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Adherence to Guideline-Directed Medical Therapy and its Impact on Clinical Outcomes in Heart Failure Patients Admitted to a Teaching Hospital

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Abstract

Background: Adherence to guideline-directed medical therapy (GDMT) remains suboptimal among heart failure (HF) patients despite proven benefits in reducing mortality and hospitalizations. Data on adherence patterns and their clinical impact in Middle Eastern settings remain limited. ***Objective***: To evaluate adherence to GDMT among HF patients at Shar Teaching Hospital, Sulaimani; identify sociodemographic correlates; and assess associations with short-term clinical outcomes, including NYHA class, hospitalizations, and quality of life. ***Methods***: This prospective observational study enrolled 140 adult patients with HFrEF (diagnosed >3 months) at Shar Teaching Hospital cardiology wards/outpatient clinics (April–December 2025). Adherence was assessed using the validated 8-item Morisky Medication Adherence Scale (MMAS-8), categorizing patients as low (<6), medium (6–<8), or high adherence. Sociodemographic/clinical data were collected via structured interviews and medical record review. ***Results***: Low adherence predominated (81.43%, n=114), with medium (12.86%, n=18) and high adherence (5.71%, n=8) less common (p<0.001). Higher adherence correlated with older age (p=0.009) and being male (p=0.037). Key non-adherence barriers included lack of understanding (24.24%), cost (23.48%), and regimen complexity (21.21%). After GDMT optimization/adherence counseling, significant NYHA class improvement occurred (p<0.001), HF-related 3-month hospitalization was low (10.71%), and quality of life improved in 70.71%. ***Conclusions***: Alarmingly high low-adherence rates exist among HF patients in this setting, though older age and being male predict better adherence. Higher adherence, supported by GDMT optimization and counseling, was associated with better NYHA class, fewer hospitalizations, and improved quality of life.

Keywords: Guideline-directed medical therapy; Heart failure; Medication adherence; Morisky scale.

الالتزام بالعلاج الطبي الموجه للإرشادات وتأثيره على النتائج السريرية لدى مرضى عجز القلب الذين تم إدخالهم إلى مستشفى تعليمي

الخلاصة

الخلفية: لا يزال الالتزام بالعلاج الطبي الموجه وفقا للإرشادات (GDMT) غير مثالي بين مرضى عجز القلب (HF) رغم الفوائد المثبتة في تقليل الوفيات ودخول المستشفى. لا تزال البيانات حول أنماط الالتزام وتأثيرها السريري في بيئات الشرق الأوسط محدودة. **الهدف**: تقييم الالتزام ب GDMT بين مرضى HF في مستشفى شار التعليمي في السليمانية؛ تحديد الارتباطات الاجتماعية الديموغرافية؛ وتقييم الارتباطات مع النتائج السريرية قصيرة الأمد، بما في ذلك فئة NYHA، وحالات الاستشفاء، وجودة الحياة. **الطرائق**: شملت هذه الدراسة الرصدية 140 مريضا بالغا مصابين ب HFrEF (تم تشخيصهم >3 أشهر) في أجنحة/عيادات القلب في مستشفى شار التعليمي (أبريل–ديسمبر 2025). تم تقييم الالتزام باستخدام مقياس موريسكي للالتزام الدوائي المكون من 8 بنود (MMAS-8) المعتمد، حيث صنف المرضى إلى منخفض (<6)، متوسط (6–<8)، أو عالي. تم جمع بيانات اجتماعية ديموغرافية/سريرية من خلال مقابلات منظمة ومراجعة السجلات الطبية. **النتائج**: كان الالتزام المنخفض هو السائد (81.43٪)، مع الالتزام المتوسط (12.86٪) والعالي (5.71٪) أقل شيوعا (p<0.001). ارتبط التزام أعلى بالتقدم في العمر (p=0.009) وكون المريض ذكرا (p=0.037). شملت الحواجز الرئيسية لعدم الالتزام عدم الفهم (24.24٪)، التكلفة (23.48٪)، وتعقيد النظام (21.21٪). بعد استشارات تحسين والالتزام ب GDMT، حدث تحسن ملحوظ في فئة NYHA، وكان الاستشفاء المرتبط ب HF لمدة 3 أشهر منخفضا (10.71٪)، وتحسن جودة الحياة بنسبة 70.71٪. **الاستنتاجات**: هناك معدلات منخفضة ومرتفعة بشكل مقلق بين مرضى HF في هذا السياق، رغم أن العمر الأكبر وكونهم ذكورا يعبر عن التزام أفضل. ارتبط الالتزام الأعلى، المدعوم بتحسين GDMT والاستشارات، بتحسن فئة NYHA، وتقليل فترة الاستشفاء، وتحسين جودة الحياة.

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INTRODUCTION

Heart failure (HF) is a chronic, high-hospitalization burden of disease and one of the most common conditions we face internationally [1,2]. A condition characterized by an impaired ability of the heart to pump enough blood into the systemic circulation, with several risk factors identified, including smoking, hypertension, alcohol consumption, and a suspected previous history of heart disease [3]. The American College of Cardiology/American Heart Association and European Society of Cardiology guidelines highlight the impact of adherence to medication on heart failure morbidity and death [4]. There are easily available treatment options (behavioral, medicinal, or technological) that can dramatically improve clinical outcomes (symptom control, exercise capacity, and the chances of hospitalization or death) [5]. Patient non-adherence to drugs continues to be one of the most prominent challenges to the effectiveness of medications, leading to less-than-optimal results and a greater burden on the patient and healthcare system [5]. Adherence is a research-encoded abstract that measures how well patients take their prescribed medication relative to a metric. It also has a wider meaning, as expressed in a World Health Organization (WHO) report, which expresses adherence as the level to which a person's behavior agrees with the

endorsements made by professional healthcare, e.g., medication intake, diet, and lifestyle change [6]. Beyond the medical and financial problems, drug adherence is a major matter in the Middle East, with the non-adherence rate extending from 1.4% to 88%, relying upon the nation and the sort of illness [7,8]. Factors include social aspects that promote distrust in modern medicine, differences in the quality of the health care system, financial factors like the cost of medications and coverage systems, and a lack of patient information about the importance of treatment compliance. Forgetfulness, side effects, and trouble understanding the regimen were pointed out as major reasons for non-adherence in some studies [9]. The present study was conducted to evaluate GDMT among patients with HF admitted to Shar Teaching Hospital in Sulaimani and to determine how varying adherence levels relate to short-term clinical outcomes. It specifically aimed to quantify the proportions of patients with low, medium, and high adherence to GDMT; to identify sociodemographic and clinical factors associated with these adherence categories; and to study the association between adherence patterns and subsequent changes in NYHA functional class, heart failure–related hospitalizations, and patient-reported QOL over a 3-month follow-up period.

METHODS

Study design and setting

This prospective observational study was conducted at the cardiology wards of Shar Teaching Hospital, Sulaimani, Kurdistan Regional Governorate, Iraq. Over 9 months (April–December 2025), a total of 140 patients with HF were enrolled and assessed for GDMT and its association with short-term clinical outcomes among the patients.

Sample size calculation

The required sample size was determined using Cochran's formula for proportions ($n=Z^2 \cdot P(1-P)/E^2$). With a confidence level of 95% ($Z=1.96$), an estimated incidence of non-adherence of 10% ($p=0.10$), and a margin of error of 5% ($E=0.05$), the calculated sample size was 138. To ensure adequacy, this figure was rounded to 140 patients, thereby providing sufficient precision to detect adherence proportions with 95% confidence and ±5% accuracy.

Data collection procedure

Specific patients meeting eligibility criteria were identified from admission logs and cardiology clinic schedules and approached by a trained investigator who described the study to the potential participants in Kurdish or Arabic and enrolled them only after obtaining written informed consent. They were told that participation was voluntary and did not adversely affect their care if they declined to enter the study or withdrew from it. A standardized, timed (approx. 15–20 min) interviewer/administered questionnaire was used at the bedside or in outpatient clinics to collect data; medical records were also reviewed, and clinical variables (HF diagnosis, NYHA class, comorbidities, and most recent hospitalizations) were cross-checked with their patients' charts for mitigation of errors. Medicine adherence was evaluated using the 8-item MMAS-8 [3], a validated self-report tool for long-term pharmacotherapy that examines forgetfulness, intentional and unintentional missed doses, perceived burden of the regimen, and struggle to memorize to take medicines. According to the MMAS-8 total score, patients with high adherence (score of 8), medium adherence (score 6 to <8), and low adherence (score <6) were defined. The study population consisted of adult HF patients with reduced ejection fraction (HFrEF) who were receiving GDMT. Patients were included if they were aged 18 years or older, had a documented diagnosis of HFrEF for more than 3 months, and had been prescribed GDMT (including beta blocker, ACEI/ARB/ARNI, SGLT2 inhibitor, or mineralocorticoid receptor antagonist) for longer than 3 months. In addition, eligible patients had to be admitted to or attending follow-up at Shar Teaching Hospital during the study period and be able to provide informed consent and participate in the interview. Conversely, patients were excluded when they were younger than 18 years, had newly diagnosed HF of 3 months' duration or less, or had been on HF pharmacotherapy for less than 3 months. Furthermore, those with severe cognitive impairment, acute critical illness, or communication barriers that precluded reliable interviewing or informed consent were not enrolled. Finally, any patient who declined participation or subsequently withdrew consent at any stage was also excluded from the study. Adherence counseling and GDMT optimization were provided by clinical pharmacists as part of routine care. Sessions lasted about 10 minutes at the bedside or clinic, focusing on medication purpose, dosing, and common barriers. Optimization involved pharmacist-guided adjustments in line with guideline recommendations, coordinated with physicians.

Clinical outcome

Short-term clinical outcomes in relation to GDMT adherence were evaluated, using variables aligned with the main study endpoints and results tables. Clinical status was assessed through HF-related hospitalizations during the previous 3 months (yes/no and number of admissions), emergency department visits for HF symptoms in the previous 6 months, and change in NYHA functional class about 3 months after GDMT, categorized as improved, unchanged, or worsened according to the standard NYHA classification. Patient-reported outcomes also included the perceived symptomatic response to GDMT (very much improved, much improved, no change, or worse), HF-related hospitalizations despite [reported adherence] to recommended doses of GDMT, and the change in reduced QOL from before the initiation of GDMT (better vs. no better). Quality of life was assessed using a single patient-reported item: "How would you rate your current quality of life

compared to before starting GDMT?" with response options of "unchanged" or "improved." Improvement was defined as selecting "improved." Regular follow-up by cardiologists (yes/no) was obtained as a measure of continuity of specialist care and was analyzed along with comorbidities and adherence patterns.

Ethical considerations

The Medical Research Scientific and Ethics Committee of the Kurdistan Higher Council of Medical Specialties approved the study protocol (Approval ID: 1558, dated 05/05/2025).

Statistical analysis

Data analyses were performed with SPSS 27. The categorical variables were summarized as frequency rates and percentages n(%). Constant variables were expressed as mean ± SD and 95% confidence intervals (95% CI). Continuous variables were measured for normality using the Kolmogorov–Smirnov and Shapiro–Wilk tests. Based on these findings, between-group differences in continuous variables were compared using either the Kruskal–Wallis test or the Mann–Whitney U test where appropriate, and associations in categorical variables were tested using the chi-square test, with a two-sided p value ≤ 0.05 considered significant.

RESULTS

As shown in Table 1, a total of 140 patients with HF were included in the analysis. Low adherence was observed in 114 patients (81.43%), whereas 18 (12.86%) and 8 (5.71%) patients demonstrated medium and high adherence to GDMT, respectively.

Table 1: Sociodemographic characteristics of HF patients according to GDMT adherence level

Sociodemographic character	Low adherent n= 114 (81.40)	Medium adherent n= 18 (12.80)	High adherent n= 8 (5.70)	Total n= 140 (100.00)	*p*-value
Age					
95% CI	68.24-71.36	69.54 - 78.46	71.16-87.84	69.41-72.38	0.009
Mean±SD	69.80±8.41	74.00±8.97	79.50±9.97	70.89±8.88	
<75 (non-elderly)	80(70.18)	9(50)	2(25)	91(65)	0.013
≥75 (Elderly)	34(29.82)	9(50)	6(75)	49(35)	
Gender					
Female	47(41.23)	2(11.11)	2 (25)	51(36.43)	0.037
Male	67(58.77)	16(88.89)	6 (75)	89(63.57)	
Marital state					
Single	3(2.63)	0(0.0)	1(12.5)	4(2.86)	0.199
Married	111(97.37)	18(100)	7(87.5)	136(97.14)	
Occupation					
Employed	3(2.63)	1(5.56)	0(0.0)	4(2.86)	
Non-employed	107(93.86)	16(88.89)	7(87.5)	130(92.86)	0.688
Retired	4(3.51)	1(5.56)	1(12.5)	6(4.29)	
Educational level					
No formal education	60(52.63)	9(50)	5(62.5)	74(52.86)	
Primary	47(41.23)	8(44.44)	3(37.5)	58(41.43)	0.947
Secondary	7(6.14)	1(5.56)	0(0.0)	8(5.71)	
Smoking status					
Current smoker	7(6.14)	3(16.67)	1(12.5)	11(7.86)	
Former smoker	59(51.75)	13(72.22)	5(62.5)	77(55)	0.090
Non-smoker	48(42.11)	2(11.11)	2(25)	52(37.14)	
Residency					
Inside city	46(40.35)	5(27.78)	1(12.5)	52(37.14)	0.196
Outside city	68(59.65)	13(72.22)	7(87.5)	88(62.86)	

Values are presented as frequency and percentage and mean±SD. CI: confidence interval; n: number; Age (continuous variable) was analyzed using the Kruskal–Wallis test, and categorical variables were compared using the chi-square test.

When stratified by adherence level, the mean age was 69.80 ± 8.41 years (95% CI: 68.24–71.36) in the low adherence group, 74.00 ± 8.97 years (95% CI: 69.54–78.46) in the medium adherence group, and 79.50 ± 9.97 years (95% CI: 71.16–87.84) in the high adherence group, with a significant variance across categories (p= 0.009). The low adherence group included 29.82% elderly patients (≥75 years), compared with 50.00% for the medium adherence group and 75.0% for the high adherence group, meaning age was significantly associated with adherence level (p= 0.013). Females included 41.23% of the low-adherence group, while the medium-adherence group contained only 11.11% of the females; on the other hand, 25.0% of the high-adherence group were female. In the low adherence group, 58.77% were male; in the medium adherence group, 88.89% were male; and in the high adherence group, 75.00% were male, and the difference among groups was significant (p= 0.037). Marital status did not significantly differ across adherence categories (p= 0.199), as the vast majority of patients in all groups were married, comprising 97.37% of the low adherence, 100% of the medium adherence, and 87.50% of the high adherence groups. Employment status also showed no significant variation (p = 0.688); most patients were non-employed, representing 93.86%, 88.89%, and 87.50% of the low, medium, and high adherence groups, respectively, while employed and retired patients formed only a small proportion in each category. Adherence status was not significantly correlated with educational level. Patients with no formal education represented 52.63% of the low-adherence group, 50.00% of the medium-adherence group, and 62.5% of the high-adherence group; primary education was observed in

41.23%, 44.44%, and only 37.5%, whereas only a few of the patients had secondary education. Similarly, the smoking status did not differ significantly between levels of adherence. More than half of the former smokers were in the low-adherence group (51.75%), while 22.22% and 62.50% were from the medium-adherence and high-adherence groups, respectively. On the other hand, current smokers and those who did not smoke were all under one-third of the total adherence level. Table 1 showed that there was no significant association between residence and adherence. Patients who resided outside the city were 59.65% of the low-adherence group, 72.22% of the medium-adherence group, and 87.50% of the high-adherence group. However, patients who resided in the city were about 40.35%, 27.78%, and only 12.50%, respectively. Table 2 showed that hypertension in combination with at least one additional comorbidity was highly prevalent, affecting 85.71% (n= 120) of patients, whereas isolated hypertension was documented in 14.29% (n= 20).

Table 2: Clinical comorbidities, GDMT non-adherence patterns, and short-term heart failure outcomes among the study patients

Comorbidities, GDMT Non-Adherence, and Clinical Outcomes	n(%)
Comorbidity	
HTN alone	20(14.29)
HTN with other	120(85.71)
Missing prescribed GDMT medication	
Never	21(15)
Rarely (1–2 times/month)	67(47.86)
Occasionally (1–2 times/week)	52(37.14)
Main reasons for GDMT non-adherence	
Complexity of regimen	28(21.21)
Cost of medication	31(23.48)
Forgetfulness	18(13.64)
Lack of understanding	32(24.24)
Side effects	23(17.42)
Symptom improvement with GDMT adherence	
No change	1.0(0.71)
Moderate improvement	31(22.14)
Significant improvement	108(77.14)
Heart failure–related hospitalization in the three months after adherence counselling	
No hospitalized	125(89.29)
Hospitalized	15(10.71)
Current QOL now vs before GDMT	
Unchanged	41(29.29)
Improved	99(70.71)

Values are presented as frequency and percentage. n: number; HTN: hypertension; QOL: quality of life; GDMT: guideline-directed medical therapy.

Missing prescribed GDMT doses was common: only 15% (n= 21) reported never missing medication, while 47.86% (n= 67) missed doses rarely (1–2 times/month) and 37.14% (n= 52) missed doses occasionally (1–2 times/week). Among the reported determinants of GDMT non-adherence, lack of understanding of the treatment regimen was the most frequently cited factor, reported by 24.24% (n= 32) of patients, followed by medication cost in 23.48% (n= 31) and regimen complexity in 21.21% (n= 28). Patients could provide one primary reason for non-adherence (n= 132); high-adherence patients (n= 8) were excluded from this sub-analysis. Side effects and forgetfulness were also relevant contributors, reported by 17.42% (n= 23) and 13.64% (n= 18) of patients, respectively. Regarding perceived treatment response, 77.14% (n= 108) of patients described significant symptomatic improvement with GDMT, whereas 22.14% (n= 31) reported moderate improvement, and only 0.71% (n= 1) noted no change in symptoms. Among the short-term clinical outcomes, heart failure–related hospitalization could be seen within three months of adherence counseling in 10.71% (n= 15) and 89.29% (n= 125) patients did not require admission within this time period. 70.71% (n= 99) of patients reported QOL as improved compared to baseline, while 29.29% (n= 41) reported no change in QOL. At baseline, the functional profile was substantially comprised; 66.43% (n= 93) of the patients were NYHA class III, while 19.29% (n= 27) were class II. On the other hand, Class IV and I were 12.14% (n= 17) and 2.14% (n= 3), respectively. After three months of GDMT, the NYHA classes were significantly changed; the highest class was II (67.86%, n= 95), then I (20%, n= 28), followed by class III (9.29%, n= 13), whereas class IV reported only 2.86% (n= 4). This reclassification across NYHA categories over the follow-up period was statistically significant ($p< 0.001$), indicating an association between adherence counseling and better functional status (Table 3 and Figure 1).

Table 3: Change in NYHA functional class from baseline to 3-month follow-up after GDMT

NYHA classes	Follow up		*p*-value
	Baseline	After 3 months of GDMT	
I	3(2.14)	28(20)	<0.001
II	27(19.29)	95(67.86)	
III	93(66.43)	13(9.29)	
IV	17(12.14)	4(2.86)	

Values are presented as frequency and percentage. GDMT: guideline-directed medical therapy; NYHA: New York Heart Association. Significant difference, as determined by the Kruskal–Wallis test.

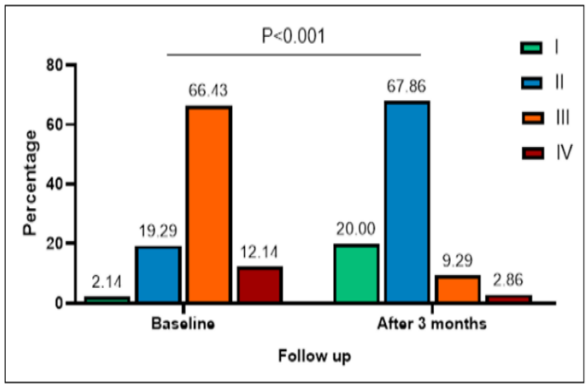

Figure 1: Modification of NYHA functional status after 3 months of guideline-directed medical therapy

Logistic regression analysis identified age group and gender as significant factors influencing medium and high adherence levels. Individuals aged 75 years and older were more likely to adhere compared to those under 75 years (OR= 0.312, 95% CI: 0.130–0.748, *p*= 0.009). Similarly, male patients exhibited greater adherence, whereas females had notably lower odds (OR= 0.259, 95% CI: 0.084–0.801, *p*= 0.019). Conversely, factors such as marital status, occupation, education, smoking status, and residence did not show a significant correlation with adherence (all p > 0.05). Although there was a trend of higher adherence among smokers (OR= 2.779), it did not achieve statistical significance (*p*= 0.127) (Table 4).

Table 4: Logistic Regression Analysis of Sociodemographic Predictors of Treatment Adherence

Sociodemographic character	*B*	*P*	OR (Exp(B))	95% CI
Age group (<75 years *vs*. ≥75 years)	1.166	0.009	0.312	0.130–0.748
Gender (female *vs*. male)	–1.35	0.019	0.259	0.084–0.801
Married vs Single	–0.392	0.739	0.676	0.067–6.769
Employed/Retired *vs*. Non-employed	0.547	0.444	1.728	0.426–7.018
Education (No *vs*. Yes)	0.049	0.911	1.05	0.447–2.467
Current *vs*. Non-smoker/ Formal smoker	1.022	0.127	2.779	0.749–10.314
Urban *vs*. Rural	–0.813	0.106	0.443	0.165–1.189

Values are presented as regression coefficients (B), p-values (P), odds ratios (OR), and 95% confidence intervals (CI). %: percentage; CI: confidence interval. Reference categories: age ≥75 years, male gender, single marital status, non-employed occupation, educated, non-smoker, and rural residence. Significant differences were determined by multivariable logistic regression analysis.

DISCUSSION

Cardiovascular diseases (CVDs), including heart failure (HF), are increasingly recognized as the primary cause of mortality and disability globally [10]. The WHO indicated that in 2008, of the 17.3 million global fatalities from cardiovascular disease, myocardial infarctions accounted for 7.3 million and strokes for 6.2 million [11]. Other serious consequences associated with poor adherence to medications include poorly controlled blood pressure, re-admission, and increased healthcare utilization [12]. This study aimed to assess adherence to GDMT among HF patients admitted to Shar Teaching Hospital in Sulaimani and explore how different levels of adherence correlate with short-term clinical outcomes. The data showed that low adherers represented 81.43%, while medium and high adherers only represented 12.86% and 5.71%, respectively, with a considerable gap between evidence-based guidelines providing medical therapy versus real-life use in clinical practice for HFrEF. Similarly, a study of 151 HF patients by Raffa *et al*. reported rates of medication adherence were low, medium, and high at 53.6%, 39.1%, and 7.3%, respectively, underscoring that non-optimal adherence with HF pharmacotherapy remains a widespread and longstanding issue in routine practice [6]. The results are supported by Omer et al. (2024), whose study reported non-adherence in 78.2% of hypertensive patients, who were divided into 18.4% partially adherent and only 3.4% fully adherent to antihypertensive drugs [13]. By contrast, a recent cross-sectional study in Jordan by Jarrah *et al*. (2023) found that only 21 (33.5%) of their HF patients attained high adherence, and on the whole, half of all participants experienced partial to poor adherence [14], which again emphasizes that many of the region's HF population do not adhere thoroughly enough to their regimens. Additionally, a systematic review specifically evaluating medication adherence among HF patients in Middle Eastern countries found inadequate medication adherence to be common among patients studied, and many studies reported a significant percentage of study participants with low or heterogeneous medication adherence; it identified key barriers such as socioeconomic-related factors, complexity of the regime, and limited health literacy as prominent contributors to poor medication adherence, which is very relevant given the study context [9]. We found that adherence to GDMT was significantly higher in older patients and increased progressively with GDMT adherence: the mean age of the low-adherence group (69.80 ± 8.41 years), medium (74 ± 8.97 years), and high-adherence group (79.50 ± 9.97 years). Elderly patients (≥ 75 years) were 75.07% in the high-adherence group compared with 29.82% in the low-adherence group, respectively. This phenomenon may be because older patients had a larger/more severe nuisance of symptoms to start, which often leads to better adherence by fostering treatment conviction, as older patients also usually have a longer disease duration, allowing for habit formation, and fewer work/family-related barriers compared to younger patients who may deny that they are sick or come across as lifestyle conflicted. Our findings are similar to previous reports. Raijmann *et al*. (2025) showed that elderly hospitalized patients with HF were significantly more likely to adhere to GDMT, both at hospital discharge and at 3-month follow-up [15]. In a similar vein, a systematic review by Tan *et al*. (2024) corroborated survival advantages of GDMT among elderly cohorts with significantly higher adherence rates when compared to their younger counterparts. Additional registry data further support that older age is positively associated with sustained GDMT use and

improved event-free survival [16]. Even some investigations have not shown an association between age and adherence [6,17-20]. These differences may be explained by differences in study design, populations evaluated, healthcare systems, and adherence assessment. This study also showed that there was a difference in sex regarding adherence; the majority of males belonged to medium (88.89%) and high-adherence groups (75%), while females were more represented in the low-adherence group (41.23%). This is because we know the reality of males complying more with better health care availability, home support networks, and less depression; females struggled with caregiving tasks, mental comorbidities, and increased side effects from medications (ACEI cough, etc.). This pattern squares with the work of Omer *et al*. (2024), who reported a much higher non-adherence rate (86.1%) in females compared to males (69.4%) (p= 0.0128) among HF patients [13]. Rezaei *et al*. and Sadeghiazar *et al*. are supplemented with caution for implementation in females, who may have poorer health literacy or higher illness denial rates. The results also suggest a need for gender-specific rethinking of strategies to aid with adherence in the management of heart failure [17,21]. Conversely, variables not significantly associated with adherence categories in our study were marital status, employment status, level of education, baseline smoking behavior status (i.e., never versus former/current), urbanization, and occupation. Consistent with prior reports. Alternatively, there were no significant associations identified by Raffa *et al*. between adherence and smoking, education, or place of residence. Such observations lead to the conclusion that other lifestyles or demographic variables may come out as potential predictors (of guideline-guided medicinal treatment adherence in heart failure) with weak and variable effects [6]. A high rate of multimorbidity was present in our cohort; 85.71% (n= 120) had hypertension comorbid with at least one other condition, and solely hypertension was seen in 14.29% (n= 20). This comorbidity burden is considerable and reflects the complexity of the clinical milieu in which GDMT adherence must be accomplished. This is consistent with previous evidence that found high rates of HF and multimorbidity (the coexistence of two or more chronic or long-term conditions) leading to a complex regimen, which may exacerbate poor adherence over time [22,23]. This study also demonstrates that the determinants of non-adherence are both cognitive and structural in nature, as self-reported by participants. The most commonly identified barriers were a lack of understanding of the prescribed treatment regimen, followed by medication cost and the complexity of the regimen. By comparison, side effects and forgetting to take therapy were reported less frequently as a reason for non-adherence, in line with previous studies reporting that cost barriers [24], lack of knowledge [25], and complex regimens [26] are important determinants of adherence in HF populations. Moreover, Raffaa *et al*. (2020) revealed that the main reason for poor adherence was forgetfulness to take the medication [6]. In this study, in the three months following adherence counseling, 10.71% (n= 15) of patients required heart failure–related hospitalization during the follow-up period available compared with 89.29% (n= 125) during this interval who did not [14]. The relatively low short-term admission rate is in the context of structured counseling and GDMT optimization and suggests that reinforcing adherence through systematic means, along with close/early follow-up, may help reduce near-term HF-related hospitalization utilization in this population. Additionally, QoL was also improved in the majority of patients, with 70.71% (n= 99) reporting an ameliorated QOL as compared to the pre-GDMT period and 29.29% (n= 41) stating no change in their QOL. Previous evidence supports this finding, indicating that poor adherence to therapies correlates with rehospitalization and increased healthcare resource utilization [12]. When it comes to hospitalization rates for patients with HF, adherence to GDMT is vital. Guideline-directed medical therapy is a crucial component to maintain physiological function, improve patient-reported QOL, and lower rates of hospitalization in heart failure [2]. Furthermore, the study conducted by Ruppar *et al*. (2016) showed that the improvement of symptoms, QOL, and reduced hospital readmissions was associated with superior compliance to GDMT [27]. The functional status in this cohort shifted significantly toward less severe categories of limitation after the initiation and optimization of GDMT (i.e., guideline-directed medical therapy). Most were previously assigned more severe NYHA classes, but subsequent reclassification was skewed toward lower classes with improved exercise tolerance and reduced burden of symptoms. This significant transition in patient class demonstrated the clinical implications of organized GDMT optimization and adherence confirmation. This marked improvement is in line with prior evidence reported by Savarese *et al*. (2025), which showed that not only did GDMT improve the rates of both mortality and hospitalization, but it also improved functional capacity and survival among patients with HF [28].

Study Limitations

Single-center study limitations include self-reported adherence measures susceptible to recall bias; inability to demonstrate causality; limited generalizability of results beyond inpatients at Shar Teaching Hospital; the short three-month follow-up period; and few patients (in the high-adherence group), leading to lower power for subgroup analyses. In addition, the high-adherence subgroup included only 8 patients (5.7%), which limits statistical power and reliability of subgroup comparisons. Finally, quality of life was assessed using a single self-reported item rather than a validated instrument, which may limit the robustness and generalizability of this outcome measure.

Conclusion

The results of the current study showed that low adherence to GDMT was high among the HF patients in a tertiary-care setting in Sulaimani; only a small percentage exhibited high adherence. Older age and being male were associated with better adherence, while the main barriers included multimorbidity, regimen complexity, cost, and knowledge gaps. Compliance optimization with GDMT and counseling was associated with favorable changes in NYHA functional class, lower short-term hospitalization rates, and improved QOL. While these associations are encouraging, the observational design precludes causal inference, and further controlled studies are warranted.

Recommendations

To enhance long-term outcomes in this population, we recommend routine screening for adherence barriers with standardized assessment (e.g., MMAS-8) and corresponding individualized patient-centered counseling, development of multilingual patient education programs specifically addressing the knowledge gaps in GDMT, cost subsidization programs to alleviate medication access issues, standardized post-discharge follow-up protocols at 1 and 3 months, and the conduct of multicenter prospective studies utilizing objective adherence assessment methods. Additionally, future studies must obtain serial blood pressure, BNP/NT-proBNP, troponin, eGFR, and electrolytes pre-GDMT and at 3 and 6 months thereafter for an objective assessment of adherence-related changes in cardiac remodeling and end-organ function, in addition to NYHA/QOL assessments.

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Conflict of interests

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Data sharing statement

The data that supports the findings of this study are available from the corresponding author upon a reasonable request.

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