Published in final edited form as:

Heart Lung. 2015 ; 44(4): 276–281. doi:10.1016/j.hrtlng.2015.03.006.

Type D Personality, Self-Efficacy, and Medication Adherence in Patients with Heart Failure

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Abstract

Background—Type D personality is a known predictor of non-adherence to prescribed medication regimens among patients with heart failure (HF). Both Type D personality and non-adherence are independent predictors of poor health outcomes among HF patients. Self-efficacy, which is modifiable, is also associated with medication adherence.

Objectives—To determine the relationships among Type D personality, medication self-efficacy, and medication adherence in 84 patients with HF.

Methods—Medication self-efficacy, Type D personality, medication adherence, demographic and clinical data were collected. Hierarchical linear regression and mediation analyses were used.

Results—Type D patients were more likely to have lower medication self-efficacy ($p = .023$) and poorer medication adherence ($p = .027$) compared with non-Type D patients. Low medication self-efficacy was associated with poor medication adherence ($p < .001$). Type D did not predict ($p = .422$) medication adherence after entering medication self-efficacy in the model demonstrating that medication self-efficacy was a mediator of the relationship between Type D and medication adherence.

Conclusions—Medication self-efficacy mediates the relationship between Type D personality and medication adherence. Developing and applying interventions to enhance medication self-efficacy for Type D patients may help to sever the link between Type D personality and poor outcomes.

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Keywords

Type D personality; medication adherence; medication self-efficacy; heart failure

Introduction

Type D (distressed) personality is a concept used in the field of medical psychology that includes negative affectivity (NA) and social inhibition (SI) personality traits.^{1,2} Type D personality was developed by Dr. Denollet based on clinical and research experience in patients with cardiac disease. Individuals with Type D personality are more likely to have negative emotions (worry, touchiness, sadness) and not to interact or share their thoughts and emotions with others (fear of disapproval).

Patients with Type D personality are more likely to have worse health outcomes.¹ Previous research has shown that Type D personality is associated with poor quality of life,³⁻⁵ and higher morbidity,⁶⁻⁹ and mortality^{2,8,10-12} among patients with^{1,2,6,8,10,11,13} and without¹⁴ cardiovascular disease. Patients with heart failure (HF) and Type D personality were more likely to report worse health-related quality of life,³⁻⁵ more depressive symptoms,⁵ and have a higher cardiac mortality¹² compared with HF patients without Type D personality.

Many investigators have studied the mechanism(s) linking Type D personality with poor health outcomes. One of the mechanisms potentially linking Type D personality with adverse outcomes is poor self-management skills, including adherence to the recommended medical regimen. For example, patients with obstructive sleep apnea syndrome and Type D personality were more likely to be nonadherent to prescribed respiratory treatment than patients without Type D personality.^{15,16}

Medication adherence is a crucial self-care behavior for patients with HF because optimal pharmacological therapy will not benefit patients if they do not take their medications regularly as prescribed. Yet, rates of medication adherence remain suboptimal.¹⁷ Poor medication adherence is associated with poor health outcomes and leads to high health care costs.¹⁸⁻²⁰ To our knowledge, only four investigative groups have examined the relationship between Type D personality and medication adherence.²¹⁻²⁴ In these studies, Type D personality was associated with poor medication adherence in patients with myocardial infarction (MI),²² acute coronary syndrome (ACS),²¹ asthma,²³ and HF.²⁴

It is not known, however, why patients with Type D personality are more likely to be non-adherent to their prescribed medication. Self-efficacy is frequently found to be associated with health-related behaviors.²⁵ Self-efficacy refers to an individual's perception of their ability to perform a specified behavior or set of behaviors in order to produce desired outcomes.²⁶ For example, high self-efficacy is associated with better medication adherence.²⁷⁻³³ According to Social Cognitive Theory, there is a direct correlation between performance of a behavior and a person's perceived self-efficacy.²⁶ Adults with chronic illnesses who have high levels of self-efficacy are more likely to perform self-management behaviors appropriately.³³ Moreover, there is evidence of a mediating role of self-efficacy. Investigators have demonstrated that self-efficacy mediated the relationship between

depressive symptoms and medication adherence in 167 African Americans with hypertension,²⁷ and between depressive symptoms and adherence to the recommended self-care regimen in 56 patients with Type 2 diabetes.³⁴ Thus, it is plausible that patients with Type D personality may be less likely to adhere to their prescribed medication than their non-Type D counterparts because they have lower medication self-efficacy.

However, it is unknown if medication self-efficacy, a modifiable predictor of medication adherence, mediates the relationship between Type D personality and medication adherence in patients with HF. Based on empirical findings from the current literature and theoretical support from the Social Cognitive Theory, the purpose of our study was to examine the relationships among Type D personality (and its components [NA and SI]), medication self-efficacy, and medication adherence in patients with HF in order to determine whether medication self-efficacy is a mediator between Type D personality (and its components [NA and SI]) and medication adherence in this patient population.

Methods

Study Design

This was a secondary analysis of baseline data of a randomized controlled trial (RCT) in patients with HF. The original RCT was to determine whether an educational counseling intervention improved medication adherence and cardiac event-free survival.³⁵

Demographic, clinical, and psychological data were collected before randomization by interview, questionnaires, and medical record review.

Sample and Setting

Detailed eligibility criteria and recruitment methods have been published previously.^{24,35} Briefly, we recruited patients from the outpatient cardiology clinic and inpatient hospitals from the Southern region of the United States. Patients with a confirmed diagnosis of chronic HF who did not change dosage or types of HF medications prescribed by their physician as verified in their medical record were enrolled in the study. We excluded patients with obvious cognitive impairment (as defined by inability to understand the informed consent process or participate in an interview) and any co-existing terminal illness (e.g., end stage renal disease or advanced cancer).

Measurement of Variables

Independent variable: Type D personality—Type D personality was assessed using the Type D Scale (DS-14),³⁶ a 14-item questionnaire that includes items such as whether patients would describe themselves with phrases such as, “I am a closed person” and “I often feel unhappy.” The items were answered on a 5-point Likert scale. Seven items reflect negative affectivity (NA), and seven items reflect social inhibition (SI). Total scores for the NA and SI subscales can range from 0 to 28 to assess these personality traits. People who scored 10 points or more on both the NA and SI subscales were classified as Type D personality. The DS-14 is a reliable and valid instrument that has been used to measure Type D personality in patients with hypertension,³⁶ MI,²² and HF.^{4,12,37} In this study, Cronbach's alpha was .86 and .82 for the NA and SI subscales, respectively.

Outcome variable: Medication adherence—Medication adherence was defined as the extent to which the patient's medication-taking behavior corresponded with the medication regimen prescribed by their healthcare provider.³⁸⁻⁴⁰ The Morisky Medication Adherence Scale [MMAS-4] was used to assess medication adherence.⁴¹ Patients were asked to answer four items (yes [score = 1], no [score = 0]) assessing whether or not they missed taking any of their medications under four situations over the last month. The scores range from 0 to 4; higher scores indicate poorer medication adherence. The MMAS-4 demonstrated relative low, but acceptable internal consistency (Cronbach's $\alpha = .61$). It is important to note that our Cronbach's α is the same as demonstrated when the scale was initially used in patients with hypertension.⁴¹ The MMAS-4 has been used previously to measure medication adherence in patients with HF.⁴²

Mediator: Medication self-efficacy—In this study, self-efficacy was defined as medication self-efficacy, which was assessed using the Self-Efficacy for Appropriate Medication Use Scale (SEAMS).²⁸ Proponents of Social Cognitive Theory suggest use of a measure that specifically targets self-efficacy in relation to a specific behavior that will better represent the self-efficacy belief.²⁶ Patients were asked to answer the stem of “how confident are you that you can take your medicines correctly” for 13 situations (e.g., when you are away from home, when your normal routine gets messed up). Each situation is scored using 1 of the following 3 options: not confident (score = 1), somewhat confident (score = 2), or very confident (score = 3). The scores of the 13 items are summed for a total score of 13-39; higher scores indicate higher medication self-efficacy. The SEAMS is a reliable (Cronbach's $\alpha = .89$) and valid scale that has been used across different literacy levels in patients with chronic diseases.²⁸

Other variables of interest—Age,⁴³ gender,^{43,44} left ventricular ejection fraction (a measure of ventricular function),^{45,46} and comorbidity (using the Charlson Comorbidity Index),^{47,48} were collected as covariates from medical records or patient interview. These covariates were chosen as they might influence medication adherence. We also collected patients' marital status, length of time with HF diagnosis, body weight and height to calculate body mass index (BMI), New York Heart Association functional classification (NYHA), prescribed medications including angiotensin-converting enzyme inhibitor, and beta-antagonist from patient interview and medication records to characterize patients. BMI was calculated as weight (kg)/height (m²).

Procedure

Approval to conduct the original RCT was obtained from the Institutional Review Board. The review board at the primary author's current institution approved the secondary data analyses as an exempt protocol. Patient eligibility was confirmed by a trained nurse who then explained study requirements to patients and invited them to participate. After obtaining informed consent, patients' demographic and clinical characteristics were collected by interview and medical record review, and patients completed the DS-14, MMAS-4, and SEAMS. We collected data before randomization to ensure that these data were not influenced by patients' knowledge of the group to which they were randomized.

Data Analysis

All data analyses were performed using SPSS (Chicago, IL), version 22.0, 2014; an alpha level of 0.05 was used. Data analysis began with a descriptive examination of all variables, including frequency distributions, means, standard deviations, medians, and interquartile ranges, as appropriate to the level of measurement of the variables. Medication adherence was analyzed as a continuous variable. Pearson's correlation was used to examine the relationship between medication adherence and medication self-efficacy. In this study we analyzed Type D as a categorical variable by dichotomizing patients into Type D personality or non-Type D personality using the cutpoint of 10 on the NA and SI subscales as has been done in most studies of Type D personality.^{3,4,12,49} Normal distributions for independent and dependent variables were confirmed by histogram, and assessment of skewness and kurtosis ($-2 < \text{skewness} < +2$), thereby indicating no violation of the normality assumption of linear regression. In the regression models, we also performed multicollinearity tests to evaluate this assumption of regression. There were no issues with multicollinearity as all variance inflation factors were < 8 .

To test whether medication self-efficacy was a mediator of the relationship between Type D personality and medication adherence, a series of regression analyses were conducted before and after adjusting for demographic (age, gender) and clinical (LVEF and comorbidities) factors. The test for mediation followed the paths outlined by Baron and Kenny.⁵⁰ We tested four regression models to examine the mediator effect as shown in Figure 1.

We also conducted sensitivity analyses by analyzing Type D personality as a continuous variable in the multiple regression and mediation models.

Results

Patient Characteristics

Detailed patient characteristics have been published previously.²⁴ Briefly, a total of 84 patients with HF were included in this study. More than half of the patients were male. About one quarter of the patients was African Americans. The average length of time of HF diagnosis was 87 ± 74 months. The mean LVEF was $38\% \pm 14.2\%$. More than half of the patients were married (58%). The majority of patients were taking ACE inhibitors (70%) and beta-blocker (95%).

Type D personality, Medication Self-efficacy, and Medication Adherence

The mean (SD) total score of medication self-efficacy was 35.3 (5.0). Patients with Type D personality had a lower score on medication self-efficacy than those without Type D personality (32.2 vs. 36.3, $p = .023$). Higher scores on medication self-efficacy was correlated with better medication adherence ($r = .470$, $p < .001$). About half (48%) of the patients in this study reported that they missed taking some of their medications. Type D personality was associated with medication adherence in that patients with Type D personality had poorer medication adherence compared with those without Type D personality.²⁴ In multiple linear regression, Type D personality was associated with

medication adherence before and after adjusting for age, gender, LVEF, and comorbidities factors ($p = .027$ and $.05$, respectively).

Mediation Analysis

In a series of regression analyses, medication self-efficacy was demonstrated to mediate the relationship between Type D personality and medication adherence based on the following sequence of regression analyses. First, in Path A (Table 1, Figure 1), Type D personality independently predicted medication self-efficacy ($\beta = .356$, $p = .023$). Second, in Path B, medication self-efficacy was associated with medication adherence ($\beta = -.47$, $p < .001$). Third, in Path C, Type D personality predicted medication adherence ($\beta = -.24$, $p = .027$). In the final Path D, Type D personality was no longer a significant predictor of medication adherence when medication self-efficacy was entered into the model ($\beta = -.084$, $p = .422$). After adjusting for age, gender, LVEF, and comorbidity, medication self-efficacy still mediated the relationship between Type D personality and medication adherence (Table 1).

In addition to Type D personality, we also performed mediation analysis to examine whether medication self-efficacy mediated the relationship between the Type D components of NA and SI and medication adherence. In Path A, both NA and SI predicted medication self-efficacy ($p = .001$ and $.039$, respectively). In Path B, medication self-efficacy was associated with medication adherence ($p < .001$). In Path C, only NA (but not SI) predicted medication adherence ($p = .044$). In the final Path D, NA was no longer a significant predictor of medication adherence when medication self-efficacy was entered into the model ($p = .417$). Medication self-efficacy mediated the relationship between NA and medication adherence even after adjusting for age, gender, LVEF, and comorbidity (Table 2).

Sensitivity Analysis

When Type D personality was analyzed as a continuous variable, we had similar results. Type D personality predicted medication self-efficacy in Path A ($\beta = -.493$, $p < .001$). In Path C, Type D personality was associated with medication adherence before and after adjusting for the same covariates ($\beta = .276$, $p = .011$ and $\beta = .267$, $p = .019$, respectively). In the final Path D, Type D personality was no longer a significant predictor of medication adherence when medication self-efficacy was entered into the model ($\beta = .058$, $p = .609$ and $\beta = .074$, $p = .527$, respectively).

Discussion

In this study, we explored the associations among Type D personality, medication self-efficacy, and medication adherence in patients with HF in order to investigate self-efficacy as a potential mechanism linking Type D personality with poor medication adherence. Self-efficacy is critical for patients with HF^{27,31} in order to promote better medication adherence. Prior investigators have shown that patients with higher self-efficacy were more adherent to their prescribed medication.²⁷⁻³² We expanded on these findings by demonstrating that medication self-efficacy mediated the relationship between Type D personality and medication adherence. Type D personality is a distressed personality state that is not likely to change.²¹ Thus, it is helpful to understand that the link between Type D personality and

poor medication adherence may be uncoupled by improving self-efficacy, which is modifiable.

Our findings about the mediating role of self-efficacy in patients with HF are consistent with those of similar studies.^{21,27,31,34,51} In these studies, self-efficacy mediated the relationship between depressive symptoms or Type D personality and medication adherence among hypertensive patients,²⁷ in patients with type 2 diabetes,³⁴ and in patients with MI.²¹

Demonstration of mediation by medication self-efficacy of the relationship between Type D and medication adherence provides a valuable opportunity for future intervention work. A few intervention studies had demonstrated the effectiveness of self-efficacy training interventions on health behaviors.⁵²⁻⁵⁴ Specifically, Lorig and colleagues⁵² tested a self-management, self-efficacy-enhancing intervention which was effective in improving health behaviors, health status, and reduced emergency department visits. Fu and colleagues⁵⁴ found that the Chronic Disease Self-Management Program, which is based on self-efficacy theory, improved amount of aerobic exercise performed, cognitive symptom management, and health status in Chinese patients with chronic diseases. Likewise, Tsay⁵³ reported better fluid restriction adherence after self-efficacy training in patients with end-stage renal disease. Our findings, in conjunction with prior researchers' findings, support the importance of self-efficacy for self-care behaviors and provide a potential intervention strategy to improve self-management adherence in patients with chronic diseases.

Self-efficacy is likely a strong mediator of the relationship between Type D personality and medication non-adherence for a number of reasons. Based on social cognitive theory, individuals develop self-efficacy from four sources: enactive attainment (individuals' prior mastery experiences of that behavior), vicarious experience (individuals view others' experiences), verbal persuasion (direct encouragement or discouragement from another person), and physiological state (individuals' perception of their physiological signs of distress: shakes, fatigue, fear).²⁶ The aforementioned intervention studies⁵²⁻⁵⁴ incorporated guided mastery of skills through weekly action planning and feedback of progress, modeling of behaviors, problem-solving strategies, reinterpretation of symptoms, and social persuasions through group support to enhance participant's sense of personal efficacy in their intervention program. However, it is not clear whether one or all of the active components of these self-efficacy enhancing interventions are needed.

This study has limitations that must be considered in interpreting the results. First, the sample size is small, and may produce unstable results in multiple regression models. Thus, these findings need confirmation in a larger sample. Second, although the DS-14 is a reliable measure of Type D personality, the use of potentially artificial cutpoints to dichotomize patients into Type D and non-Type D personality groups may result in spurious findings.^{55,56} However, in the sensitivity analysis, when Type D personality was analyzed as a continuous variable, the same results were found, strongly suggesting that the cutpoint is valid. Third, medication adherence was measured only by self-report, a method that is subject to recall bias and social desirability.⁵⁷ Finally, the study is based on cross-sectional data. Therefore, causality cannot be implied. Regardless, the findings from this study

provide important information related to the nature of the relationships among Type D personality, self-efficacy, and medication adherence in patients with HF.

Conclusion

Using the Baron and Kenny analytic framework of mediation, we found among HF outpatients, that Type D personality is associated with poor medication adherence, and that this association is explained by medication self-efficacy. If the finding of this study is confirmed in a larger sample, it is crucial to develop and apply interventions to enhance medication self-efficacy for patients who have Type D personality to improve medication adherence and subsequent outcomes.

Acknowledgments

source of funding: This study was supported by funding from was supported by the Philips Medical-American Association of Critical Care Nurses Outcomes Grant (Jia-Rong Wu, principal investigator), American Heart Association Great River Affiliate Post-doctoral Fellowship to Jia-Rong Wu, the National Institute Of Nursing Research of the National Institutes of Health under Award Number K23NR014489 (Jia-Rong Wu, principal investigator), and a Center grant to the University of Kentucky, College of Nursing from NIH, NINR, 1P20NR010679 (Debra Moser, principal investigator). Funding agents have no role in study design; in the collection, analysis and interpretation of data; in the writing of the report; and in the decision to submit the article for publication.

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Highlights

- Medication adherence was worse in Type D patients than in non-Type D patients.
- Type D patients had lower self-efficacy compared with non-Type D patients.
- Self-efficacy mediates the relationship between Type D and medication adherence.
- Interventions to increase medication self-efficacy for Type D patients are needed.

Figure 1. Self-efficacy is a mediator between Type D personality and medication adherence
 Path A: Test of whether Type D personality is a predictor of medication self-efficacy.
 Path B: Test of whether medication self-efficacy is a predictor of medication adherence.
 Path C: Test of whether Type D personality is a predictor of medication adherence.
 Path D: Test of whether Type D personality and medication self-efficacy together are predictors of medication adherence.

Table 1
The Association of Type D Personality[¶], Medication Adherence[§], and Self-efficacy (N = 84)

Variable	Unadjusted			Adjusted		
	β	95% CI	p	β	95% CI	p
Model 1 (without medication SE) Type D personality [¶]	-.241	-.919 - -.056	.027*	-.225	-.909 - -.001	.05***
Model 2 (with medication SE) Type D personality [¶]	-.084	-.591 - .425	.422**	-.092	-.626 - .452	.400****
Medication SE	-.440	-.112 - -.768	< .001	-.411	-.107 - -.715	< .001

CI = confidence interval; SE = self-efficacy;

[§] Outcome: medication adherence as measured by the Morisky Medication Adherence Scale-4

[¶] Type D personality was coded as 1; non-Type D personality was coded as 2

* F = 5.059, p = .027

** F = 11.906, p < .001

*** F = 2.588, p = .032. Adjusting for age, gender, left ventricular ejection fraction, and comorbidity

**** F = 5.097, p < .001. Adjusting for age, gender, left ventricular ejection fraction, and comorbidity

Table 2
Negative Affectivity[¶], Social Inhibition, Medication Adherence[§], and Self-efficacy (N = 84)

Variable	Unadjusted			Adjusted		
	β	95% CI	p	β	95% CI	p
Model 1 (without medication SE)						
Negative Affectivity [¶]	-.240	-.865 - -.013	.044*	-.255	-.906 - -.025	.039***
Social Inhibition [#]	-.057	-.506 - .306	.625	-.057	-.418 - .388	.940
Model 2 (with medication SE)						
Negative Affectivity [¶]	-.093	-.583 - .244	.417**	-.122	-.651 - .204	.300*****
Social Inhibition [#]	.001	-.374 - .378	.991	.039	-.308 - .443	.722
Medication SE	-.434	-.112 - -.038	< .001	-.405	-.107 - -.033	< .001

CI = confidence interval; SE = self-efficacy;

[§] Outcome: medication adherence as measured by the Morisky Medication Adherence Scale-4

[¶] Negative affectivity was coded as 1; non- negative affectivity was coded as 2

[#] Social Inhibition was coded as 1; non- negative affectivity was coded as 2

* F = 3.160, p = .048

** F = 7.882, p < .001

*** F = 2.384, p = .036. Adjusting for age, gender, left ventricular ejection fraction, and comorbidity

**** F = 4.387, p < .001. Adjusting for age, gender, left ventricular ejection fraction, and comorbidity