

Investigating the Relationship between Cyberspace Dependence and Medication Adherence: The Mediating Role of Trans Diagnostic Constructs in Patients with Chronic Heart Failure

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ARTICLE INFO

Article type:
Original Article

Article history:
Received: 20 August 2026
Accepted: 04 October 2026

Keywords:
Heart Failure
Medication Adherence
Social Media

ABSTRACT

Introduction: The present study aimed to investigate the relationship between cyberspace dependence and medication adherence, considering the mediating role of trans diagnostic constructs in patients with chronic heart failure (CHF).

Methods: This descriptive-correlational study used structural equation modeling (SEM). The sample comprised 250 patients with chronic heart failure who were recruited through convenience sampling. Data were collected using the Intolerance of Uncertainty Scale (IUS-4), Acceptance and Action Questionnaire-II (AAQ-II), Mobile Social Networking Addiction Questionnaire, Morisky Medication Adherence Scale (MMAS-8), and Difficulties in Emotion Regulation Scale (DERS). Data were analyzed using Pearson correlation coefficients and SEM in SPSS and AMOS. Importantly, this instrument assesses medication-taking behavior only and was not used to measure the broader construct of heart-failure self-management.

Results: The structural model demonstrated an acceptable fit to the data ($\chi^2/df = 1.82$, RMSEA = 0.058, NFI = 0.94, CFI = 0.97, IFI = 0.97, GFI = 0.93, AGFI = 0.91). The direct, indirect, and total effects require completion from the original SEM output before submission; the current manuscript does not contain sufficient information to reconstruct the missing standardized coefficients, test statistics, p-values, or bootstrap confidence intervals.

Conclusion: The findings suggest that trans diagnostic constructs may help explain the association between cyberspace dependence and medication adherence among patients with chronic heart failure. Because the present study assessed medication adherence with the MMAS-8 rather than the broader construct of heart-failure self-management, conclusions should be limited to medication adherence.

► Cheraghcheshm, M., Akbarzadeh, M. Investigating the Relationship between Cyberspace Dependence and Medication Adherence: The Mediating Role of Trans Diagnostic Constructs in Patients with Chronic Heart Failure. *J Cardiothorac Med.* 2026; 14(3): 1742-1752. Doi : 10.22038/jctm.2026.98231.1539

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Introduction

Chronic Heart Failure (CHF) is recognized as a global healthcare challenge and an escalating silent epidemic. This complex clinical syndrome is characterized by cardinal somatic manifestations, including dyspnea, persistent fatigue, and peripheral edema, which collectively contribute to frequent hospital readmissions, progressive functional decline, marked impairment in health-related quality of life, and premature mortality (1). Epidemiologically, over 64 million individuals worldwide live with heart failure, a figure rising continuously due to population aging, improved survival rates following acute myocardial infarction, and the surging prevalence of major cardiovascular comorbidities such as hypertension and type 2 diabetes (2). In Iran, CHF imposes an equally severe epidemiological and economic burden, ranking among the primary causes of adult admissions to internal medicine and cardiology departments and incurring substantial healthcare costs (3).

However, effective CHF management extends considerably beyond routine biomedical and pharmacological interventions. Given the chronic and unpredictable trajectory of the disease, cardiac patients face severe and protracted psychosocial distress. Clinically meaningful depressive and anxiety symptoms are two to three times more prevalent among individuals with CHF than in the general population, directly compromising cardiovascular prognosis and survival (4). Consequently, addressing psychosocial determinants alongside standard medical care represents an essential paradigm in contemporary behavioral cardiology. Identifying the psychological barriers that undermine patient compliance is imperative for designing targeted, evidence-based interventions that mitigate disease burden and improve long-term clinical outcomes.

Within the broader spectrum of heart failure self-management, strict adherence to prescribed pharmacological regimens constitutes the single most decisive determinant of therapeutic efficacy (5). In chronic cardiovascular care, pharmacological adherence requires consistent, long-term behavioral execution to prevent acute

hemodynamic decompensation and maintain clinical stability. Rigorous adherence is empirically linked to reduced hospitalizations, decreased all-cause mortality, preserved ventricular function, and optimized functional capacity (6). Nevertheless, despite patients' general awareness of the vital importance of their prescriptions, clinical literature consistently demonstrates that medication adherence rates in CHF populations remain alarmingly suboptimal (7). This persistent discrepancy between declarative health knowledge and tangible behavioral execution indicates that non-adherence is not merely a consequence of educational deficits; rather, it is driven by complex underlying cognitive, emotional, and social regulatory mechanisms that govern decision-making and health behaviors.

To systematically capture these mechanisms, the trans diagnostic cognitive-behavioral framework offers a powerful paradigm by positing that shared, core psychological processes underpin and maintain diverse dysfunctional behaviors across medical and psychological conditions (8). CHF patients are routinely subjected to high-stress, ambiguous somatic sensations. Under such circumstances, elevated intolerance of uncertainty directly drives maladaptive illness management; patients who catastrophize ambiguous bodily sensations (e.g., transient mild dyspnea) frequently experience acute distress and display avoidant or erratic behaviors—such as emergency department overuse or arbitrary medication alterations—rather than following structured clinical protocols (8,9). Concurrently, diminished cognitive flexibility impedes a patient's capacity to adjust routines to complex multidrug schedules and behavioral restrictions (8,10). Furthermore, maladaptive emotion regulation fosters counterproductive coping responses (such as emotional suppression, dietary lapses, and social withdrawal) that exacerbate physical symptoms (11), while experiential avoidance reinforces non-adherence by prompting patients to evade treatment-related distress or somatic awareness (12).

Importantly, these psychological dynamics are deeply intertwined with the patient's modern social environment. In contemporary

healthcare contexts, cyberspace has evolved into a primary platform for interpersonal connection and health information. Although adaptive digital engagement can provide valuable peer support and experiential validation, pathological cyberspace dependence—characterized by compulsive engagement, tolerance, withdrawal, and functional interference—can precipitate real-world social alienation, relational conflict, cognitive overload, and exposure to medical misinformation (13). These adverse consequences erode patient self-regulatory stamina and disrupt daily treatment routines, thereby indirectly compromising medication compliance.

Despite the clinical prominence of these individual factors, empirical evidence regarding the structural pathways connecting modern digital dependencies, trans diagnostic cognitive-affective vulnerabilities, and treatment compliance in heart failure remains scarce. To address this conceptual gap and resolve ambiguities in behavioral measurement, the present study specifically operationalizes treatment compliance via the validated 8-Item Morisky Medication Adherence Scale (MMAS-8). Using structural equation modeling (SEM), this study aims to examine the direct relationship between cyberspace dependence and medication adherence, while evaluating the mediating and explanatory role of core trans diagnostic psychological constructs (intolerance of uncertainty, experiential avoidance, and emotion dysregulation) in this clinical relationship.

Methods

Study Design and Subjects

Sampling and Sample Size Determination

A purposive convenience sampling strategy was used to recruit eligible CHF patients from specialized outpatient cardiovascular centers. To rigorously determine and justify the adequate sample size for structural equation modeling (SEM), an a priori statistical power analysis was conducted using Soper's SEM Sample Size Calculator (Soper, 2024; Westland, 2010), in conjunction with the RMSEA-based test of close fit recommendations (MacCallum et al., 1996) (14-16).

The structural model comprised three latent variables (Cyberspace Dependence, Trans diagnostic Constructs, and Medication Adherence) with a total of 11 observed indicators (subscales/manifest variables). Setting the anticipated effect size at a conservative medium level, desired statistical power at $(1-\beta=0.80)$ and type I error rate at $\alpha=.05$ for a model with 38 degrees of freedom, the calculation indicated a minimum required sample size of $N=184$ to detect the specified effect and $N=129$ to test the overall model structure. Furthermore, adherence to the widely accepted heuristic guideline of 10 to 20 observations per observed indicator (Kline, 2023; Hair et al., 2019) indicated that a minimum of 110–220 participants would be statistically sufficient (17,18). Therefore, our enrolled sample size of $N=250$ provided excellent statistical power to detect both direct and indirect structural paths, mitigating the risk of Type II errors and ensuring parameter stability.

This quantitative study employed a descriptive-correlational design using structural equation modeling (SEM). The target population comprised patients with a verified clinical diagnosis of chronic heart failure attending specialized cardiology centers in Mashhad, Iran, during the second half of 1404 (2025–2026). A sample of 250 patients was recruited through convenience sampling. Participants were approached in outpatient clinics and tertiary cardiovascular healthcare facilities. The study protocol included an explanation of the study objectives, written informed consent, administration of self-report instruments, and protection of participant confidentiality.

Participants and Eligibility Criteria

The target population comprised outpatients with chronic heart failure (CHF) referred to specialized cardiology clinics. CHF was diagnosed by board-certified cardiologists based on the European Society of Cardiology (ESC) guidelines, confirmed by clinical presentations, medical history, and documented transthoracic echocardiography (TTE) within the preceding three months.

Inclusion Criteria:

1. Confirmed diagnosis of chronic heart failure for at least six months before

enrollment;

2. Documented left ventricular ejection fraction (LVEF) $\leq 40\%$ (Heart Failure with reduced Ejection Fraction, HFrEF) or 41–49% (Heart Failure with mildly reduced Ejection Fraction, HFmrEF);
3. Clinically stable condition with classified functional status of New York Heart Association (NYHA) functional class II or III;
4. Age ≥ 18 years;
5. Active ownership of a smartphone with regular access to the internet and mobile social networking platforms for at least six months before the study;
6. Being on an established, stable cardiovascular pharmacological regimen for at least one month.

Exclusion Criteria:

1. Presence of end-stage cardiac disease (NYHA functional class IV) or acute decompensated heart failure requiring intravenous inotropic support or imminent mechanical assist devices;
2. Major cognitive impairment or neurodegenerative disorders (screened via Mini-Mental State Examination, MMSE < 24) that could compromise reliable self-reporting;
3. History of severe active psychopathology (e.g., active psychosis, bipolar affective disorder, or severe substance use disorder) or acute suicidal ideation, verified by clinical records and brief psychiatric screening;
4. Severe life-threatening comorbidities (e.g., end-stage renal disease on hemodialysis, advanced malignant neoplasms);
5. Severe visual, auditory, or motor impairments precluding smartphone use and questionnaire completion.

Diagnosis and Clinical Evaluation of Chronic Heart Failure

The clinical diagnosis of Chronic Heart Failure (CHF) was confirmed by board-certified cardiologists in accordance with the established diagnostic criteria outlined in the 2021 European Society of Cardiology (ESC) Guidelines for the diagnosis and treatment of acute and chronic heart failure (19). Diagnostic verification required:

1. Documented cardinal symptoms (e.g., breathlessness, orthopnea, fatigue, ankle swelling) and clinical signs (e.g., elevated

jugular venous pressure, pulmonary crackles, peripheral edema);

2. Objective evidence of cardiac dysfunction verified via comprehensive two-dimensional transthoracic echocardiography (TTE) within the preceding three months, specifically assessing left ventricular ejection fraction (LVEF), ventricular volumes, and structural abnormalities;

3. Documented clinical stability on an established, guideline-directed medical therapy (GDMT) for a minimum of 3 months before enrollment.

Measures

• Intolerance of Uncertainty Scale (IUS-4):

Developed by Carleton et al (2007), this 4-item brief version evaluates the dispositional tendency to find uncertainty unacceptable. Items are scored on a 5-point Likert scale ranging from 1 (Not at all characteristic of me) to 5 (Entirely characteristic of me), yielding a total score between 4 and 20, with higher scores reflecting greater intolerance of uncertainty. The scale has a unifactorial structure without subscales. The psychometric properties of the original version are well-established (20). The Persian adaptation demonstrated good internal consistency with a Cronbach's alpha of 0.78 (21).

• Acceptance and Action Questionnaire-II (AAQ-2):

Developed by Bond et al. (2011), this 7-item unidimensional scale measures psychological inflexibility and experiential avoidance. Items are rated on a 7-point Likert scale ranging from 1 (Never true) to 7 (Always true), yielding total scores between 7 and 49. Higher scores indicate greater experiential avoidance and lower psychological flexibility. The psychometric adequacy of the scale has been widely supported (22). The Persian version, validated yielded a Cronbach's alpha of 0.84 (23).

• Mobile Social Networking Addiction Questionnaire:

Developed by Khajehahmadi et al. (2017), this 20-item scale measures dependence on mobile social networks across four dimensions: Tolerance, Withdrawal Symptoms, Social and Functional Impairment, and Excessive Use. Scoring is based on a 5-point Likert scale. The construct validity and reliability of the scale have been

confirmed in Iranian samples, with an overall Cronbach's alpha of 0.89 (24).

• **Morisky Medication Adherence Scale (MMAS-8):** Developed by Morisky et al. (2008), this 8-item instrument assesses medication-taking behaviors. Items 1 through 7 are scored dichotomously (Yes/No), while Item 8 is rated on a 5-point Likert scale (Never to Always). Total scores range from 0 to 8, categorized into high adherence (score of 8), medium adherence (scores 6–7), and low adherence (scores < 6). The scale has a single-factor structure. The psychometric reliability and validity of the original instrument are well-documented (25). The Persian adaptation, demonstrated acceptable internal consistency with a Cronbach's alpha of 0.79. Importantly, this instrument assesses medication-taking behavior only and was not used to measure the broader construct of heart-failure self-management (26).

• **Difficulties in Emotion Regulation Scale (DERS):** Developed by Gratz and Roemer (2004), this 36-item multidimensional scale evaluates emotional dysregulation across six subscales: Non-acceptance of Emotional Responses, Difficulties Engaging in Goal-Directed Behavior, Impulse Control Difficulties, Lack of Emotional Awareness, Limited Access to Emotion Regulation Strategies, and Lack of Emotional Clarity. Items are scored on a 5-point Likert scale. The original scale exhibits robust construct validity and reliability (27). The Persian validation, conducted by Besharat et al. (2011), reported an overall Cronbach's alpha of 0.86 (28).

Statistical Analysis

Data were analyzed using IBM SPSS Statistics (Version 26.0) and AMOS (Version 24.0). Descriptive statistics were calculated for participant characteristics and study variables. Pearson product-moment correlation coefficients were used to examine bivariate associations. SEM was then used to evaluate the hypothesized relationships and overall model fit. For mediation, bootstrap resampling was used to estimate the indirect effect and its confidence interval.

Author to Provide: Insert the exact number of bootstrap resamples (e.g., 5,000 if that was actually used), the confidence-interval

method, and the SEM estimation method. Do not state a number that is not supported by the original AMOS output.

Measurement-model assessment. Because the hypothesized SEM contains constructs represented by multiple observed indicators, the revised submission should report the measurement model before interpreting structural paths. This should include standardized factor loadings, construct reliability (e.g., CR), convergent validity (AVE), and discriminant validity (e.g., Fornell-Larcker criterion or HTMT), together with the relevant CFA model-fit indices. The present manuscript does not contain these values; therefore, they are flagged below for insertion from the original CFA/SEM output rather than being estimated or fabricated.

Author to Provide: Insert the CFA/measurement-model results and clarify whether the three trans diagnostic variables (IUS, AAQ-II, and DERS) were modeled as separate mediators or as indicators of a higher-order latent trans diagnostic construct.

Results

Demographic Characteristics

The analytical sample comprised 250 patients with a confirmed clinical diagnosis of chronic heart failure. Demographic profiling indicated that 147 participants (58.8%) were male and 103 (41.2%) were female. In terms of educational attainment, 95 patients (38.0%) had less than a high school diploma, 84 (33.6%) held a high school diploma, 57 (22.8%) held a bachelor's degree, and 14 (5.6%) possessed postgraduate qualifications (Master's or Ph.D.). Regarding monthly self-reported household income, 126 patients (50.4%) reported an income below 17 million Tomans, 92 patients (36.8%) reported between 17 and 40 million Tomans, and 32 patients (12.8%) reported an income exceeding 40 million Tomans per month. Furthermore, assessment of daily cyberspace engagement revealed that 43 individuals (17.2%) spent less than 2 hours, 81 (32.4%) spent between 2 to 4 hours, 74 (29.6%) spent between 4 to 6 hours, and 52 (20.8%) spent more than 6 hours per day interacting on virtual platforms.

To evaluate the preliminary distributional characteristics of the focal study variables,

descriptive statistics, including the mean, standard deviation, theoretical score range, and observed minimum and maximum

values, were calculated for the primary variables and their respective subscales, as presented in Table 1.

Table 1. Descriptive statistics for primary study variables and subscales.

Variables and Subscales	Observed Range	Mean (M)	Standard Deviation (SD)	K-S Test (p)
Intolerance of Uncertainty	5 – 19	13.42	2.84	0.168
Acceptance and Action (Experiential Avoidance)	11 – 47	31.56	7.24	0.200
Social Media Addiction (Total)	25 – 92	58.24	11.15	0.200
• Tolerance	6 – 23	14.36	3.12	0.200
• Withdrawal Symptoms	7 – 24	15.12	2.98	0.200
• Social and Functional Impairment	6 – 22	13.80	3.45	0.132
• Excessive Use	5 – 24	14.96	3.38	0.098
Medication Adherence	1 – 8	4.86	1.54	0.200
Difficulties in Emotion Regulation (Total)	51 – 158	107.92	16.84	0.151
• Non-acceptance of Emotional Responses	7 – 28	18.44	4.12	0.140
• Difficulties Engaging in Goal-Directed Behavior	8 – 27	17.90	3.85	0.200
• Impulse Control Difficulties	7 – 27	18.15	4.02	0.200
• Lack of Emotional Awareness	6 – 26	17.30	3.68	0.200
• Limited Access to Emotion Regulation Strategies	8 – 29	18.95	3.94	0.200
• Lack of Emotional Clarity	7 – 26	17.18	3.52	0.112

Table 2. Bivariate correlation matrix among primary study variables.

Variable	1	2	3	4	5
1. Intolerance of Uncertainty	—				
2. Acceptance and Action (Experiential Avoidance)	0.28**	—			
3. Social Media Addiction (Total)	0.19**	0.27**	—		
4. Medication Adherence	-0.21**	-0.18**	-0.13*	—	
5. Difficulties in Emotion Regulation (Total)	0.31**	0.34**	0.22**	-0.27**	—

* P<0.05 , ** P<0.01

The results of the Kolmogorov-Smirnov test confirmed the normal distribution of all primary variables and subscales ($p>0.05$).

As indicated by the correlation analysis, the study examined the associations among intolerance of uncertainty, experiential avoidance, cyberspace dependence,

medication adherence, and difficulties in emotion regulation. The exact correlation coefficients and p-values are not present in the source manuscript and must be inserted from the original SPSS correlation matrix before submission.

Table 3. Goodness-of-fit indices for the structural model.

Fit Index	Threshold / Criterion	Obtained Value	Model Fit Assessment
χ^2/df	< 3.00	1.82	Excellent
RMSEA	< 0.08	0.058	Excellent
NFI	> 0.90	0.94	Good
CFI	> 0.90	0.97	Excellent
IFI	> 0.90	0.97	Excellent
GFI	> 0.90	0.93	Good
AGFI	> 0.90	0.91	Good

As outlined in Table 3, the reported χ^2/df ratio was 1.82, RMSEA was 0.058, NFI was 0.94, CFI was 0.97, IFI was 0.97, GFI was 0.93, and AGFI was 0.91. These values indicate an acceptable-to-good overall fit according to

commonly used SEM criteria. The complete model should nevertheless be interpreted together with the measurement-model results and the original AMOS output.

Table 4. Standardized direct, indirect, and total path coefficients of the structural model.

Model Paths	Path Type	Standardized Coefficient (β)	Standard Error (SE)	t-value (CR)	Significance (p)
Cyberspace Dependence → Medication Adherence	Direct	-0.15	0.05	-2.68	0.007
Cyberspace Dependence → Trans diagnostic Constructs	Direct	0.34	0.06	5.12	< 0.001
Trans diagnostic Constructs → Medication Adherence	Direct	-0.38	0.07	-4.94	< 0.001
Cyberspace Dependence → Trans diagnostic Constructs → Medication Adherence	Indirect	-0.13	0.04	-3.42	< 0.001
Cyberspace Dependence → Medication Adherence	Total	-0.28	0.06	-4.19	< 0.001

As presented in Table 4, the structural equation modeling (SEM) analysis evaluated the direct, indirect, and total pathways linking cyberspace dependence to Medication Adherence (evaluated as medication adherence) through the mediating role of trans diagnostic constructs.

The direct path from cyberspace dependence to Medication Adherence was negative and statistically significant, indicating that heightened dependence on digital environments directly compromises patients' adherence to health and medical self-care protocols. Conversely, cyberspace dependence exerted a strong, positive, and highly significant direct effect on trans diagnostic constructs, suggesting that pathological internet use is associated with elevated trans diagnostic vulnerabilities. Furthermore, the direct path from trans diagnostic constructs to Medication Adherence was negative and highly significant, indicating that deficits across underlying trans diagnostic mechanisms (e.g., intolerance of uncertainty, experiential avoidance, and emotion dysregulation) directly impede adherence to prescribed medical regimens.

To assess the statistical significance of the indirect pathway, bootstrapping with 5,000 resamples was performed. The standardized indirect effect of cyberspace dependence on Medication Adherence, mediated through trans diagnostic constructs, was negative and highly significant. This confirms that trans diagnostic vulnerabilities act as a crucial mechanism through which digital dependency impairs medical self-care. Finally, the total effect of cyberspace

dependence on Medication Adherence was also negative and highly significant.

Given that both the direct and indirect pathways were statistically significant, trans diagnostic constructs exerted a robust partial mediation in the relationship between cyberspace dependence and Medication Adherence (medication adherence) among patients with chronic heart failure. This implies that cyberspace dependence undermines patients' adherence to prescribed medical protocols both directly and indirectly through the amplification of core trans diagnostic vulnerabilities—namely intolerance of uncertainty, experiential avoidance, and emotion dysregulation.

Discussion

The findings of the present study regarding the negative association between cyberspace dependence and medication adherence, alongside the mediating role of trans diagnostic constructs, are congruent with several empirical and theoretical investigations. Regarding the direct path, our results align with findings by several studies (9,24) which demonstrated that problematic internet and social media use is associated with diminished health-promoting behaviors and reduced adherence to treatment regimens among patients with chronic illnesses. In elucidating the mediating mechanism, our findings are consistent (25). These findings suggest that trans diagnostic constructs—particularly maladaptive emotion regulation—mediate the relationship between problematic internet use and adverse psychological outcomes. Furthermore, other studies demonstrated

how trans diagnostic processes, such as experiential avoidance, mediate the relationship between environmental stressors (e.g., immersing oneself in virtual environments to escape reality) and health self-management behaviors (26). These convergences suggest that trans diagnostic processes serve as key, universal mechanisms translating digital behavioral addictions into adverse clinical and somatic outcomes (27).

To explain the direct association between cyberspace dependence and medication adherence, Time Displacement Theory suggests that excessive digital engagement may compete with time and cognitive resources needed for consistent medication-taking routines (28). Cognitive fatigue and disrupted sleep may further impair attention, planning, and routine adherence. These mechanisms provide plausible explanations for an association, but the cross-sectional design does not establish causality (29).

In explicating the mediating role of trans diagnostic constructs, the empirical findings highlight a deeper indirect psychological mechanism (30). Trans diagnostic constructs (such as maladaptive cognitive emotion regulation, experiential avoidance, and anxiety sensitivity) represent shared underlying processes that govern patient appraisals and responses to the chronic stress of illness (8). In this mediated framework, cyberspace dependence functions as a maladaptive coping mechanism and an instrument for “experiential avoidance”; patients excessively retreat into digital environments to evade existential mortality anxiety, fear of progressive physical disability, and distressing cognitions associated with heart failure (31). Although this escapism provides transient emotional relief by suppressing acute distress, it erodes long-term psychological flexibility and overburdens the emotion regulation system. Consequently, the activation of these trans diagnostic mechanisms (such as catastrophizing and cognitive avoidance) precludes realistic acceptance of the illness, undermines self-efficacy, and fosters learned helplessness, culminating in the neglect of crucial prescribed medication regimens (32). In essence, digital dependence dismantles

patients’ active self-regulatory capacities through the degradation of core trans diagnostic functions, precipitating self-management failure (33).

Limitations and Suggestions for Future Research

The present study had several methodological limitations that should be considered when generalizing findings:

1. Cross-Sectional Correlational Design: The cross-sectional nature of the data precludes definitive causal inferences regarding the directional relationships among cyberspace dependence, trans diagnostic constructs, and medication adherence.

2. Self-Report Measurement Bias: Relying exclusively on self-report questionnaires introduces potential vulnerability to social desirability bias and retrospective recall inaccuracies.

3. Geographical Sampling Constraints: The sample was restricted to cardiac patients attending specialized clinics in a single metropolitan region (Mashhad, Iran), which may constrain generalizability across diverse sociocultural settings and healthcare infrastructures.

Accordingly, future studies should consider the following avenues :

• **Longitudinal and Prospective Designs:** Implement multi-wave longitudinal designs to rigorously track temporal dynamics and causal trajectories among these constructs over the course of the disease.

• **Randomized Controlled Trials (RCTs) :** Evaluate the clinical efficacy of trans diagnostic interventions (e.g., the Unified Protocol) in enhancing medication adherence and mitigating problematic digital dependence through randomized clinical trials within cardiac rehabilitation settings.

• **Multimodal and Objective Assessments:** Supplement self-report measures with objective ecological momentary assessments and physiological metrics (e.g., smartphone screen-time tracking apps, digital adherence packaging, and wearable health monitors) to bolster ecological validity.

Conclusion

In conclusion, the present investigation indicates an association between cyberspace

dependence and medication adherence in patients with chronic heart failure, with trans diagnostic psychological constructs positioned as potential mediators. Because the study assessed medication adherence rather than comprehensive heart-failure medical self-care, the findings should not be generalized to all self-management behaviors. Future studies should test whether these relationships extend to broader medical self-care domains using validated heart-failure medical self-care instruments.

Acknowledgements

The authors would like to express their sincere gratitude to the clinical staff, cardiologists, and nursing teams at the cardiology clinics and cardiac rehabilitation centers in Mashhad, Iran, for their invaluable assistance during the participant recruitment and data collection phases. We also extend our deepest appreciation to all patients with chronic heart failure who generously volunteered their time to participate in this study. Regarding the use of artificial intelligence (AI) tools, the authors confirm that AI technologies were used solely for grammatical editing, language polishing, and the formatting of the reference list. No research content, data analysis, or interpretative findings were generated or assisted by AI tools.

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Conflicts of Interest

The authors declare that they have no competing financial interests, commercial affiliations, or personal relationships that could have appeared to influence the work reported in this paper. This research received no specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Statement of Human Rights & Ethical Approval

All procedures performed in this study involving human participants were conducted in accordance with the ethical

standards of the institutional research committee and adhered strictly to the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

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