Habitual sleep efficiency | 2.41±0.74 |
| Sleep disturbances | 2.35±0.99 |
| Use of sleeping medication | 0.54±0.58 |
| Daytime dysfunction | 1.6±0.47 |
| Global PSQI score (0-21) | 13.11±0.98 |
| Nutrition | MNA questionnaire score (12-14) | 12.25±1.1 |
| Elimination | | |
| Constipation scoring system (0-30) | 7.32±3.50 |
indicates a negative self-concept (global total score = 98.87 of the total score of 124). However, in the self-concept mode, part of the challenge, patients’ scores were lower than the average in all areas, and considering that the lower score in the challenge indicates the worse condition of patients, therefore, it shows that patients have an unsuitable self-concept about their disease and self-care [Table 3].

In terms of role function mode, patients had scores close to the total score, and it seems that they had no problem with the function of their primary and secondary roles. In independence and dependence mode, patients’ scores were higher than average. Considering that a higher score on the MSPSS questionnaire indicates a better condition for patients, it seems that patients had a better condition in terms of interpersonal communication and independence than other modes [Table 3].

Table 5 shows the findings related to multivariate regression of modes with other variables. The results showed that in the field of sleep, by increasing 1 standard deviation (SD) in the number of shock discharges, the patients’ sleep disorder score increased by 27.3% of the SD. In terms of self-concept, by increasing 1 SD in the number of shock discharges, the patients’ self-concept score in the part of threat increased by 29.8% of the SD.

Also, by increasing 1 SD in the number of years of ICD implantation, the patients’ self-concept score increased by 26.8% of the SD ± Mean.

| Table 3: Adjustment status of the patients living with ICD in self-concept mode |
|-----------------------------|-------------------|
| Self-concept mode            | SD ± Mean          |
| Physical self                |                   |
| Threat (15-60)               | 45.25±4.4          |
| Challenge (10-40)            | 22.15±5.15         |
| Personal self                |                   |
| Self-consistency             |                   |
| Threat (9-36)                | 34.41±3.13         |
| Challenge (6-24)             | 11.23±3.23         |
| Self-ideal                   |                   |
| Threat (5-20)                | 17.11±2.23         |
| Challenge (7-28)             | 11.41±3.25         |
| Moral-ethical-spiritual self |                   |
| Threat (2-8)                 | 2.1±0.25           |
| Challenge (3-12)             | 9.1±2.1            |
| Total score                  |                   |
| Threat (16-64)               | 53.62±2.71         |
| Challenge (16-64)            | 31.74±2.17         |
| Global Self-conception score |                   |
| Threat (31-124)              | 98.87±3.42         |
| Challenge (30-120)           | 53.89±3.1          |

| Table 4: Adjustment status in patients living with ICD in role function and independence and dependence modes |
|----------------------------------------------------------|
| Mean±SD                                                  |
| Role function (0-4)                                      | 3.78±0.21         |
| Independence and dependence (12-60)                     | 5.21±6.2          |

Discussion

The aim of this study was to determine the adaptation status and its related factors in patients with an implantable defibrillator. The results showed that the patients’ physical activity was not in an appropriate condition. Kramer et al. [2017] concluded that mobility limitations are common among patients living with ICD. Also, Sassone et al. [2020] assessed the impact of the COVID-19 pandemic on the physical activity of patients living with an ICD device. They reported low physical activity in ICD patients. Therefore, our findings are consistent with previous results related to low physical activity and mobility limitation after implanting ICD.

The present study indicated that patients had some degree of sleep disorders. Habibovic et al. [2018] concluded that sleep disturbance was common among patients with an ICD. In another study, Gallagher et al. [2016] showed a high prevalence of sleep disturbance, which was associated with poorer device acceptance. It seems that sleep disorders are high prevalence among patients with ICDs. Hence, assessing and recognizing focal and underlying stimuli of sleep disorder and implementing nursing care based on Roy’s nursing theory could be an effective strategy to improve sleep quality.

The present study showed a low level of self-concept about patients’ disease and treatment. Habibovic et al. [2017] and Emons et al. [2019] found that patients with ICD had a negative self-perception about their treatment, therefore they experienced negative emotions such as post-traumatic stress disease, anxiety, and depression during their lives. Moreover, Ooi et al. [2016] and Pach [2020] report low self-esteem in patients living with ICD. These findings reveal the failure in self-consistency and self-ideal after implanting ICD. Therefore, patients have unadjusted behavior as negative emotions, which are patients’ psychological responses to unpleasant conditions.

The finding of the present study indicated the lack of optimal score in interdependence mode. However, a better score of interdependence than other modes was obtained. Recent studies showed that patients with ICD and their partners tended to discontinue the social relationship with friends and the family. Also, they may experience low relationship satisfaction after implanting ICD. These findings are consistent with our results. The patients and their families may prefer to be away from society because of changes in self-esteem, body image, or even stigma. Supportive and psychological interventions such as group support are recommended for patients living with ICD to adapt to the new condition.
According to our results, there was a significant relationship between the number of shock discharges with sleep disorder and worsening of self-concept. Furthermore, the number of years of device placement with worsening self-concept of patients was a positive significant relationship. Da Silva (2018) showed a significant relationship between ICD shocks and QoL. Moreover, Gallagher et al. (2016) showed that shock anxiety is associated with poorer device acceptance. These findings are consistent with our findings. It seems that shock deliveries are the cause of unadjusted behaviors including insomnia and negative self-concept. Shock discharge is an unpleasant experience that leads to restlessness and agitation due to the pain and pressure, that is, established in the chest. The nurse needs to recognize the signs and symptoms of stress and distress among the patients and provide psychosocial and social support, especially for patients with higher and repeated shocks and those who have been implanted with the device for longer times.

**Conclusion**

The results of this study showed that patients’ adjustment with ICD was not an inappropriate condition. Patients did not have adequate physical activity and had sleep disturbance and also had a negative self-concept about the disease and adherence to their treatment. Factors including the number of shock discharges as well as the duration of the device implantation led to the impaired self-concept and insomnia in patients.

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**Conflicts of interest**

There are no conflicts of interest.

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