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The definitive publisher version is available online at <https://doi.org/10.1016/j.apnr.2022.151583>

Illness acceptance, medication adherence and the quality of life in patients with heart failure: A path analysis of a conceptual model

Running title: The quality of life in heart failure

Original research

Saman SADEGHIAZAR, RN, BSc

MSc student, Faculty of Nursing and Midwifery, Tabriz University of Medical Sciences, Tabriz, East Azerbaijan, Iran

Email: samansadeghi2018@gmail.com

Khorshid MOBASSERI, BSc, MSc

PhD Candidate, School of Public Health, Tabriz University of Medical Sciences, Tabriz, Iran

Email: khorshid.m69@gmail.com

Leila GHOLIZADEH, RN, BSc, MSc, PhD

Lecturer, IMPACCT, Faculty of Health, University of Technology Sydney, Sydney, Australia

Email: Leila.Gholizadeh@uts.edu.au

ORCID number: 0000-0002-6711-3312

Parvin SARBAKSH, BSc, MSc, PhD

Assistant Professor, Department of Statistics and Epidemiology, School of Public Health, Tabriz

University of Medical Sciences, Tabriz, Iran

Email: p.sarbakhsh@gmail.com

Atefeh ALLAHBAKHSIAN, RN, BSc, MSc, PhD

Faculty of Nursing and Midwifery, Tabriz University of Medical Sciences, Tabriz, East
Azerbaijan, Iran

Email: atefebakhshian@gmail.com

Corresponding author before publication

Leila Gholizadeh

15 Broadway, Faculty of Health, University of Technology Sydney, Sydney, NSW 2007,
Australia

Email: Leila.Gholizadeh@uts.edu.au

Phone: 00612 9514 4814

Corresponding author after publication

Atefeh AllahBakhshian

Faculty of Nursing and Midwifery, Tabriz University of Medical Sciences, Tabriz, East
Azerbaijan, IR

Email: atefebakhshian@gmail.com

Sources of funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Conflict of interest

No conflict of interest has been declared by the authors.

Abstract

Heart failure (HF) is a chronic disease that negatively affects different aspects of the patients' lives, diminishing their quality of life. This research studied factors that impact the health-related quality of life (HRQoL) of patients with HF, particularly medication adherence and acceptance of illness. In this cross-sectional study, data were collected from 273 patients admitted to a tertiary hospital with the diagnosis of HF. Participants' level of illness acceptance, medication adherence, and HRQoL were assessed using validated questionnaires, and data were analyzed using the regression path analysis. There was found a moderate level of acceptance of illness (24.9 ± 6.79) and low levels of medication adherence (3.44 ± 3.15) and HRQoL (53.81 ± 17.99) among participants. Gender, education, income, history of coronary artery bypass (CABG), the New York Heart Association (NYHA) class, acceptance of illness, and medication adherence were statistically significantly associated with HRQoL. Patients with diminished HRQoL were more likely to be female, less educated, have lower income, higher NYHA class, no prior CABG, low medication adherence, and low level of acceptance of illness. The final path model demonstrated a good fit with the data ($\chi^2/df= 1.70$, CFI=0.92, RMSEA= 0.05, and $p=0.01$). Health care providers should target and promote medication adherence and the acceptance of illness as modifiable factors to help improve the HRQoL of patients with HF.

Keywords: Acceptance of illness, medication adherence, health-related quality of life, heart failure

Introduction

Heart failure (HF) is a chronic and progressive disease characterized by a spectrum of symptoms caused by cardiac dysfunction, such as fatigue, chest pain, dyspnea, and edema (Jaski, 2015). The disease affects approximately 26 million people globally, with the prevalence projected to increase (Savarese & Lund, 2017) mainly due to the aging population and improved survival of patients with coronary events (Schjødt et al., 2017). Patients with HF experience declined physical function, impaired individual and social relationships, economic and living problems, and between 18% and 32% of these patients are readmitted to the hospital within 30 days after discharge, with the readmission rates reaching between 50% and 67% within one year (Schjødt et al., 2017). These adverse experiences negatively affect the patients' health-related quality of life (HRQoL) (Obiegło et al., 2016; Polanczyk et al., 2020).

Patients with HF should participate in self-care activities to manage their illness symptoms, prevent complications and rehospitalizations, and improve their quality of life (Aga et al., 2019). An essential aspect of self-care in patients with chronic disease, including HF, is adherence to a long-term medication regimen (Ling et al., 2020). Medication adherence is theoretically defined as the degree to which one's behavior in taking medications is consistent with the physician's (Osterberg & Blaschke, 2005). Noncompliance with medications can worsen HF symptoms, leading to rehospitalization, increased treatment costs, and reduced HRQoL (Adriaanse et al., 2016; Alexa et al., 2006). It has been shown that medication adherence itself is positively associated with the level of acceptance of illness by the patient (Jankowska-Polańska et al., 2016; Jankowska-Polańska et al., 2017; Obiegło et al., 2016). Further, patients with higher illness acceptance are more likely to have greater HRQoL (Jankowska-Polańska et al., 2016; Jankowska-Polańska et al., 2017; Obiegło et al., 2016).

Acceptance of illness is a process in which a person adapts to living with an illness (Cybulski et al., 2017); they do not judge, avoid, or deny their illness, and continue reasonable engagement in daily activities (McCracken & Eccleston, 2003). Acceptance of illness is characterized by the lack of negative responses and emotions associated with the disease (Kowalewska et al., 2020). The person takes active roles in the treatment and recovery process by adhering to their medications and prescribed diet and implementing necessary lifestyle changes (Ankarali, 2020; Obiegło et al., 2016; Turen, 2021).

Although the associations between medication adherence and HRQoL, medication adherence and acceptance of illness, and acceptance of illness and HRQoL have been demonstrated in different studies, the interactions between acceptance of illness, medication adherence, and HRQoL have not been investigated altogether in a single study. This study examined the direct and indirect effects of factors, identified through theoretical and experimental research, on the HRQoL of patients with HF, particularly focusing on the role of medication adherence and acceptance of illness.

Materials and Methods

This is cross-sectional research, and participants were recruited using a convenient sampling method from XXX Hospital in 2019. Inclusion criteria included: 1) admitted to the hospital with HF exacerbation, 2) age older than 18 years, 3) having the HF classification above II according to the New York Heart Association (NYHA), and 4) not dependent on someone else to take medications. Patients who diagnosed with HF for the first time, and those who had significant comorbidities, such as an incurable disease, mental disorders, or a history of cardiac intervention within the last six months (e.g., coronary angioplasty, coronary artery bypass grafting, or valve replacement) were excluded. Overall, 273 participants who were hospitalized with the main

diagnosis of HF were recruited for the study. This sample size was big enough to allow the inclusion of 16 independent variables in the path regression analysis. The recommend sample size for pass analysis is a minimum of 10 subjects for each included variable (Kline, 1998). The research ethics committee of XXX approved the study. All participants received information about the research and provided written consent. Participation in the research was voluntary, and participants had the right to withdraw from the study anytime without penalty. Participants' confidentiality and privacy were maintained.

Instruments

The Acceptance of Illness Scale (AIS)

Illness acceptance was assessed using the AIS. The tool contains eight statements on the limitations imposed by an illness, lack of independence, the sense of dependence on others, and diminished self-esteem. Responses are scored on a five-point Likert scale ranging from one (strongly agree) to five (strongly disagree). The total score ranges from 8 to 40, with higher scores indicating greater acceptance of illness (Felton et al., 2009); scores between 8 and 19 designate no acceptance or low acceptance of illness, between 20 and 30 moderate acceptance, and above 30 high or full acceptance (Bień et al., 2016). The validity and reliability of the Persian version of the questionnaire have been demonstrated with content validity ratio (CVR) of 0.95, content validity index of 0.92, and Cronbach's α of 0.84 (Baneh et al., 2018).

The Medication Adherence Report Scale (MARS-10)

Adherence to medication regimen was measured by the MARS-10. The tool assesses the individual's thoughts and behaviors about their medications over the preceding week. It contains ten items; each item requires a Yes or No answer. Items 1, 2, 3, 4, 5, 6, 9, and 10 are scored

reversely. The total score ranges between 0 and 10, with higher scores indicating greater medication adherence. Individuals with a total score between 0 and 5 are categorized as 'non-compliant' and between 6 and 10 as 'compliant.' The validity and reliability of the Persian version of the scale have been confirmed on patients with bipolar disorders, with Cronbach's α of 82% (Javadpour et al., 2013).

The Minnesota Living with Heart Failure Questionnaire (MLHFQ)

The health-related quality of life of participants was measured by the MLHFQ. This questionnaire was designed by Rector in 1987, specifically for patients with HF. The questionnaire contains 21 items addressing physical, socioeconomic, and emotional/psychological aspects of living with HF. Each item is graded on a six-point Likert scale ranging from 0 (none) to 5 (very much). The total score ranges between 0 and 105, with higher scores representing lower HRQoL (Rector, 2005). Behlouli et al. (2009) suggested that in patients with HF, a total MLHFQ score of <24, 24-45, and >45 be considered as good, moderate, and low HRQoL respectively (24). The MLHFQ is a valid and reliable scale internationally (Mogle et al., 2017) and for Iranian patients with Cronbach's α of 0.90, 0.84, and 0.92 for the Physical and emotional domain respectively (Moghadam et al., 2019).

The sociodemographic and clinical characteristics were gathered using a researcher-developed questionnaire. Data collection was carried out during participants' hospital stay. The day of data collected varied depending on the patient's health status and availability.

Data analysis

The research data were analyzed using STATA (version 14.0). The path analysis was performed to explore factors that affect the HRQoL of HF patients and their magnitudes (direct, indirect,

and total effects). The regression or path coefficients were all in a standardized form. The path was considered significant at $p < 0.05$. The researchers used chi-square/df of ≤ 2 , $p > 0.05$, comparative fit index (CFI) of ≥ 0.95 , Tucker-Lewis Index ≥ 0.95 , and the root mean square error approximation (RMSEA) of < 0.06 (Fabrigar et al., 1999) to evaluate the model fit.

Variables entered into the path model included sociodemographic variables, behavioral, and clinical factors. Based on the available theoretical and empirical evidence, the hypothesized relationships between these variables are demonstrated in Figure 1. The figures illustrates that medication is affected by the patients' acceptance of illness and affects HRQoL the quality of the patients. The patients' acceptance of disease and adherence to medications are affected by some sociodemographic factors and clinical characteristics.

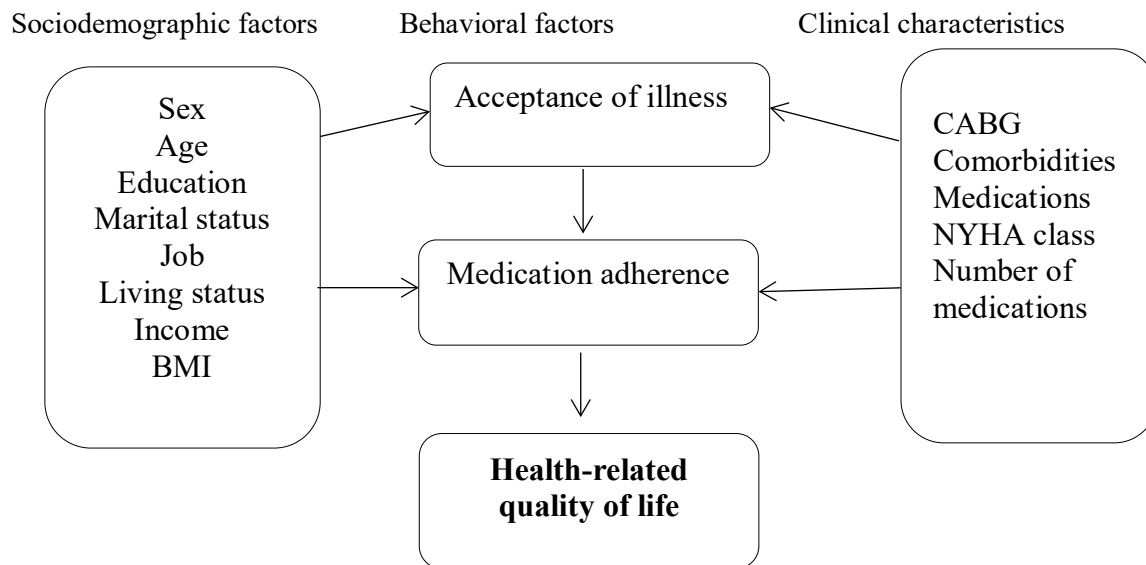


Figure 1. The hypothesized relationships between sociodemographic, behavioral, and clinical factors and health-related quality of life of patients with HF

Results

Participants' demographic and clinical characteristics were demonstrated in Table 1.

Table 1: Sociodemographic and clinical characteristic of the participants (n=273)

	Variable	Number(percent)
Sex	Male	134(49.1)
	Female	139(50.9)
Age	<65	125(46)
	>65	147(54)
Marital status	Single	197(53.19)
	Married	8(35.87)
	Widow	68(57.72)
Education level	Illiterate	135(49.45)
	Primary	66(24.18)
	Diploma	55(20.14)
	Associate and higher	17(6.22)
Job	Housewife	113(41.4)
	Employed	25(9.2)
	Unemployed	5(1.8)
	Others (Retired, ...)	130(47.6)
Living status	Alone	33(12.13)
	With spouse	97(35.66)
	With spouse & children	102(37.49)
	With children	40(14.7)
Income	Income < Expenses	127(46.52)
	Income = Expenses	137(50.18)

	Income > Expenses	9(3.3)
CABG	Yes	127(46.52)
	No	146(53.48)
Comorbidities	Hypertension	210(76.92)
	Diabetes	131(47.46)
	heart attack	118(43.22)
	Coronary artery disease	127(46.52)
	Pulmonary diseases	76(27.83)
	Gastrointestinal diseases	13(4.76)
	Liver disease	13(4.76)
	Endocrine diseases	12(4.39)
	Brain disease	21(7.69)
	Musculoskeletal diseases	11(4.03)
	Blood disorders	5(1.83)
	Other cases	51(18.68)
	Regular medications	Beta-blockers
Diuretics		213(78.02)
Digitalis		98(35.89)
Anticoagulants		198(72.52)
Calcium channel blockers		33(12.08)
Angiotensin-converting enzyme inhibitors (ACEIs)		154(56.41)
Other medications		132(48.35)
Number of medications	≤3	116(42.5)
	4-7	154(56.4)

	>7	3(1.05)
	<18.5	7(2.6)
BMI	18.5-24.9	68(24.9)
	25-29.9	100(36.6)
	≥30	98(35.9)
	≤30	162(59.4)
EF	31-50	111(40.6)
	<5 years	101(37)
Duration of the disease	5-9 years	71(26)
	10-19 years	66(24)
	20 years and above	35(13)
	2	9(3.3)
	3	133(48.7)
NYHA	4	109(39.9)
	Missing	22(8.1)

The mean participants' age was 64.81±14.0 years, slightly more than half were female (51.92%), illiterate (49.45%), and 12.13% were living alone. They mainly were urban dwellers (81.68%), 41.4% were housewives, and slightly more than half (51.8%) reported their income as not adequate. In terms of medical history, 46.52% had a history of CABG. The most commonly reported comorbidity was hypertension (76.92%), and diuretic was the most commonly taken medication (78.02%). The classifications of participants based on their acceptance of illness, medication adherence, and HRQoL are presented in Table 2. Half of the participants (50%) had

moderate, 25.6% high, and 23.4% poor acceptance of illness. Only 23.1% of participants were compliant with their medication regimen, and most participants (71.8%) had poor HRQoL.

Table 2. The mean (SD) scores of acceptance of illness, medication adherence, and health-related quality of life (n=273)

Variable	Score	Category	N (%)	Mean(SD)
The AIS	8-19	Poor acceptance	64(23.4%)	24.09(6.79)
	20-30	moderate acceptance	139(50%)	
	>30	High acceptance	70(25.6%)	
The MARS-10	0-5	Noncompliance	210(76.9%)	3.44(3.15)
	6-10	Compliance	63(23.1%)	
The MLHFQ	<24	Good	20(7.3%)	53.81(17.99)
	24-45	Moderate	57(20.9%)	
	>45	Low	196(71.8%)	

The direct, indirect, and total effects of sociodemographic, behavioral, and clinical factors on participants' HRQoL are shown in Table 3. None of the sociodemographic and clinical factors had direct effects on HRQoL; however, different degrees of indirect effects were observed from these factors. Medication adherence had a direct effect on HRQoL, while illness acceptance affected HRQoL both directly and indirectly. Figure 2 illustrates the standardized path coefficients for the hypothesized model. Only statistically significant paths for the total effects ($p<0.05$) were presented. The path diagram demonstrates the interactions among the variables. Acceptance of illness showed statistically significant direct and indirect effects on HRQoL, meaning that participants with a lower level of illness acceptance were more likely to have

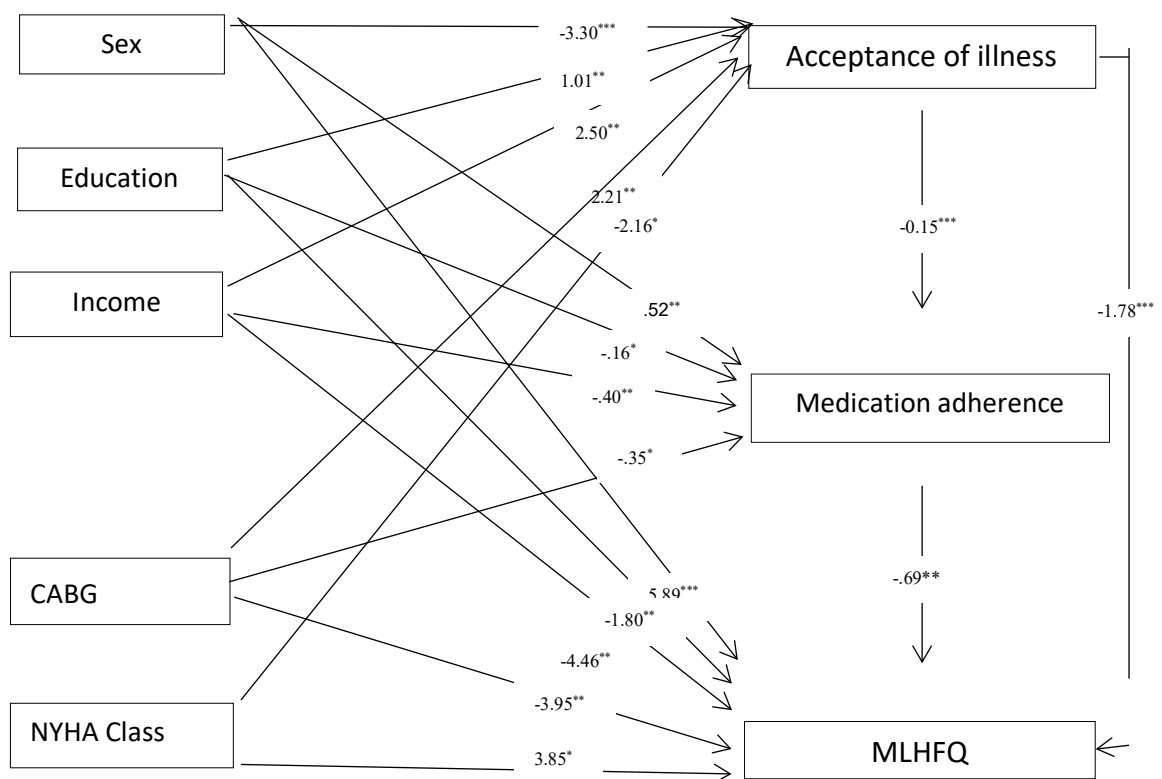
poorer HRQoL. Poor illness acceptance also affected patients' HRQoL indirectly via influencing patients' adherence to their medications.

Table 3. The standardized direct, indirect, and total effects of different sociodemographic, behavioral, and clinical factors on MLHFQ scores (n=273)

Variables	Direct effects	Indirect effects	Total effects	p-values
Sex (man: reference)	0	5.89	5.89	0.00
Age	0	-0.02	-0.02	0.62
Education	0	-1.80	-1.80	0.00
Marital status (Married: reference)				
Single	0	-8.44	-8.44	0.05
Widowed	0	-0.14	-0.14	0.93
Living status	0	1.76	1.76	0.37
Income	0	-4.46	-4.46	0.00
Job (employed: reference)				
Housewife	0	0.12	0.12	0.54
unemployed	0	0.1	0.1	0.06
Others (Retired, ...)	0	3.4	3.4	0.40
BMI	0	0.22	0.22	0.14
The AIS	-1.89	0.11	-1.78	0.00
CABG	0	-3.95	-3.95	0.00
Comorbidities	0	1.21	1.21	0.80
Medications	0	-2.14	-2.14	0.76
NYHA class	0	3.85	3.85	0.04
EF	0	0.14	0.14	0.14

Number of medications	0	0.00	0.00	0.425
The MARS-10	-0.69	0.00	-0.69	0.022

Medication adherence showed a statistically significant direct effect on HRQoL, indicating that lower medication adherence adversely affected patients' HRQoL. Likewise, female gender ($\beta = 5.89$), low level of education ($\beta = -1.80$), low income ($\beta = -4.46$), no history of CABG ($\beta = -3.95$), and higher NYHA class ($\beta = 3.85$) adversely affected patients' HRQoL.



* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 2. Path analysis diagram

The summary of the final model fit statistics was presented in Table 4. With RMSEA of less than 0.08, standardized root mean square residual (SRMR) of 0.031, CFI above 0.90, and the relative chi-square of 1.70, the final path model showed a good fit for the data.

Table 4. Summary of final model fit statistics

Model fit index	Value
χ^2	47.64
$\frac{\chi^2}{df}$	1.70
CFI	0.92
RMSEA	0.05
90% CI	0.02- 0.08
SRMR	0.031

χ^2 Chi-square test; df degree of freedom; CFI comparative fit index; RMSEA root mean square error of approximation; CI confidence intervals; SRMR standardized root mean square residual

Discussion

Patients with HF commonly experience diminished quality of life because of multiple factors, including disease symptoms, disease complications, and the side effects of treatments (Audi et al., 2017; Seto et al., 2011). HRQoL is an important patient and disease outcome; it is a predictor of cardiac events and survival/ death in people with HF (Audi et al., 2017; Kim et al., 2019). In addition, maintaining a quality life is as important as survival for most patients with HF (Iqbal et al., 2010). Therefore, understanding factors that disturb the quality of life in patients with HF is important.

This is the first study that addressed the associations between medication adherence, acceptance of illness, and quality of life of patients with HF in a single study. Path analysis allowed the researchers to understand the interactions between multiple factors better and map the direct and indirect pathways through which different sociodemographic, clinical, and behavioral factors affected the HRQoL of the patients. Overall, participants in our study had poor HRQoL, a finding that is consistent with the previous research (Audi et al., 2017; Seto et al., 2011). Factors that adversely affected the HRQoL of the participants included: female sex, lower education, low income, high NYHA class, nonadherence to medications, and low acceptance of illness while having a history of CABG positively affected this outcome. These findings align with the results of previous studies that aimed to identify factors associated with HRQoL in HF (Iqbal et al., 2010; Kim et al., 2019; Lindquist et al., 2003). The association between age and HRQoL was non-significant; this finding is also consistent with the past research. A systematic review by Moradi et al. (Moradi et al., 2020) found that although some dimensions of quality of life are more disrupted in elderly patients with HF, age is not associated with the overall quality of life. Understanding the factors that affect HRQoL of patients with HF is important to help health professionals identify patients who need extra support to maintain or improve their quality of life. In our study, female patients, those with lower education, lower income, and those with high NYHA class, lack of previous CABG were more likely to have impaired HRQoL. These patients' HRQoL was also indirectly affected via poor medication adherence and acceptance of illness. Medication adherence and acceptance of illness are amenable to improvement and worth further discussion. A high proportion of participants in our study were non-adherent to their prescribed medication regimens (77%). Although this high non-adherence rate can be related to the fact that the setting for the participants was inpatient only, and readmission to hospital is

generally higher for non-adherent patients (Pallangyo et al., 2020; Sadiq et al., 2020), poor medication adherence is overall common in patients with HF (Al-Tamimi et al., 2021; Ruppap et al., 2016). Previous studies report various degrees of medication nonadherence among these patients. A review by Jia-Rong et al. (2008) found that using a self-reported assessment tool, between 5% and 54% of HF patients were non-compliant with their medication regimen; the rates ranged from 2% to 90% when the pharmacy refill measure was used (Wu et al., 2008). Differences in the assessment tools, the self-report nature of the assessments, and variances in participants' demographic characteristics can explain the differences in medication adherence across the studies.

In this study, medication adherence directly affected the HRQoL of the participants, meaning that patients who failed to adhere to their medication regimens were more likely to suffer from a poor HRQoL. This finding supports previous research (Silavanich et al., 2019) and is conceivable given the significant health benefits associated with medication adherence, such as improved HF symptoms, daily functioning, and cardiac event-free survival (Ruppap et al., 2016; Wu & Moser, 2018). Despite the established benefits, the full benefits of medications are not often realized, as adherence to medication regimens is less than 50% in people with chronic diseases. Therefore, interventions that aim to improve medication adherence need to consider all these factors to overcome the complexity of medication nonadherence (Al-Ganmi et al., 2020).

Participants in our study showed a moderate level of illness acceptance (the mean AIS score of 24.09 ± 6.79), and about one out of four participants failed to accept their illness. In general, the concept of illness acceptance has not been adequately studied in HF populations. Similar to our results, Obeiglo et al. (Obeiglo et al., 2016) reported a moderate level of illness acceptance among HF patients. The acceptance of illness was statistically significantly associated with the

HRQoL in our study, which is also compatible with the findings of Obeiglo et al.'s (Obiegło et al., 2016), who reported that illness acceptance was the only independent predictor of quality of life in HF. The association between illness acceptance and HRQoL has also been demonstrated in patients with other chronic conditions (Chabowski et al., 2017; Juzwiszyn et al., 2020). This may be because patients who accept their illness have less negative emotions about their disease and can therefore better participate in the treatment course and self-care activities (Wu et al., 2008), leading to better control of their disease symptoms, improved functionality, and rehospitalization rates (Wu & Moser, 2018; Wu et al., 2008).

This research was conducted in a single center, although it was a tertiary referral hospital, which may affect the generalizability of the results. The higher rate of medication non-adherence, and lower acceptance of illness and HRQoL in our study can be related to the study setting which was inpatient only. Future studies should include both inpatient and outpatient settings to more accurately assess medication adherence rate, illness acceptance, and quality of life in patients with HF. The study used mostly self-reported data, including medication adherence, this can affect the accuracy of the collected data. Finally, our data were lacking on factors such as depression, anxiety, social support, physical activity, functional status, and the number of hospital readmissions. Future research is recommended to comprehensively examine factors impacting the HRQoL of patients with HF. Also, further research is needed to examine the possibility of improving the HRQoL of HF patients through modifying factors, such as medication adherence and acceptance of illness. For example, assessing and discussing medication adherence in patients' regular check-ups. Different individual, cultural, care provider, and health care system factors that affect HF patients' medication adherence and illness acceptance need further investigation.

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