

Cardiac Self-Efficacy Mediates the Relationship Between Patient Empowerment and Medication Adherence: A Path Analysis in Patients With Coronary Artery Disease - Empirical Research Quantitative

Atefeh Allahbakhshian¹, Fatemeh Hashempour², Samin Saiyadani², Parvin Sarbakhsh³,
Masoud Mohammadnezhad⁴, Fatemeh Radimajer²

¹Department of Medical Surgical Nursing, Tabriz University of Medical Sciences, Tabriz, Iran

²Student Research Committee, Tabriz University of Medical Sciences, Tabriz, Iran

³Department of Statistic and Epidemiology, Tabriz University of Medical Sciences, Tabriz, Iran

⁴Education and Life Sciences, Birmingham City University, Birmingham, UK

Correspondence: Fatemeh Radimajer (fatemehradimajer@gmail.com)

Abstract

Aim: To examine the mediating role of cardiac self-efficacy in the relationship between patient empowerment and medication adherence among patients with coronary artery disease (CAD) and to identify which empowerment sub-dimensions are most prominent.

Design: A cross-sectional correlational study.

Methods: A convenience sample of adults attending a cardiology clinic completed validated versions of the Coronary Artery Disease Empowerment Scale (CADES), Cardiac Self-Efficacy Scale and Morisky Medication Adherence Scale. Data were analysed using Spearman's correlations, ordinal logistic regression and path analysis with bootstrap mediation testing.

Results: Positive correlations were found among empowerment, self-efficacy and adherence. Regression analysis showed that cardiac self-efficacy predicted adherence, while empowerment did not directly predict adherence. Path analysis confirmed that self-efficacy

mediates the empowerment-adherence relationship. The self-determination subscale of empowerment was the strongest predictor of self-efficacy, whereas personal competence was not significant.

Conclusion: Patient empowerment enhances medication adherence indirectly by building cardiac self-efficacy, primarily through fostering patient autonomy rather than merely providing knowledge.

Implications for the Profession and/or Patient Care: Nurse-led strategies should target cardiac self-efficacy. Motivational interviewing and autonomy-supportive interventions may be more effective than traditional education.

Impact:

- What problem did the study address? The study addressed the gap in understanding the nurse-led interventions that translate patient empowerment into actual medication adherence behaviours.
- What were the main findings? Self-efficacy acts as the essential bridge between empowerment and adherence and this bridge is built most effectively through self-determination rather than personal competence.

1. Introduction

Effective management of coronary artery disease (CAD) is fundamentally dependent on patient self-management, with steadfast medication adherence being a cornerstone of secondary prevention [1, 2]. Non-adherence is a pervasive clinical problem that compromises therapeutic goals, increases morbidity, and raises healthcare costs [3, 4]. This persistent gap between prescribed therapies and patient behavior signals that traditional, didactic patient education is often insufficient. Consequently, healthcare providers are increasingly focused on patient-centered counseling strategies that foster the internal psychological resources required for sustained self-care [5-7].

Within this patient-centered framework, two constructs are paramount: patient empowerment and self-efficacy. Patient empowerment is a process through which individuals gain the knowledge, skills, and, crucially, the confidence to take an active, autonomous role in their health decisions [8, 9]. This concept is distinct from, yet theoretically linked to, self-efficacy, which is defined within Social Cognitive Theory-the guiding framework for this study-as an individual's specific belief in their capability to execute the behaviors necessary to manage their condition, such as taking medications correctly even when faced with challenges [10-12].

A robust body of evidence confirms the independent value of these constructs. Patient empowerment is increasingly recognized as a positive correlate of self-efficacy across chronic conditions [13-16]. Empowerment-based interventions, which often include goal setting and shared decision-making, have been shown to improve psychological resources and, in some cases, long-term cardiovascular health outcomes [17-19]. Separately, self-efficacy is consistently identified as one of the most powerful and proximal predictors of medication adherence and other self-care behaviors [16, 20].

While the literature supports that empowerment and self-efficacy are both beneficial, a critical gap exists in understanding how they work together. It is theoretically plausible that empowerment does not influence behavior directly, but rather that its primary role is to build self-efficacy, which in turn drives adherence. This mediation pathway (Empowerment → Self-Efficacy → Adherence) has been established for other antecedents, such as health literacy, but it has not been empirically validated for the empowerment-adherence relationship in CAD patients [21, 22].

Furthermore, empowerment itself is a complex, multidimensional concept. A key debate in the literature questions whether empowerment is merely the paternalistic helping process of transferring knowledge and skills (i.e., personal competence) or a deeper redistribution of power that strengthens a patient's self-determination and autonomy [23]. It is unknown which of these specific dimensions of empowerment is most critical for building a patient's self-efficacy. Finally, these psychological models are predominantly studied in Western populations; their applicability within different sociocultural contexts, such as a Middle Eastern population in Iran, remains largely unexplored.

Therefore, the present study was designed to address these gaps by testing a hypothesized mediation model in a sample of Iranian patients with CAD. Our primary aim was to determine if the relationship between patient empowerment and medication adherence is mediated by cardiac self-efficacy. A secondary aim was to identify which specific sub-dimensions of empowerment (e.g., self-determination, personal competence) are the most salient predictors of self-efficacy.

Based on this theoretical framework, we hypothesized the following:

- **H₁:** Patient empowerment will be positively correlated with medication adherence.
- **H₂:** Patient empowerment will be positively correlated with cardiac self-efficacy.
- **H₃:** Cardiac self-efficacy will be positively correlated with medication adherence.
- **H₄:** Cardiac self-efficacy will mediate the relationship between patient empowerment and medication adherence.

By elucidating this specific psychological pathway, this research aims to provide an empirical basis for designing more targeted and effective counseling strategies. If self-efficacy is indeed the essential bridge, clinical practice must shift from simply informing patients to actively building their belief in themselves.

2. Methods

This study is reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cross-sectional studies (supplementary file 1). Sex and gender were considered in the study design as demographic variables, and associations with key outcomes were analyzed (table 1).

2.1 Design

This study employed a cross-sectional correlational design to examine the relationships between empowerment, self-efficacy, and medication adherence among patients with coronary artery disease (CAD). Data were collected from patients referred to the Cardiology Clinic of Tabriz University of Medical Sciences during 2025. This design allowed for the assessment of associations between variables as they naturally occur, without experimental manipulation.

2.2 Participants

A final sample of $N = 266$ patients was recruited from a university-affiliated outpatient cardiology clinic in Tabriz, Iran, using a convenience sampling method.

An a priori power analysis using G*Power 3.1 indicated that a minimum sample of 259 participants was required to detect a small-to-medium effect size ($f^2 = 0.05$) in a multiple regression model with two predictors, given an alpha of .05 and 90% power. We aimed to recruit 300 participants to account for potential incomplete data. The final sample of 266 represents the total number of participants who provided complete responses to all three primary scales.

Inclusion criteria were: (1) age 18 years or older, (2) a confirmed diagnosis of CAD, (3) attending the clinic for a routine follow-up, (4) ability to provide informed consent, and (5) a current prescription for at least one daily oral medication for CAD. Patients were excluded if they had documented cognitive impairments or had experienced an acute cardiac event (e.g., myocardial infarction) within the 30 days preceding data collection.

2.3 Instruments and Variables

A comprehensive questionnaire composed of four sections was used for data collection.

Demographic and Clinical Variables: A researcher-developed questionnaire was used to collect demographic and clinical information, including age, gender, marital status, educational level, occupation, income, living situation, duration of disease, family history of CAD, exercise habits, substance use, and history of hospitalization and non-drug treatments.

Coronary Artery Disease Empowerment Scale (CADES): Patient empowerment was measured using the 25-item Coronary Artery Disease Empowerment Scale (CADES), developed by Kim et al. (2021) [24]. This scale assesses patients' perceived control and active role in managing their heart disease. It includes three subscales: Self-determination, Emotional self-regulation, and Personal competence. Items are rated on a 5-point Likert scale, with higher total scores indicating greater empowerment. The Farsi version of the CADES, validated by Jalali et al., has demonstrated acceptable psychometric properties [9]. In the conceptual model, Patient Empowerment served as the independent variable.

Sullivan's Cardiac Self-Efficacy Scale (SCSES): Self-efficacy was assessed with the 13-item Sullivan's Cardiac Self-Efficacy Scale (SCSES), developed by Sullivan et al. (1998) [25]. This instrument measures a patient's confidence in their ability to manage CAD, broken down into two subscales: maintaining function and symptom control. Responses are given on a 5-point Likert scale, with higher scores indicating greater self-efficacy. Varaei et al. (2014) validated the Farsi version of Sullivan's Cardiac Self-Efficacy Scale, demonstrating excellent reliability with a Cronbach's alpha of 0.977 [26]. Self-Efficacy served as the proposed mediating variable in the model.

Morisky Medication Adherence Scale (MMAS-8): Medication adherence was measured using the 8-item Morisky Medication Adherence Scale (MMAS-8) [27]. This widely used self-report tool assesses specific adherence behaviors and barriers (e.g., Do you ever forget to take your medicine?). Total scores range from 0 to 8, with higher scores reflecting better medication adherence. Iranpour et al. (2022) validated the Persian version of the 8-item Morisky Medication Adherence Scale (MMAS-8), demonstrating acceptable reliability with a Cronbach's alpha of 0.70 [28]. Medication Adherence served as the dependent (outcome) variable.

2.4 Procedure and Standardization

A standardized protocol was followed for data collection. Research assistants provided clear, standardized verbal instructions to participants on how to complete the self-report questionnaires. For illiterate patients, a structured interview was conducted where questions were read verbatim. All questionnaires were checked for completeness on-site. Ethical approval was obtained from the institutional review board of Tabriz University of Medical Sciences [IR.TBZMED.REC.1404.359], and informed consent was secured from all participants. The study complied with the ethical principles outlined in the Declaration of Helsinki.

2.5 Data Management and Analysis

All data were analyzed using IBM SPSS Statistics, Version 28, and IBM SPSS AMOS, Version 28. A p-value of $< .05$ was considered statistically significant. Descriptive statistics (frequencies, percentages, means, and standard deviations) were calculated to summarize participant characteristics and the main study variables as presented in Table 1. Due to the non-normal distribution of the scale scores, confirmed by the Shapiro-Wilk test, preliminary relationships between empowerment, self-efficacy, and medication adherence were examined using Spearman's rank-order correlation.

To test the hypothesized theoretical model and the mediating role of self-efficacy (Hypothesis H4), a path analysis was conducted using AMOS 28. This analysis examined the hypothesized direct and indirect relationships between the independent variable (Patient Empowerment), the mediator (Self-Efficacy), and the dependent variable (Medication Adherence). The model was estimated using Maximum Likelihood (ML) estimation.

Model fit was assessed using established indices: the chi-square to degrees of freedom ratio (χ^2/df), the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), and the Root Mean Square Error of Approximation (RMSEA) with its 90% confidence interval. A good fit was defined by $\chi^2/df < 3.0$, CFI/TLI $> .95$, and RMSEA $< .06$. Standardized indirect effects were calculated to confirm the significance of the mediating pathways.

3. Results

3.1 Participant Characteristics and Descriptive Statistics

The final sample for analysis consisted of 266 adult participants with coronary artery disease. The mean age of the sample was 53.56 years ($SD = 13.57$), with ages ranging from 18 to 86. The majority of participants were female (52.6%, $n = 140$), married (79.7%, $n = 212$), and reported an income less than their expenses (61.7%, $n = 164$). Regarding clinical characteristics, 67.7% had hypertension, 22.2% had diabetes, and 44.7% had hyperlipidemia. Most participants (43.2%) reported a disease duration of more than four years. Descriptive statistics for the key study variables are presented in Table 1.

3.2 Descriptive Statistics and Scale Reliability

Participants reported a mean total empowerment score of 97.71 ($SD = 13.06$) and a mean cardiac self-efficacy score of 50.12 ($SD = 9.92$). The mean medication adherence score on the MMAS-8 was 5.75 ($SD = 1.83$), indicating a medium level of adherence on average.

Internal consistency for the scales was assessed using Cronbach's alpha. All scales demonstrated good to excellent internal consistency in this sample: The 25-item Cardiac Patients Empowerment Scale demonstrated excellent reliability ($\alpha = .87$). The 8-item Medication Adherence Self-Efficacy scale showed acceptable reliability ($\alpha = .75$). The 13-item Cardiac Self-Efficacy Scale demonstrated excellent reliability ($\alpha = .92$).

3.3 Bivariate Correlational Analysis

The Shapiro-Wilk test confirmed that the distributions for Empowerment ($r_s = .974, p < .001$) and medication adherence ($r_s = .911, p < .001$) deviated significantly from normality. The distribution for cardiac self-efficacy was approximately normal ($r_s = .990, p = .057$). An examination of skewness and kurtosis further indicated that not all items satisfied the acceptable thresholds (± 1), collectively indicating a non-normal distribution for the key study variables.

Spearman's rank-order correlation was conducted to examine the relationships among the key variables. As hypothesized, all three variables were positively and significantly correlated. There was a statistically significant, positive correlation between medication adherence and patient

empowerment, $r_s(264) = .24, p < .001$. A statistically significant, positive correlation was also found between medication adherence and cardiac self-efficacy, $r_s(264) = .44, p < .001$. Finally, a statistically significant, positive correlation was observed between total patient empowerment and cardiac self-efficacy, $r_s(264) = .49, p < .001$. Table 2 summarizes the Spearman's correlation coefficients among the study measures.

3.4 Regression Analysis Predicting Medication Adherence

A standard multiple linear regression was calculated to predict medication adherence from total patient empowerment and cardiac self-efficacy. The regression model was statistically significant, $F(2, 262) = 34.67, p < .001$, and accounted for 20.9% of the variance in medication adherence ($R^2 = .21$, Adjusted $R^2 = .20$). Cardiac self-efficacy was a significant positive predictor in the model ($\beta = .41, p < .001$), while total patient empowerment was not a significant predictor ($\beta = .09, p = .162$). The results of the regression analysis are presented in Table 3.

3.5 Path Analysis of the Hypothesized Model

To test the hypothesized theoretical model and the mediating role of self-efficacy (Hypothesis H4), a path analysis was performed using IBM SPSS AMOS (Version 28) with the Maximum Likelihood estimation method. The model specified Patient Empowerment (with sub-factors Self-determination, Emotional self-regulation, and Personal Competence) as the exogenous variable predicting Self-Efficacy (with sub-factors symptom control and maintaining function), which in turn predicted the final outcome, Medication Adherence.

3.6 Model Fit

The model fit indices indicated an excellent fit for the proposed model to the data. The chi-square test was non-significant, $\chi^2(3) = 4.061, p = .255$, indicating no significant discrepancy between the model and the data. Other key indices confirmed the fit:

- CMIN/DF: 1.354 (below the 3.0 threshold)
- CFI: 0.998 (above the .95 threshold)
- TLI: 0.990 (above the .95 threshold)
- RMSEA: 0.037 (90% CI [0.000, 0.116]) (below the .06 threshold)

- PCLOSE: 0.507 (indicating a high probability of close fit)

3.7 Path Coefficients: Direct Effects

We examined the standardized path coefficients (β) to understand the relationships between the subscales (see Figure 1).

Step 1: Empowerment → Self-Efficacy

The analysis revealed that the Self-determination subscale of empowerment was a significant positive predictor of both self-efficacy subscales: 'symptom control' ($\beta = 0.25, p < .001$) and 'maintaining function' ($\beta = 0.33, p < .001$). The Emotional self-regulation subscale also positively predicted 'maintaining function' ($\beta = 0.17, p = .019$).

Notably, the Personal competence subscale of empowerment was *not* a significant predictor of either 'symptom control' ($\beta = 0.12, p = .109$) or 'maintaining function' ($\beta = 0.10, p = .125$).

Step 2: Self-Efficacy → Medication Adherence

As hypothesized, cardiac self-efficacy strongly and significantly predicted medication adherence. Both 'maintaining function' ($\beta = 0.34, p < .001$) and 'symptom control' ($\beta = 0.15, p = .038$) had significant positive paths to medication adherence.

3.8 Mediation Effects: Indirect Effects

To test our main hypothesis (H4), we examined the indirect effects of the empowerment subscales on medication adherence, mediated by the self-efficacy subscales.

The analysis confirmed a full mediation. The direct paths from all three empowerment subscales to medication adherence were non-significant ($p > .05$). However, the indirect effects were significant:

- The total indirect effect of Self-determination on Adherence (via both SE factors) was significant ($\beta = 0.150$).

- The total indirect effect of Emotional self-regulation on Adherence was also significant ($\beta = 0.065$).

These results support our fourth hypothesis (H4), indicating that the positive relationship between patient empowerment and medication adherence is fully explained by cardiac self-efficacy. Patients with higher self-determination and emotional regulation reported higher levels of cardiac self-efficacy, which in turn was associated with better medication adherence.

4. Discussion and conclusion

4.1 Discussion

This study's primary contribution is the empirical validation of a mediation model where the effect of patient empowerment on medication adherence in Coronary Artery Disease (CAD) patients is fully channeled through cardiac self-efficacy. While our initial analysis confirmed positive correlations between empowerment, self-efficacy, and adherence, our path analysis revealed a more sophisticated relationship. The direct path from empowerment to adherence was non-significant, while the indirect path through self-efficacy was strong and significant. This finding provides an empirical pathway that supports conceptual models used in major systematic reviews, suggesting that self-efficacy is the more proximal and direct driver of adherence [16]. This aligns with its foundational role in Social Cognitive Theory and with other research identifying self-efficacy as a key translational mechanism; for instance, it has also been found to mediate the relationship between health literacy (i.e., numeracy) and medication adherence [12]. This positions self-efficacy as a central, critical mechanism that translates various patient assets into behavioral action [21].

The strong, direct relationship found between cardiac self-efficacy and medication adherence confirms our third hypothesis (H3) and aligns with a vast body of literature [16]. Our regression model ($\beta = .41$) and path model, where both maintaining function ($\beta = .338$) and symptom control ($\beta = .151$) directly predicted adherence, reinforce this. This finding is consistent with systematic reviews which have concluded that high levels of self-efficacy are consistently found to promote medication adherence across various chronic conditions [16]. Our findings confirm this principle holds true for this specific population of Iranian CAD patients. Furthermore, a recent review of patient-related factors influencing adherence in cardiometabolic patients confirmed that psychosocial constructs, including self-concept and patient beliefs (of which self-efficacy is a core component), are a primary category of factors determining adherence to overall treatment [20]. Our findings confirm this principle holds true for this specific population of Iranian CAD patients.

If self-efficacy is the key, this study's findings also clarify how to build it, confirming our second hypothesis (H2) that empowerment is a critical antecedent. This was evidenced by the strong, positive correlation between the two constructs ($r_s = .49$) and the significant paths from empowerment subscales to self-efficacy subscales. This link is robustly supported in the literature;

a recent descriptive review of empowerment correlates found that self-efficacy is one of the most frequently identified and significant correlates of patient empowerment [13]. This cross-sectional model is strongly supported by intervention studies. Empowerment-based interventions have been shown to significantly improve not only self-efficacy but also closely related psychological resources such as resilience in patients recovering from coronary artery stent implantation [17]. For instance, a randomized controlled trial (RCT) by Moattari et al. (2012) found that an empowerment program significantly improved self-efficacy, including decision-making, in hemodialysis patients [29]. Similarly, an RCT with liver transplant patients demonstrated that empowerment education, based on Self-Determination Theory, significantly enhanced self-efficacy [30]. Our data provides a theoretical model that helps explain *why* such empowerment interventions are successful: they build the necessary psychological reserves, like self-efficacy, that are required for sustained self-care.

This study offers a crucial refinement of which aspects of empowerment matter most, highlighting a distinction between autonomy and simple competence. A particularly salient finding was the contrast between the empowerment subscales: Self-determination was the strongest predictor of both self-efficacy factors, while Personal competence had no significant effect. The non-significant path from Personal competence suggests that merely providing patients with knowledge and skills (i.e., education) is insufficient to build the robust confidence required for daily disease management. This finding challenges models that equate empowerment with education and supports the more complex critique by Aujoulat et al. (2008), who argue that true empowerment is not just about gaining control or skills, but also involves finding meaning and coherence [15].

Conversely, the strong path from Self-determination empirically demonstrates a core critique within empowerment theory. Halvorsen et al. (2020), in a synthesis of empowerment concept analyses, argued that empowerment is often misconstrued as a paternalistic helping process of making patients act differently [23]. They argue that true empowerment is not just about gaining skills but is a redistribution of power characterized by mutual partnership, reciprocity, trust... and a process of strengthening self-determination [23]. Our data provides tangible evidence for this conceptual distinction: the intervention that merely provides Personal competence (the helping model) failed to build self-efficacy, whereas the factor related to autonomy and Self-determination (the power redistribution model) was the significant driver. This aligns perfectly with the Self-

Determination Theory (SDT) framework, which posits that supporting patient autonomy is the key to internalizing motivation and enhancing self-efficacy [12].

Our finding of a non-significant direct path from empowerment to adherence in the mediation model (failing to support H1 in the final model) may seem to contradict other studies, but it actually provides a more sophisticated explanation. While empowerment and adherence were significantly correlated in our initial analysis ($r_s = .24$), this relationship vanished once self-efficacy was introduced as a mediator. Other cross-sectional [16, 31] and intervention studies [32] have reported a direct, significant relationship between empowerment and adherence. Our findings suggest the relationship they observed is likely explained by self-efficacy, a variable they did not concurrently model as a mediator. Therefore, our model does not refute their findings but rather provides the missing causal link, positioning self-efficacy as the full mediator of this relationship.

The clear pathway identified in this study—from self-determination to self-efficacy to adherence—has direct implications for clinical practice and future research. To improve medication adherence, clinical interventions should not just aim to empower patients with information (which relates to our non-significant Personal competence factor). Instead, they must specifically target and build cardiac self-efficacy. Our model suggests the most effective way to do this is by enhancing a patient's sense of Self-determination, such as by using motivational interviewing or collaborative goal-setting. This supports the call for empowerment-based interventions in recent systematic reviews [33-35].

Furthermore, our findings highlight a critical methodological point. We found a strong correlation ($r_s = .49$) between empowerment and cardiac-specific self-efficacy. In contrast, Kärner Köhler et al. (2018) found only a weak correlation ($r_s = 0.38$) between empowerment and general self-efficacy in their CAD patient sample [36]. The stronger association in our study underscores the necessity for future research to use disease-specific, rather than general, self-efficacy measures, which may be more sensitive to these clinically meaningful relationships.

4.2 Limitations These conclusions must be interpreted within the context of the study's limitations. Primarily, the cross-sectional design precludes definitive causal inference. The relationship between adherence and self-efficacy is likely bidirectional; successful adherence may, in itself, reinforce a patient's self-efficacy over time. Empowerment is also described as a process

of personal transformation, which further implies a temporal dynamic that our study could not capture. Also, cross-sectional mediation may overestimate or bias effects compared to longitudinal models. Future studies should employ prospective designs to confirm the mediational pathway. Second, this study relied exclusively on self-report measures, which are prone to social desirability bias, particularly for adherence. Although validated scales were used, these were not mitigated in the current study. Future research should incorporate objective adherence measures, such as electronic pill monitoring, pill counts, or therapeutic drug monitoring, to validate findings and reduce bias. Third, the convenience sample from a single university clinic in Tabriz may not be generalizable to all CAD patients.

4.3 conclusion

Despite these limitations, this study provides a crucial empirical model of the psychological pathway from empowerment to adherence in this population. It moves beyond simple correlation to propose an ordered, functional pathway, providing an empirical model of how a patient's sense of empowerment is translated into action. This study empirically confirms that self-efficacy is the essential bridge that empowerment must cross to become behavior, shifting the clinical focus from simply informing patients to actively building their belief in themselves.

5. Practice Implications

This study's findings, which position cardiac self-efficacy as the full mediator of the empowerment-adherence relationship, offer clear guidance for patient education and counseling.

- **Shift Focus from Knowledge to Confidence:** The finding that personal competence (knowledge/skills) did not predict self-efficacy, while self-determination (autonomy) did, is critical. It suggests that traditional, didactic education is insufficient. Counseling efforts must shift from simply informing patients to actively building their confidence and sense of autonomy.
- **Prioritize Autonomy-Supportive Techniques:** Clinicians, health coaches, and counselors should prioritize autonomy-supportive communication. Techniques such as motivational interviewing, collaborative goal-setting, and shared decision-making are designed to enhance a patient's self-determination and are therefore more likely to build the self-efficacy needed to improve adherence.

- Use Self-Efficacy as a Clinical Target: Rather than only measuring adherence, providers should consider assessing cardiac self-efficacy (using scales like the SCSES) as a key intermediate outcome. A patient reporting low self-efficacy is an evidence-based target for adherence support, even if their empowerment level seems high.

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Declaration of Competing Interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Funding Sources

This work was supported by the Student Research Committee, Tabriz University of Medical Sciences.

Table 1: Sociodemographic and Clinical Characteristics and their Association with Empowerment, Medication adherence and Self-Efficacy Scores

Characteristics	Group / Category	N (%)	Empowerment (Mean $\pm$ SD)	Self-Determination (Mean $\pm$ SD)	Emotional Self-Regulation (Mean $\pm$ SD)	Personal Competence (Mean $\pm$ SD)	Medication Adherence (Mean $\pm$ SD)	Self-efficacy (Mean $\pm$ SD)	Symptom Control (Mean $\pm$ SD)	Maintenance Function (Mean $\pm$ SD)
Gender ^t^	Female	140 (52.6%)	98.29 $\pm$ 13.71	46.42 $\pm$ 7.96	28.84 $\pm$ 4.42	23.04 $\pm$ 3.80	5.66 $\pm$ 2.04	27.29 $\pm$ 10.60	9.87 $\pm$ 4.71	17.41 $\pm$ 6.88
	Male	126 (47.4%)	97.06 $\pm$ 13.72	46.21 $\pm$ 8.28	28.58 $\pm$ 4.47	22.42 $\pm$ 4.03	5.78 $\pm$ 1.92	29.26 $\pm$ 11.11	10.85 $\pm$ 4.84	18.41 $\pm$ 7.28
	p-value		.476	.835	.593	.276	.622	.208	.043	.284
Marital Status ^a^	Single	29 (10.9%)	99.72 $\pm$ 11.34	46.55 $\pm$ 7.02	29.83 $\pm$ 3.99	23.34 $\pm$ 3.85	5.53 $\pm$ 2.10	30.52 $\pm$ 11.08	11.03 $\pm$ 5.05	19.48 $\pm$ 7.09

Characteristics	Group / Category	N (%)	Empowerment (Mean $\pm$ SD)	Self-Determination (Mean $\pm$ SD)	Emotional Self-Regulation (Mean $\pm$ SD)	Personal Competence (Mean $\pm$ SD)	Medication Adherence (Mean $\pm$ SD)	Self-efficacy (Mean $\pm$ SD)	Symptom Control (Mean $\pm$ SD)	Maintenance Function (Mean $\pm$ SD)
	Married	211 (79.6%)	97.85 $\pm$ 13.83	46.54 $\pm$ 8.21	28.70 $\pm$ 4.48	22.69 $\pm$ 3.93	5.75 $\pm$ 1.97	28.47 $\pm$ 10.53	10.37 $\pm$ 4.75	18.10 $\pm$ 6.81
	Divorced	8 (3.0%)	100.38 $\pm$ 12.36	46.75 $\pm$ 8.46	29.25 $\pm$ 3.20	24.38 $\pm$ 1.41	6.97 $\pm$ 0.85	31.88 $\pm$ 14.33	11.50 $\pm$ 6.48	20.38 $\pm$ 8.38
	Widowed	17 (6.4%)	91.35 $\pm$ 15.46	42.94 $\pm$ 8.19	26.76 $\pm$ 4.78	21.65 $\pm$ 4.46	5.07 $\pm$ 2.16	19.47 $\pm$ 9.47	8.18 $\pm$ 3.63	11.29 $\pm$ 6.67
	p-value		0.203	0.368	0.156	0.328	0.152	0.004	0.208	<0.001
Patient Education ^a^	Illiterate	57 (21.5%)	91.61 $\pm$ 14.74	42.91 $\pm$ 8.94	27.30 $\pm$ 4.64	21.40 $\pm$ 4.01	5.33 $\pm$ 2.34	22.05 $\pm$ 9.57	8.47 $\pm$ 4.43	13.58 $\pm$ 6.22

Characteristics	Group / Category	N (%)	Empowerment (Mean ± SD)	Self-Determination (Mean ± SD)	Emotional Self-Regulation (Mean ± SD)	Personal Competence (Mean ± SD)	Medication Adherence (Mean ± SD)	Self-efficacy (Mean ± SD)	Symptom Control (Mean ± SD)	Maintenance Function (Mean ± SD)
	Below Diploma	86 (32.5%)	95.69 ± 12.86	45.41 ± 7.77	28.17 ± 4.56	22.10 ± 3.97	5.78 ± 1.89	27.36 ± 9.59	9.95 ± 4.40	17.41 ± 6.44
	Diploma	72 (27.2%)	100.04 ± 12.49	47.40 ± 7.01	29.11 ± 4.17	23.53 ± 3.58	5.48 ± 1.94	28.71 ± 9.52	10.03 ± 4.33	18.68 ± 6.27
	Bachelor's	38 (14.3%)	106.13 ± 8.94	50.29 ± 6.02	31.18 ± 2.62	24.66 ± 3.45	6.56 ± 1.52	36.29 ± 10.44	13.53 ± 5.07	22.76 ± 6.29
	p-value		<0.001	<0.001	0.001	0.001	0.038	<0.001	<0.001	<0.001
Occupation ^a	Housewife	109 (41.1%)	96.80 ± 14.03	46.03 ± 8.21	28.39 ± 4.62	22.38 ± 3.89	5.63 ± 1.98	25.39 ± 9.57	9.06 ± 4.26	16.33 ± 6.40

Characteristics	Group / Category	N (%)	Empowerment (Mean $\pm$ SD)	Self-Determination (Mean $\pm$ SD)	Emotional Self-Regulation (Mean $\pm$ SD)	Personal Competence (Mean $\pm$ SD)	Medication Adherence (Mean $\pm$ SD)	Self-efficacy (Mean $\pm$ SD)	Symptom Control (Mean $\pm$ SD)	Maintenance Function (Mean $\pm$ SD)
	Employee	34 (12.8%)	106.53 $\pm$ 11.08	50.49 $\pm$ 7.93	31.29 $\pm$ 2.80	25.06 $\pm$ 2.84	6.52 $\pm$ 1.84	39.71 $\pm$ 10.35	14.94 $\pm$ 4.74	24.77 $\pm$ 6.54
	Self-Employed	59 (22.3%)	97.86 $\pm$ 11.66	46.75 $\pm$ 6.52	28.25 $\pm$ 4.33	22.86 $\pm$ 4.12	5.64 $\pm$ 2.06	27.75 $\pm$ 9.44	9.78 $\pm$ 4.55	17.97 $\pm$ 5.89
	p-value		0.002	0.016	0.008	0.004	0.234	<0.001	<0.001	<0.001
Income ^a^	Less than Expenses	164 (61.9%)	95.42 $\pm$ 14.54	44.62 $\pm$ 8.60	28.30 $\pm$ 4.66	22.50 $\pm$ 3.90	5.50 $\pm$ 2.05	25.51 $\pm$ 10.15	9.40 $\pm$ 4.32	16.12 $\pm$ 6.81

Characteristics	Group / Category	N (%)	Empowerment (Mean $\pm$ SD)	Self-Determination (Mean $\pm$ SD)	Emotional Self-Regulation (Mean $\pm$ SD)	Personal Competence (Mean $\pm$ SD)	Medication Adherence (Mean $\pm$ SD)	Self-efficacy (Mean $\pm$ SD)	Symptom Control (Mean $\pm$ SD)	Maintenance Function (Mean $\pm$ SD)
	Equal to Expenses	90 (34.0%)	101.39 $\pm$ 11.43	49.05 $\pm$ 6.41	29.29 $\pm$ 4.06	23.20 $\pm$ 3.81	6.05 $\pm$ 1.89	32.49 $\pm$ 10.60	11.99 $\pm$ 4.90	20.51 $\pm$ 6.73
	p-value		0.002	<0.001	0.138	0.395	0.078	<0.001	<0.001	<0.001
Disease Duration ^a^	6 Months - 1 Year	76 (28.7%)	99.66 $\pm$ 11.20	47.84 $\pm$ 6.82	29.21 $\pm$ 4.31	22.80 $\pm$ 3.84	6.15 $\pm$ 1.85	29.95 $\pm$ 12.32	10.43 $\pm$ 5.35	19.52 $\pm$ 7.76
	1 to 2 Years	33 (12.5%)	102.85 $\pm$ 10.83	48.73 $\pm$ 6.19	30.00 $\pm$ 3.14	24.12 $\pm$ 3.78	6.34 $\pm$ 1.69	32.12 $\pm$ 11.62	12.55 $\pm$ 5.03	19.58 $\pm$ 6.86
	2 to 4 Years	41 (15.5%)	100.05 $\pm$ 11.18	47.27 $\pm$ 7.07	29.32 $\pm$ 3.22	23.46 $\pm$ 2.98	5.88 $\pm$ 1.84	28.80 $\pm$ 9.17	11.05 $\pm$ 3.69	17.76 $\pm$ 5.92

Characteristics	Group / Category	N (%)	Empowerment (Mean $\pm$ SD)	Self-Determination (Mean $\pm$ SD)	Emotional Self-Regulation (Mean $\pm$ SD)	Personal Competence (Mean $\pm$ SD)	Medication Adherence (Mean $\pm$ SD)	Self-efficacy (Mean $\pm$ SD)	Symptom Control (Mean $\pm$ SD)	Maintenance Function (Mean $\pm$ SD)
	> 4 Years	115 (43.4%)	94.12 $\pm$ 15.82	44.27 $\pm$ 9.24	27.80 $\pm$ 5.04	22.05 $\pm$ 4.18	5.20 $\pm$ 2.09	25.74 $\pm$ 9.65	9.38 $\pm$ 4.46	16.36 $\pm$ 6.76
	p-value		0.001	<0.001	0.025	0.011	0.001	0.002	<0.001	0.011

Legend. The table presents associations between sociodemographic/clinical characteristics and mean scores for empowerment, medication adherence, and self-efficacy scales. Categorical variables were analyzed using independent samples t-tests (indicated by ^t^) or one-way Analysis of Variance (ANOVA) (indicated by ^a^). The p-values correspond to the overall F-test from the ANOVA or the t-test comparing group means. SD = Standard Deviation. Bolded p-values indicate statistical significance at the $\alpha < 0.05$ level. Percentages may not sum to 100% due to rounding.

Table 2: Spearman's Rho Correlations among Medication Adherence, Empowerment, and Self-Efficacy

Variable	Medication adherence	Empowerment	Cardiac self-efficacy
Medication adherence	-		
Empowerment	.238	-	
Cardiac self-efficacy	.442	.487	-

Legend. N=266. Correlation coefficients are Spearman's rho. $p < .01$ (2-tailed).

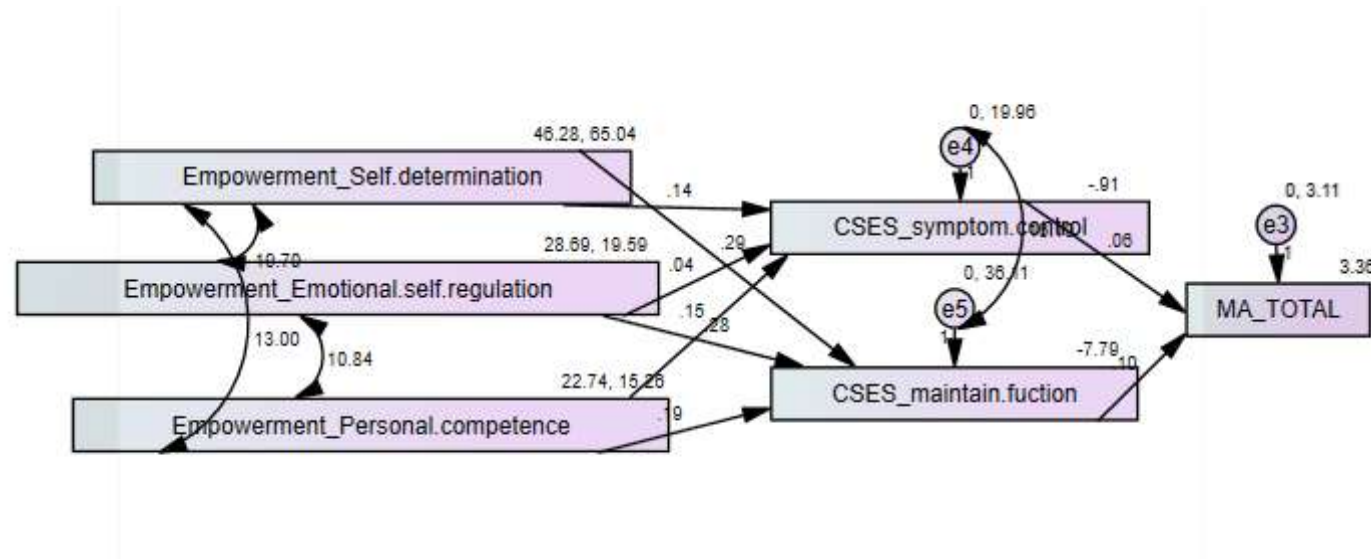
Table 3.**Predicting Medication Adherence (N = 266)**

Predictor	B	SE B	β	t	p	Bootstrap 95% CI for B
Constant	2.36	0.79		2.98	.003	[0.40, 4.22]
Empowerment	0.01	0.01	.09	1.40	.162	[-0.01, 0.03]
Cardiac Self-Efficacy	0.08	0.01	.41	6.50	<.001	[0.06, 0.10]

Legend. $R^2 = .21$. CI = Confidence Interval. The bootstrap results are based on 1,000 samples. The outcome variable is Medication Adherence

Figure 1.

Standardized Path Model of Cardiac Self-Efficacy Mediating the Relationship between Patient Empowerment Subscales and Medication Adherence (N=266).



Legend. Standardized path coefficients for the hypothesized full mediation model. Patient Empowerment factors (Self-determination, Emotional self-regulation, and Personal competence) predict Medication Adherence, fully mediated by Cardiac Self-Efficacy factors (Symptom control and Maintaining function). All paths shown are significant at $p < .05$ (Solid lines) or $p > .05$ (Dashed lines). The model demonstrated excellent fit indices ($X^2/df = 1.354$, CFI = 0.998, TLI = 0.990, RMSEA = 0.037). Note the non-significant direct path from all empowerment factors to Medication Adherence, and the non-significant paths from Personal Competence to both Self-Efficacy factors. MA_TOTAL: Medication

Adherence Total score (from the Morisky Medication Adherence Scale-8, MMAS-8). CSES: Cardiac Self-Efficacy Scale (Sullivan's Cardiac Self-Efficacy Scale, CSES).