


# Sleep quality among different classes of heart failure patients in Jordan

## A STROBE compliant cross-sectional study

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### Abstract

Many researchers emphasize the importance of studying sleep quality among patients with heart failure (HF). Because of the importance of this topic, many studies have been conducted to address the different aspects of sleep in various populations of patients with HF. The purposes of our study were: to assess the types of disturbances in sleep within the different classes of HF, and to assess whether there were differences in the levels of sleep quality and types of disturbances in sleep within the different classes in non-hospitalized Jordan patients with HF. Data were gathered from 2 cardiac clinics and 2 medical clinics at 3 Jordan hospitals. A minimum sample of 200 people was recruited to participate in this study based on these criteria and factors. The prevalence of low sleep quality and types of disturbances in sleep were increased with the increase in New York Heart Association class. Nearly 3 quarters of the study sample had poor sleep quality 73.5% (n = 147). Using a score of 5 as a cut point, 147 patients with HF in our study sample had poor sleep quality. The most common types in all classes were waking up for urination, waking in the middle of the night or early morning, waking up due to coughing and snoring, and difficulty falling asleep within 30 minutes. However, waking up due to feeling cold or hot were rarely reported in all classes of patients with HF. Poor sleep quality negatively affects the quality of life in patients with HF by decreasing physical cognitive and psychosocial performance in those patients. This is the first study in literature study sleep quality in the different New York Heart Association functional classes.

**Abbreviations:** HF = heart failure, NYHA = New York Heart Association, PSQI = Pittsburgh Sleep Quality Index.

**Keywords:** HF, prevalence, quality, sleep

### 1. Introduction

Heart failure (HF) is a chronic common disease that represents a clinical challenge to health care systems.<sup>[1]</sup> HF is defined as “a clinical syndrome that involves deficiency or failure of the heart to pump adequate blood volume to meet tissue demand.”<sup>[2]</sup> In the United States of America data showed that 21 million were suffering from HF and 64.3 million worldwide.<sup>[3]</sup> There are, however, no statistical data on HF prevalence in Jordan, but the Jordan Ministry of Health reported that in the year of 2013 nearly 36% of deaths in Jordan were due to cardiovascular disease.

Despite the improved treatment and the decrease in mortality rate after cardiovascular events, the number of patients with HF is increasing all over the world.<sup>[4]</sup> Nearly 60% of patients with HF had poor sleep quality<sup>[5]</sup> which was associated with depression,<sup>[6]</sup> reduced physical and cognitive performance,<sup>[7]</sup> and increased cost due to the increase of unplanned

hospitalization.<sup>[8]</sup> Many researchers emphasize the importance of studying sleep quality among patients with HF,<sup>[9,10]</sup> and because of the importance of this topic, many studies were conducted to address the different aspects of sleep in various populations of patients with HF.<sup>[11–13]</sup> For example, there were studies that addressed sleep quality in chronic hospitalized patients with HF.<sup>[5,13]</sup> Meanwhile, Dos Santos<sup>[14]</sup> and Wang<sup>[12]</sup> addressed sleep quality in chronic non-hospitalized patients with HF. On the other hand, Redeker's studies which were conducted in 2005,<sup>[15]</sup> 2010,<sup>[16]</sup> and 2012<sup>[7]</sup> addressed sleep quality in stable patients with HF. However, there were no studies that assess whether there are differences in the levels of sleep quality and types of disturbances in sleep between the different classes of HF.<sup>[12,14]</sup>

Literature shows that patients with HF often report low sleep quality, including difficulty maintaining sleep, falling asleep, or waking up too early in the morning.<sup>[12–14,16,17]</sup> Disturbances in sleep due to sleep disordered breathing were

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The datasets generated during and/or analyzed during the current study are not publicly available, but are available from the corresponding author on reasonable request.

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also common among patients with HF and lead to poor sleep quality.<sup>[8]</sup> Several studies have demonstrated that about 50% of patients were waking up at night due to sleep disordered breathing such as apnea, paroxysmal nocturnal dyspnea, orthopnea and cough.<sup>[4,14]</sup>

Studies that addressed sleep quality and disturbances in sleep in patients with HF indicated that variations in the types of these disturbances and the levels of sleep quality might exist, because patients with HF suffer from a wide and various range of symptoms; and these various symptoms can affect sleep in different levels and aspects.<sup>[12,14]</sup> Those researchers recommended that more research is needed to identify the relationship between sleep quality and types of disturbances in sleep within the different classes of HF.<sup>[12,14]</sup> So, the purposes of our study were: to assess the types of disturbances in sleep within the different classes of HF, and to assess whether there were differences in the levels of sleep quality and types of disturbances in sleep within the different classes in non-hospitalized Jordan patients with HF.

### 1.1. Settings

Data were gathered from 2 cardiac clinics and 2 medical clinics at 3 Jordan hospitals. Two of these hospitals are classified as major. One of the major hospitals is a referral (Jordan University of Science and Technology), located in the North of Jordan. It had a total capacity of 600 beds. This hospital has 2 cardiac clinics with 5 cardiologists, who provided health care for patients with cardiac diseases. The estimated number of patients who visited the clinics were 50 to 80 patients per day.

The second major hospital is a governmental hospital which is located in Irbid North of Jordan and had a total capacity of 202 beds. The internal medical clinics in the hospital provide health care for patients with cardiac diseases in its local community. Hospital also receives patients from other peripheral hospitals.

The third hospital is a governmental hospital in Jerash city in the North of Jordan and had a total capacity of 110 beds. The internal medical clinics in the hospital provide health care for patients with cardiac diseases in its local community. The hospital can refer patients to other major hospitals. The hospital's internal medical clinics provide health treatment to people with heart disorders in the surrounding community. Patients might be referred to other large hospitals by the hospital.

### 1.2. Participants in the study

The study's target population was all Jordanians with heart illness. During the research period, the available population included cardiac patients who visited the designated hospitals. In this study, the quota sampling approach was utilized to define demographic strata and assess how many in each class. In addition, a minimum sample of 50 patients per New York Heart Association (NYHA) class of HF was required to ensure proper evaluation.

### 1.3. Sample

The G\* a power program was used to compute sample size.<sup>[18]</sup> The sample size was calculated using multiple regression analysis, and a medium effect size was necessary for the purpose of this study (0.15). The sample size was calculated using the power level (0.80) and the usual alpha (0.05) 2-tailed criteria of significance. A minimum sample of 200 people was recruited to participate in this study based on these criteria and factors. The following were the sampling inclusion criteria: individuals above the age of 18; and patients who have had HF or cardiac illness for at least 1 year.

The participants with heart disorders were selected for the study because, patients with cardiac disease but without consequent impairment of usual physical activity. Class I HF was defined as physical exertion that did not induce excessive tiredness, palpitation, dyspnea, or anginal discomfort. Exclusion criteria included: individuals who had been hospitalized for cardiac issues during the preceding month, patients with cancer, or patients with mental illnesses. Patients who had been hospitalized in the preceding month were excluded since the Pittsburgh Sleep Quality Index (PSQI) questionnaire measured sleep quality for the previous month, and hospitalization can impact sleep quality.<sup>[13]</sup> Cancer patients were also eliminated since they had several comorbidities that might impair their sleep quality,<sup>[12]</sup> and mental patients could not complete the instrument.

### 1.4. Instrumentation for research

The data collection used a self-rated questionnaire with 3 components. Part 1 of the patients' functional categorization was determined by the New York Heart Association, Part 2 was the Arabic version of the PSQI, and Part 3 was a functional categorization for the patients.

### 1.5. New York heart association functional classification sheet

Based on the definition recognized by the Standards Committee of the New York Heart Association functional classification (1994), a 4-item question in Arabic was generated. Each question item described physical activity restrictions, and each item corresponds to a different type of HF. Item 1 corresponded to class one, and so on. The following are the questions that will accurately describe your clinical status:

1. My normal physical activity does not lead to fatigue, palpitation, shortness of breath, or anginal pain.
2. I experience fatigue, palpitation, dyspnea, or anginal pain when I engage in normal physical activity.
3. Exercising less than my usual amount of physical activity leads to fatigue, palpitation, dyspnea, or angina pectoris pain, but these symptoms go away once I rest.
4. Even when at rest, I experience fatigue, palpitation, dyspnea, or anginal pain, and any physical activity increases my discomfort.

### 1.6. The PSQI

The PSQI is a measure of how well people sleep (PSQI). The PSQI is a self-report questionnaire developed to assess sleep quality in clinical populations. PSQI includes 7 sleep characteristics dimensions.<sup>[19]</sup> The number of items is nineteen, which are added together to produce a single worldwide PSQI score that really can vary between 0 and 100. A score of more than 5 on this scale indicates poor sleep quality, while a score of equal to or less than 5 indicates good sleep quality.<sup>[19]</sup> The original English version of the PSQI scale demonstrated internal consistency (Cronbach's alpha = 0.85), test-retest reliability ( $R = 0.85$ ;  $P$  value .001), sensitivity of 89.6%, and specificity of 86.5%.<sup>[19]</sup> The PSQI's face and content validity were approved with internal consistency (Cronbach's alpha = 0.86).<sup>[20]</sup> Spira et al<sup>[21]</sup> found that the PSQI's internal consistency was adequate (Cronbach's alpha = 0.69).

### 1.7. Demographic data sheet

The participants requested to fill out a demographic information sheet, which was built to review the literature. These data

include information about the participants' age, gender, height, weight, level of education, marital status, smoking status, and disease duration.

### 1.8. Disease characteristics sheet

This sheet was completed by the researcher using electronic records. The disease qualities variables were clinical assessment, ejection fraction, administration of drugs currently taken, and categorization of these medications

### 1.9. Data collection

After taking the Institutional Review Boards approval from Jordan University of Science and Technology, the permission from the Ministry of Health was taken. The researcher took permission from the administrators of 3 hospitals, to get access to patient's files. Data collection took a period of 3 months from August until October 2018.

Data had been collected by the researcher after approaching the patients with cardiac diseases and HF who were visiting the cardiac or medical outpatient clinics. First, the researcher reviewed the list of the patient's names who visited the clinic that day. Then patients' records were reviewed to identify those who are diagnosed with HF or cardiac diseases. The participants who met the eligibility criteria were invited to participate in this study.

Second, at the waiting area of the clinic, the researcher identified himself to the potential participants, explained the nature and purpose of the study and invited them to participate. Those who agreed to participate in the study received a copy of the consent form. Then, the self-reported questionnaire was administered to the participants. After that the researcher read the items, provided explanations if needed and let the patients fill out the questionnaires, at the same time the researcher was available when help was needed.

### 1.10. Ethical consideration

The Institutional Review Boards at Jordan University of Science and Technology approved all recruitment and consent procedures and informed consent that explained all the duties and rights of the participant was signed by all participants.

### 1.11. Data analysis

Data was analyzed using Statistical Package for Social Sciences (SPSS) software program version 25 (BMI, Chicago, IL). Descriptive statistics were used to describe the demographic data and the sample characteristics. Also, descriptive statistics included percentages, frequencies, ranges, means, and standard deviations were used to identify the levels of sleep quality within the different classes of HF. Only percentages and frequencies were used to identify types of disturbances in sleep that affect different classes. To explore if the differences in levels of sleep quality and in the scores of each dimension of sleep characteristics within the different classes were significant, ANOVA tests were used.

## 2. Results

### 2.1. Demographic variables

The number of participants was 200. The proportion of participants from each hospital varied widely, from 60% (n = 120) in 1 major hospital to 10% (n = 20) in the other, and 30% (n = 60) in the third one.

The typical study participant was 58 years old, male (63.5%, n = 127), was married and had at least secondary school

education (48.0%, n = 96). The range of number of years since diagnosis of cardiac disease was from 1 to 20 years with a mean of 5.12 (SD = 3.72). About 42.5% (n = 85) of the participants were smokers with a mean number of 13 cigarettes per day, with a mean body mass index of 30.14.

The most common medical diagnosis was ischemic heart disease at 71.5% (n = 143). Participants' mean ejection fraction was 47.63 (SD = 9.91); they took a mean of 6.64 number of medications, among them Beta Blockers 85% (n = 170), Diuretics 62% (n = 124) and Angiotensin Converting Enzyme Inhibitors 47% (n = 94) were used most often. All patients were taking Platelet Inhibitor medication.

### 2.2. Levels of sleep quality in the different classes of HF

Nearly 3 quarters of the study sample had poor sleep quality 73.5% (n = 147). Using a score of five<sup>[5]</sup> as a cut point, 147 patients with HF in our study sample had poor sleep quality. Most class I patients with HF had good sleep quality 86% (n = 43). On the other hand, most of the class II HF patients had poor sleep quality 80% (n = 40). All the patients in class III and class IV had poor sleep quality (see Table 1).

Total PSQI scores were calculated for patients to identify their levels of sleep quality. Sleep quality scores ranged from 1 to 18, with a mean of 9.28 (SD = 4.61). Means, standard deviation and range for total PSQI scores in each class were presented in Table 2. Class I had the lowest mean of PSQI score while class IV had the highest PSQI score.

### 2.3. Types and prevalence of disturbances in sleep in the different classes of HF

Our participants had a high prevalence of almost all types of sleep disturbances; the prevalence of these disturbances increased with the progression of the classes of HF. The most common types in all classes were waking up for urination, waking in the middle of the night or early morning, waking up due to coughing and snoring, and difficulty falling asleep within the 30 minutes. However, waking up due to feeling cold or hot were rarely reported in all classes of patients with HF.

**Table 1**

Mean scores of PSQI within the different classes of HF.

	Mean	SD	Actual range
Class I	3.5600	1.52744	1–8
Class II	7.6000	2.32993	4–14
Class III	11.2600	2.33701	7–17
Class IV	14.7000	1.72910	11–18
Total	9.28	4.61	1–18

HF = heart failure, PSQI = Pittsburgh Sleep Quality Index, SD = standard deviation.

**Table 2**

Levels of sleep quality within classes of HF.

Class of HF	Frequency (%)	
	Good sleep quality	Poor sleep quality
Class I (n = 50)	43 (86)	7 (14)
Class II (n = 50)	10 (20)	40 (80)
Class III (n = 50)	0 (0)	50 (100)
Class IV (n = 50)	0 (0)	50 (100)
Total (n = 200)	53 (26.5)	147 (73.5)

HF = heart failure.

## 2.4. Types and prevalence of disturbances in sleep in class I HF

Most types of disturbances in sleep were uncommon in class I HF. However, patients in class I HF reported difficulty getting back to sleep 76% (n = 38), waking up to urinate 72% (n = 36), waking up due to cough and snoring 56% (n = 28), and difficulty to fall asleep within the 30 minutes 50% (n = 25). Patients in class I HF were often complained from these disturbances in sleep less than once per week, which represents the lowest level of frequency. On the other hand, waking up due to difficulty breathing, waking up due to feeling cold, hot, pain or due to nightmares were rarely reported by patients in class I HF. For more detailed about types and prevalence of disturbances in sleep in class I (see Table 3).

## 2.5. Types and prevalence of disturbances in sleep in class II HF

Participants in class II HF complained of most types of sleep disturbances. The most frequent type ranked by the patients was waking up at night to urinate 94% (n = 47). The second most frequent was difficulty falling asleep within 30 minutes, 88% (n = 44). The third was difficulty getting back to sleep 86% (n = 43). And the fourth was waking up due to coughing or snoring 80% (n = 40). In addition, nearly a third of patients in class II HF had disturbed sleep due to difficulty breathing, feeling pain or due to nightmares. Feelings of hot or cold were rarely reported by class II patients (see Table 4).

## 2.6. Types and prevalence of disturbances in sleep in class III HF

All types of disturbances in sleep were common and frequent in class III HF patients, except waking up due to feeling cold or hot. More than 90% of class III HF patients reported difficulty getting back to sleep, waking up at night due to urination, and

waking up due to difficulty breathing. Nearly 80% of them had difficulty falling asleep within 30 minutes and complained of coughing, snoring or pain that woke them at night. Also waking up due to nightmares was reported by 62% of class III HF participants (see Table 5).

## 2.7. Types and prevalence of disturbances in sleep in class IV HF

Despite that the most common disturbances in sleep in class IV HF were like those in class III HF, but the frequency and severity of disturbances in sleep was higher in class IV patients than in class III patients with HF. For example, all patients in class IV HF patients (100%) were waking up at night due to urination more than 3 times per week. Also, all of them (100%) reported difficulty getting back to sleep more than 3 times per week. More than 95% of class IV patients with HF had difficulty falling asleep within 30 minutes, complained of pain, cough or snoring and had difficulty breathing at night. Waking up due to feeling cold or hot was rarely reported by patients. The variables were controlled from the confounding factors before assessing sleep quality such as sleeping pills, caffeine and other factors (see Table 6).

## 3. Discussion

There were no studies in the literature that compared sleep quality in the different classes of HF. So, our study is the first study that identifies the sleep quality within HF. Our study results showed that whenever the NYHA class of the patients with HF increased, the patient complained of higher levels of poor sleep quality and higher scores of PSQI. As mentioned previously, sleep quality was measured according to the total score of PSQI. The prevalence of poor sleep quality was referred to the percentage of patients' number who had a PSQI score higher than five. On the other hand, the prevalence of good sleep quality was referred to the percentage of patients' number who had a PSQI score lower or equal five.

Overall, the participants in our study showed poor sleep quality with the increase of NYHA class. This result was explained by Alosco et al<sup>[22]</sup> when he reported that HF is a progressive disease. With the progression of the disease the general health and the clinical symptoms were becoming worse and more complicated. General health and clinical symptoms had a meaningful relationship with sleep quality. Poorer sleep quality was found with the progression of the disease.

About 3 quarters of patients with HF in our study sample had poor sleep quality with a mean score of PSQI 9.28 (SD = 4.61). This result was consistent with a study conducted in Taiwan, including 101 outpatients with HF, which reported that 81% of the patients had poor sleep quality with a mean score of PSQI 10.78 (SD = 4.78).<sup>[12]</sup> Another study conducted in Brazil included 400 outpatients, showed that 68.5% of the sample had poor sleep quality.<sup>[14]</sup> The results of our study and the previous studies show that there is a variation in the prevalence of poor sleep quality for patients with HF who were receiving their treatment in outpatient clinics. This variation could be due to the different characteristics for the different populations with HF.<sup>[13]</sup>

Results in our study showed that the prevalence of sleep quality and the means of PSQI scores were lower than some other studies. For example, 1 study conducted in Pakistan, which included 40 hospitalized patients with HF, reported that 92.5% of patients had poor sleep quality with a mean score of PSQI 15.6 (SD = 3.0). The prevalence of poor sleep quality among 200 hospitalized patients with HF in Iran was 91.5% with a mean score of PSQI 11.61 (SD = 4.20).<sup>[15]</sup> The prevalence of poor sleep quality and the means of PSQI scores in the 2 previous studies were higher than results in the current study.

**Table 3**

**Types and prevalence of disturbances in sleep in Class I HF (N = 50).**

Type of sleep disturbance	Not present		Present		Total present, n (%)
	Never, n (%)	< once/wk, n (%)	1–2 times/wk, n (%)	>3 times/wk, n (%)	
Cannot get to sleep within 30 min	25 (50)	23 (46)	1 (2)	1 (2)	25 (50)
Wake up in the middle of the night or early morning	12 (24)	36 (72)	2 (4)	0 (0)	38 (76)
Waking up to urinate	14 (28)	23 (46)	8 (16)	5 (10)	36 (72)
Waking up due to difficulty breathing	45 (90)	4 (8)	1 (2)	0 (0)	5 (10)
Waking up due to coughing or snoring	22 (44)	13 (26)	9 (18)	6 (12)	28 (56)
Waking up due to feeling cold	49 (98)	1 (2)	0 (0)	0 (0)	1 (2)
Waking up due to feeling hot	49 (98)	1 (2)	0 (0)	0 (0)	1 (2)
Waking up due to pain	47 (94)	3 (6)	0 (0)	0 (0)	3 (6)
Waking up due to nightmares	43 (86)	7 (14)	0 (0)	0 (0)	7 (14)

HF = heart failure.

**Table 4**  
Types and prevalence of disturbances in sleep in class II HF (N = 50).

Type of sleep disturbance	Not present		Present			Total present, n (%)
	Never, n (%)	< once/wk, n (%)	1–2 times/wk, n (%)	>3times/wk, n= (%)		
Cannot get to sleep within 30 min	6 (12)	16 (32)	17 (34)	11 (22)	44 (88)	
Wake up in the middle of the night or early morning	7 (14)	12 (24)	14 (28)	17 (34)	43 (86)	
Waking up to urinate	3 (6)	12 (24)	16 (32)	19 (38)	47 (94)	
Waking up due to difficulty breathing	31 (62)	17 (34)	1 (2)	1 (2)	19 (38)	
Waking up due to coughing or snoring	10 (20)	18 (36)	15 (30)	7 (14)	40 (80)	
Waking up due to feeling cold	45 (90)	3 (6)	1 (2)	1 (2)	5 (10)	
Waking up due to feeling hot	40 (80)	4 (8)	3 (6)	3 (6)	10 (20)	
Waking up due to pain	31 (62)	13 (26)	3 (6)	3 (6)	19 (38)	
Waking up due to nightmares	33 (66)	12 (24)	4 (8)	1 (2)	17 (34)	

HF = heart failure.

These results might be attributed to the clinical and environmental factors related to hospitalization.<sup>[13]</sup> Hospitalization had a close relationship with poor sleep quality, where most hospitalized patients complained of poor quality and fragmented sleep, frequent arousals and awakenings, and lack of deep sleep.<sup>[23]</sup> As discussed before, there were no studies that reported sleep quality in class II HF, but 1 study which was conducted in Taiwan by Wang et al<sup>[12]</sup> and addressed sleep quality among 101 patients with HF. In this Taiwanese study the sample was predominantly class II HF; the author also did not compare sleep quality within the different classes of HF in his sample. Wang’s study reported that 81% of patients had poor sleep quality. This result was compatible with our result of sleep quality in class II HF, where 80% of patients in class II HF in our study had poor sleep quality. Even though all (100%) of the participants in class III and class IV had poor sleep quality, the means of total PSQI scores was higher in class IV patients with HF than in class III patients. Higher PSQI scores indicated

poorer sleep quality, so sleep quality in class IV HF was the poorest one.

**3.1. Limitations**

This study has many limitations. First, this study was a cross-sectional study which limited the generalizability of the study. Another limitation was using convenience sample which limited the generalizability to the other populations. Lastly, this study using patients from 3 hospitals limits the generalizability of the finding to where the study was conducted.

**3.2. Implication of the study**

Results of this study should encourage academic nurses to include these findings when educating nursing students and nurses staff about sleep enhancement strategies for the patients

**Table 6**  
Types and prevalence of disturbances in sleep in class IV HF (N = 50).

Types of sleep disturbance	Not present		Present			Total present, n (%)
	Never, n (%)	< once/wk, n (%)	1–2 times/wk, n = (%)	>3 times/wk, n = (%)		
Cannot get to sleep within 30 min	3 (6)	0	0	47 (94)	47 (94)	
Wake up in the middle of the night or early morning	0	3 (6)	1 (2)	46 (92)	50 (100)	
Waking up to urinate	0	0	1 (2)	49 (98)	50 (100)	
Waking up due to difficulty breathing	2 (4)	7 (14)	30 (60)	11 (22)	48 (96)	
Waking up due to coughing or snoring	1 (2)	3 (6)	26 (52)	20 (40)	49 (98)	
Waking up due to feeling cold	35 (70)	9 (18)	1 (2)	5 (10)	15 (30)	
Waking up due to feeling hot	42 (84)	2 (4)	5 (10)	3 (6)	8 (16)	
Waking up due to pain	2 (4)	27 (54)	13 (26)	8 (18)	48 (96)	
Waking up due to nightmares	7 (14)	32 (64)	9 (18)	2 (4)	43 (86)	

HF = heart failure.

**Table 5**  
Types and prevalence of disturbances in sleep in class III HF (N = 50).

Type of sleep disturbance	Not present		Present			Total present, n (%)
	Never, n (%)	< once/wk, n (%)	1–2 times/wk, n = (%)	>3 times/wk, n = (%)		
Cannot get to sleep within 30 min	10 (20)	5 (10)	16 (32)	19 (38)	40 (80)	
Wake up in the middle of the night or early morning	3 (6)	5 (10)	8 (16)	34 (68)	47 (94)	
Waking up to urinate	3 (6)	6 (12)	5 (10)	36 (72)	47 (94)	
Waking up due to difficulty breathing	4 (8)	25 (50)	12 (24)	9 (18)	46 (92)	
Waking up due to coughing or snoring	6 (12)	4 (8)	20 (40)	20 (40)	44 (88)	
Waking up due to feeling cold	44 (88)	2 (4)	1 (2)	3 (6)	6 (12)	
Waking up due to feeling hot	43 (86)	1 (2)	2 (4)	4 (8)	7 (14)	
Waking up due to pain	10 (20)	25 (50)	11 (22)	4 (8)	40 (80)	
Waking up due to nightmares	19 (38)	16 (32)	15 (30)	0 (0)	31 (62)	

HF = heart failure.

within the different classes of HF. The curriculum should be based on universal guidelines, with consideration to differences of the classes of HF. Knowledgeable nurses regarding the differences in levels of sleep quality and sleep differences within the different classes of HF can give them the power to play their educator role for patients with HF. The study findings suggest a need to develop different protocols that enhance sleep quality for patients within the different classes of HF. Managers need to provide more resources and efforts to include these protocols in the discharge planning and in the health, education programs for patients with HF.

#### 4. Conclusion

Poor sleep quality negatively affects the quality of life in patients with HF by decreasing physical cognitive and psychosocial performance in those patients. This is the first study in literature studying sleep quality in the different NYHA functional classes. Also, sleep quality was not studied among all classes of patients with HF in Jordan. This study showed many differences in sleeping between different NYHA functional classes.

#### Author contributions

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