

Self-efficacy mediates the relationship of depressive symptoms and social support with adherence in patients with heart failure

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Abstract

Poor self-care is common among adults with heart failure and leads to poor health outcomes. Low self-efficacy, depression, and low social support are associated with poor self-care, but knowledge about these relationships in heart failure is limited. Secondary data analysis of cross-sectional data from 346 adults with heart failure measuring self-efficacy, depressive symptoms, social support, and self-care adherence was conducted. Tests of mediation using multiple linear regressions indicate that self-efficacy fully mediates the relationships between depression and adherence, and social support and adherence. Bolstering self-efficacy may have a greater impact on self-care adherence than targeting either depression or social support alone.

Keywords

adherence, depression, heart, self-efficacy, social support

Introduction

Heart failure (HF) affects more than 5 million Americans (Go et al., 2013), approximately 15 million worldwide (American Heart Association (AHA), 2004) and is the fastest growing cardiovascular condition (Jessup and Brozena, 2007). Approximately half of all patients diagnosed with HF will die within 5 years of diagnosis (Roger et al., 2004) and HF is the number one cause of hospitalizations in US adults older than 64 years (Jencks et al., 2009). Patients with chronic conditions, including HF, provide as much as 95 percent of their own care (Ilioudi et al., 2010); thus, optimizing self-care is critical for improving HF patient

outcomes. Some examples of HF self-care include performing daily weights, monitoring HF symptoms daily, and taking medications as prescribed, all of which are essential components for optimizing health outcomes. However, low adherence to self-care recommendations is common among adults with HF, with a recent

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study reporting that less than 40 percent had “good” adherence on a cumulative adherence scale and only 9 percent had good adherence on all behaviors (Marti et al., 2013). Poor self-care adherence leads to worse patient outcomes (Jovicic et al., 2006; McAllister et al., 2001) and is a common cause of hospital readmissions for HF (Annema et al., 2009; Lainscak et al., 2011; Murray et al., 2009). Of the many factors that can influence self-care adherence in adults with HF, self-efficacy (Schweitzer et al., 2007), social support (Wu et al., 2008), and depression (Dekker, 2014; McMurray et al., 2012) have been identified as some of the most significant predictors of self-care adherence in this population. This study aims to explore the relationships between these predictors to identify pathways by which they influence self-care adherence behaviors.

Background

Self-efficacy is the core construct of social cognitive theory and is defined as a person’s belief in his or her ability to succeed in a particular situation (Bandura, 1977, 1994). The self-efficacy theory asserts that an individual’s health outcomes are influenced by their perceived confidence in their ability to perform certain tasks or behaviors (Bandura, 1977, 1994); thus, self-efficacy is critical for successful self-management of a chronic condition such as HF (Clark et al., 1991; Dickson et al., 2008; Lorig and Holman, 1993). The higher one’s perceived self-efficacy for a given health behavior, the more likely he or she is to perform that behavior. For example, in a study among adults with HF, self-efficacy strongly predicted medical and lifestyle adherence behavior (Schweitzer et al., 2007). It is important to note that although the terms “self-efficacy” and “confidence” are often used interchangeably in the published literature, conceptually they are different in that the theory-based construct of self-efficacy differs from the colloquial term “confidence” (Bandura, 1997). However, because the vast majority of the literature refers to self-efficacy while using scales with “confidence” in the stem (including

the self-efficacy measure used in this study), the authors agreed that for the purposes of this study and the clinical implications (e.g. confidence vs self-efficacy would have similar effects on health behaviors), these concepts were not operationally differentiated in this study.

Other important factors that can influence health behaviors include social support and depressive symptoms. Social support, defined as the perception of support received from family, friends, or significant others (Zimet et al., 1988), is associated with self-management behaviors such as medication adherence (Wu et al., 2008) with better adherence when greater perceptions of support are present. Depression is also strongly correlated with adherence, as patients who are depressed are three times more likely to be non-adherent to treatment recommendations than a patient who is not depressed (DiMatteo et al., 2000). While the individual influence of these predictors on adherence is well established, the interrelationships are less well-understood.

Self-efficacy, social support, and depression are strongly correlated with each other, such that depression is associated with both self-efficacy (Sarkar et al., 2009) and social support (Chung et al., 2011) and self-efficacy and social support are associated with each other (DiIorio et al., 1996). Some experts suggest that self-efficacy is the mechanism through which self-management works (Lorig and Holman, 2003), and as such, it is the most critical ingredient for successful self-management (Clark et al., 1991), while other predictors, such as depression and social support, may influence adherence indirectly through self-efficacy (Gallant, 2003). Empirical evidence supports this assertion in other populations where self-efficacy has been found to mediate the relationship between social support and depression with adherence in adults with diabetes (Sacco et al., 2005) and hypertension (Schoenthaler et al., 2009). However, studies investigating this in persons with HF are lacking.

A better understanding of mechanisms or pathways by which predictors influence adherence behaviors is an important step toward

improving self-care and ultimately health outcomes in adults with HF as it could facilitate more targeted and cost-effective interventions. Thus, the purpose of the current investigation was to determine whether self-efficacy mediates the relationships of depressive symptoms and social support with self-care adherence in a large sample of non-hospitalized adults with HF.

Methods

Design and sample

This study was a cross-sectional, secondary analysis of patient data from a registry of HF patients collected between 1999 and 2009; details on this registry have been published previously (Riegel et al., 2002, 2008). The sample in this study ($N = 346$) comprised patients who were assessed for depressive symptoms, perceived social support, self-efficacy related to HF self-care, and adherence to HF self-care.

Patients were eligible to be included in the original studies if they were outpatient, had a diagnosis of chronic HF associated with either reduced or preserved ejection fraction, were stable on optimal HF medications for 3 months, and were English-speaking. Exclusion criteria included myocardial infarction or unstable angina within the past 3 months, cognitive impairment that prohibited informed consent, or living in a skilled nursing facility.

Protocol

Each of the original studies obtained institutional review board approval. Research staff recruited patients in the outpatient clinic setting, and patients completed written informed consent and assessments at a research center. After each study was completed, data were completely de-identified and entered into the registry database at the first author's institution; the review board at this institution also approved all secondary data analyses from the HF Quality of Life registry as an exempt protocol.

Measures

The survey contained standard demographic and clinical characteristics, including age, gender, race/ethnicity, marital status, and education. Based on a clinical interview, New York Heart Association (NYHA) Functional Classification was used to measure functional status. The Charlson Comorbidity Index (CCI; Charlson et al., 1987, 1994) was used to measure comorbidities; the scoring assigns a score of 1, 2, 3, or 6 to each of 22 conditions, and the sum of these makes up the total CCI score.

Depressive symptoms. The 21-item Beck Depression Inventory-II (BDI-II; Beck et al., 1996) was used to measure depressed mood and psychophysiologic indicators of depression. Each item is rated according to how frequently it was experienced in the past week, with ordinal response options ranging from 0 = "Rarely or none of the time" to 3 = "Most or all of the time." The total score potentially ranges from 0 to 63, with higher scores indicating greater depressive symptoms. Cronbach's alpha for this sample was .88.

Social support. The Multidimensional Perceived Social Support Scale (MPSS; Blumenthal et al., 1987) is a 12-item self-report scale that assesses perceived social support from family, friends, or others. Items are rated on a 7-point Likert scale from 1 ("very strongly disagree") to 7 ("very strongly agree"). The total score can range from 12 to 84 with higher values indicating greater perceived social support (PSS) from family, friends, or significant others. Cronbach's alpha for this sample was .95.

Self-efficacy. The 15-item Self-Care of Heart Failure Index (SCHFI) confidence subscale (Riegel et al., 2004) is a 15-item self-report measure of self-care over the previous 3 months in persons with HF; it assesses one's confidence in his or her ability to manage their illness. It consists of three subscales (self-care maintenance, management, and confidence); these are considered separately and are not summed. In

this analysis, we used the self-care confidence score, which comprises 6 items rated on a 4-point scale ranging from “never” to “always,” to measure self-efficacy. Scores were standardized to a 0 to 100 range with higher scores indicating greater self-efficacy (or confidence). Cronbach’s alpha in this sample was .86.

As previously mentioned, there is conceptual ambiguity in the published literature between “confidence” and “self-efficacy.” The vast majority of the published literature has used these terms interchangeably, describing self-efficacy while also using the terms confidence in the measurement and discussion, including the creators of the SCHFI (Dickson et al., 2013a; Vellone et al., 2013). After an extensive literature search, the authors were unable to identify a rationale for or discussion about the distinctions between these two concepts when measuring self-efficacy (by the creators of the SCHFI or others), and thus, the authors chose to include the SCHFI as a proxy for self-efficacy in this secondary data analysis. The authors acknowledge this ambiguity as a limitation and encourage future investigations to delve further into the conceptual and operational differences and the impact of this in the application at the patient level. However, for the purposes of this study, the authors agreed that the clinical implications are the same despite semantic differences because a patient’s confidence in his or her ability to follow treatment advice and evaluate the importance of his or her symptoms, for example, will impact his or her health behaviors, and areas of low confidence or low self-efficacy need to be targeted by individual practitioners and interventions.

Self-care adherence. The Medical Outcomes Study (MOS) Specific Adherence Scale is a self-reported adherence measure that was developed for use with patients with diabetes, hypertension, and heart disease. We considered using the SCHFI maintenance and management subscales (Riegel et al., 2004) as the measure of adherence in this population since we used the SCHFI self-care confidence scale; however, the

SCHFI maintenance scale was revised during our data collection period and different versions of the SCHFI maintenance scale were used for the different patients in the registry, which would have diminished our available subject pool. Because the MOS has also been found to be a valid and reliable measure of adherence in patients with HF and was used consistently across all patients in this analysis, we chose to use this for the current investigation. We used the items in the MOS that assessed heart-disease-specific activities for HF patients: (1) following a low salt diet, (2) taking prescribed medications, (3) exercising regularly, (4) cutting down on smoking, or not smoking, (5) drinking one or less alcoholic beverage per day, (6) following a low fat diet, (7) monitoring HF symptoms every day, and (8) performing daily weights. Items are rated on a 5-point Likert scale from 0 (none of the time) to 5 (all the time) in response to a question about how often they have done the activity in the past 4 weeks. Total scores were averaged and transformed linearly to a 0 to 100 scale. Cronbach’s alpha for this sample was .64.

Data analysis

Descriptive statistics, including means and standard deviations (SDs) or frequency distributions, were used to summarize the study data and to look for missing or out-of-range values. Because 93 percent of those who selected a racial category other than “White” were “African American,” the two retained categories were “White” and “Minority.” Marital status was used as a dichotomous indicator, with “married” or “cohabitating” in one of the groups versus other non-married categories (including “divorced,” “widowed,” and “never married”) in the other. A binary indicator distinguished those with at most a high school degree versus those who had post-secondary education. For NYHA class, given that only 8 percent of the participants were in each of the two extremes, the variable was dichotomized to I/II versus III/IV for analysis. Associations among depressive symptoms, self-efficacy, social support, and

Table 1. Tests of mediation for the relationships of depressive symptoms and social support as they predict total adherence ($n = 342$).^a

Predictor	Potential mediator	Outcome	Std β for predictor	p -value	Sobel test p -value
1. Self-efficacy mediates the effect of depressive symptoms on adherence					
Depressive symptoms		Self-efficacy	-0.25	<.0001	
Depressive symptoms		Adherence	-0.15	.01	
Self-efficacy		Adherence	0.34	.006	
Depressive symptoms	Self-efficacy	Adherence	-0.065	.2	<.0001
2. Self-efficacy mediates the effect of social support on adherence					
Social support		Self-efficacy	0.21	.0003	
Social support		Adherence	0.14	.02	
Self-efficacy		Adherence	0.34	<.0001	
Social support	Self-efficacy	Adherence	0.065	.2	.0002

^aControl variables included in each model were as follows: age, gender, race/ethnicity (White vs non-White), marital status, education, New York Heart Association (NYHA) class (I/II vs III/IV), and Charlson total comorbidity score; although each variable had few missing values, the regression models were based on only participants with complete responses for all included variables, so sample sizes for these ranged from 336 to 342.

adherence were assessed using Pearson's product moment correlation.

Multiple regression analysis was used to test whether self-efficacy mediated the relationship between depressive symptoms and adherence and between social support and adherence, using the four-step method described by Baron and Kenny (1986). The four necessary steps for establishing mediation in this study included the following: (1) the predictor variable (in this case, depressive symptoms or social support, since both models were investigated) is a significant predictor of the mediator variable (i.e. self-efficacy), (2) the predictor variable is a significant predictor of the outcome variable (i.e. adherence), (3) the mediator is a significant predictor of the outcome, and (4) when both the mediator and the predictor are included in the same regression as potential predictors of the outcome, the latter is no longer significant. The Sobel test was performed to assess the statistical significance of the indirect effect of the mediator in each of the mediation models (Sobel, 1982). This test determines the significance of the reduction in the impact of the predictor variable (depressive symptoms or social support) on the dependent variable (adherence) when the mediator (self-efficacy) is included in

the regression. For each test of mediation, the Preacher and Hayes (2008) bootstrapping algorithm for the estimation of the p -value for Sobel test was used with 5000 iterations.

Multiple regression standardized beta weights were used to summarize the direct and indirect effects (the latter through self-efficacy) of depressive symptoms and social support on adherence. Each regression model included as controls age, gender, race/ethnicity (White vs Minority), marital status (married/cohabitating vs other), education (at most high school vs post-secondary), NYHA class (I/II vs III/IV), and Charlson total comorbidity score. These covariates were chosen because they are the known demographic and disease-specific indicators that may be most closely aligned with outcomes. Data analysis was conducted using SAS, v. 9.3; an alpha level of .05 was used.

Results

Most participants were male (71%), White (81%), and married or cohabitating (55%; see Supplementary Table 1). More than half had some level of post-secondary education (56%). In all, 52 percent of the sample had an NYHA class of I or II, with the remainder in the III/IV

category. The average age of the sample was 60.4 years ($SD = 11.8$ years), and participants ranged from 24 to 97 years in age. The mean Charlson comorbidity score was 3.2 ($SD = 1.9$), and scores in this sample ranged from 0 to 9. On average, this sample had low depressive symptoms ($\bar{x} = 10.4$, $SD = 8.5$), high perceived social support ($\bar{x} = 66.5$, $SD = 18.1$), moderate self-efficacy beliefs ($\bar{x} = 57.6$, $SD = 20.1$), and low adherence scores ($\bar{x} = 25.3$, $SD = 7.3$; see Supplementary Table 2).

Correlations among predictor, mediator, and dependent variables

As shown in Supplementary Table 2, there was a relatively strong negative correlation between depressive symptoms and social support ($r = -.35$). The correlations between self-efficacy and each of the depressive symptoms and social support were not quite as strong, but still significant with $p < .0001$. The weakest correlations were between adherence and each of the depressive symptoms and social support ($r = .18$ for both), while self-efficacy and adherence had a relatively strong positive correlation ($r = .37$).

Self-efficacy as a potential mediator between depressive symptoms and adherence

As shown in the first block of Table 1, depressive symptoms predict both self-efficacy and adherence, with p -values $\leq .01$, so the first two requirements for mediation were met. In addition, self-efficacy is predictive of adherence ($p = .006$; the third requirement was met). The final requirement for complete mediation was also met: self-efficacy mediates the relationship between depressive symptoms and adherence, since the inclusion of self-efficacy in the final model in the top half of Table 1 decreases the significance of depressive symptoms as a predictor of adherence to $p = .2$. The indirect effect of depressive symptoms on adherence through self-efficacy is -0.085 (see Figure 1), while the direct effect is -0.065 . The Sobel test for this

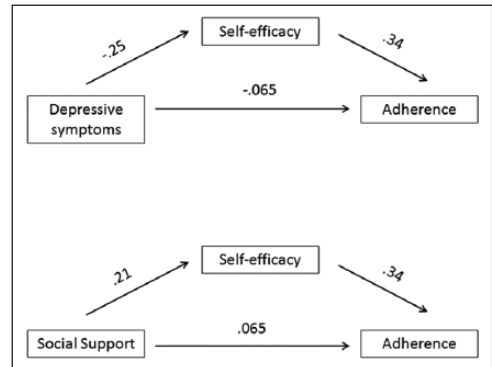


Figure 1. Direct and indirect effects of depressive symptoms and social support on adherence.

mediation model has a very small p -value ($p < .0001$), further demonstrating the significant indirect (mediator) effect of self-efficacy between depressive symptoms and adherence.

Self-efficacy as a potential mediator between social support and adherence

Social support predicted self-efficacy and adherence in separate regressions; in addition, self-efficacy was a significant predictor of adherence ($p < .02$ for each prediction effect; see lower half of Table 1). Together, these three models demonstrate that the first three requirements for complete mediation were met. In the model, with adherence on both social support and self-efficacy, social support is no longer significant ($p = .2$). This indicates that the final requirement for complete mediation was met. As shown in Figure 1, the indirect effect of social support on adherence via self-efficacy is 0.071 , and the direct effect is equal to 0.065 . The significant mediation effect is confirmed with the Sobel test; the p -value for the indirect effect between social support and adherence via self-efficacy is equal to $.0002$.

Discussion

In this study, we found that self-efficacy mediated the relationships between depression and

adherence and between social support and adherence in our sample of adult patients with HF. To date, few previous investigators have evaluated the relationships between self-efficacy, social support, and adherence in patients with HF (Cené et al., 2013; Maeda et al., 2013; Riegel and Dickson, 2008) and only one other study has evaluated the relationships between depression, self-efficacy, and adherence in this population (Maeda et al., 2013). Our findings are consistent with the findings from these previous studies despite differences in methods and measures and provide further evidence supporting the conceptual relationships and the premier role of self-efficacy for self-care adherence.

Our results suggest that even if a patient has high depressive symptoms and/or low perceived social support, we may still be able to improve HF self-care adherence and ultimately health outcomes by targeting self-efficacy. Since depression and social support are two variables frequently targeted in interventions to improve self-care adherence in patients with HF (DiMatteo, 2004; DiMatteo et al., 2000; Graven and Grant, 2013; Van der Wal et al., 2006), this finding has important research and practice implications. Because of the increased morbidity and mortality and healthcare utilization associated with poor self-care adherence (Jovicic et al., 2006; Lainscak et al., 2011; McAllister et al., 2001), the most important predictors of adherence need to be identified and targeted in practice as well as in research endeavors. If self-efficacy is indeed the mechanism through which self-management works (Lorig and Holman, 2003), this helps explain why self-efficacy is an independent predictor of HF hospitalizations and all-cause mortality, independent of depressive symptoms (Sarkar et al., 2009). Our investigation provides additional evidence to suggest that efforts to improve self-efficacy for HF care may influence engagement in adherence behaviors more effectively than efforts to increase social support or decrease depressive symptoms; thus, self-efficacy must be a key component of HF disease management programs.

Further investigations are needed to determine the best interventions to improve self-efficacy so that adherence and health outcomes may be bolstered, regardless of level of depression and social support. Furthermore, research is needed to evaluate other variables known to influence adherence such as control (Huang et al., 2013) and health beliefs (Van der Wal et al., 2006), so that we can determine whether self-efficacy continues to act as a mediator when evaluated with other known predictors of adherence behaviors. Also, researchers are beginning to explore the role of resilience in patients with HF (Lossnitzer et al., 2014), which as a component of self-efficacy is an interesting area for future study.

Another important area for further investigation is the impact of self-efficacy on selective adherence and whether certain adherence behaviors are more susceptible to perceptions of self-efficacy or depression or social support. For example, persons with HF who are depressed are significantly less adherent with medications (Marti et al., 2013; Morgan et al., 2006). Investigators have found that more than 90 percent of persons with HF demonstrate selective adherence (Marti et al., 2013) and that persons with HF tend to have less difficulty taking medications as prescribed and keeping appointments and the most difficulty following exercise and daily weight recommendations (Van der Wal et al., 2006). Studies evaluating the impact of HF self-management support interventions on patient outcomes typically are unable to demonstrate significant effects (Powell et al., 2010), which could be related to selective adherence (Marti et al., 2013).

Along these same lines, the relationships between certain types of adherence and certain psychosocial predictors of adherence should be explored. Many investigators focus on medication adherence as the primary adherence measure for patients with HF; however, despite the complexity of the medication regimen, patients with HF tend to be most adherent to medications and least adherent to other recommended behaviors including low salt diet, fluid restriction, daily weights, and activity (Van der Wal

et al., 2005). It is possible that self-efficacy has an even stronger relationship with lifestyle modifications of diet and exercise which are arguably more difficult to change and which may be why patients are less adherent in these areas. Additionally, further investigation into the design of more feasible interventions that are less resource and time intensive while still providing high yield and being patient centered are needed. To date, most HF interventions have had low patient engagement (Heisler et al., 2013; Riegel and Carlson, 2004) and thus fail to show success despite how effective the intervention may truly be, since if patients do not receive it then behavior change is unlikely to occur. Investigating ways to incorporate self-management support by focusing on self-efficacy during a regularly scheduled office visit is an important area for future research. Investigators have demonstrated that self-efficacy can be improved through brief encounters focused on promoting self-efficacy for adhering to a prescribed treatment regimen (Buss, 2009). Motivational interviewing is one such strategy that offers effective, yet brief, high-yield patient-centered interventions that could be delivered in acute and ambulatory care settings by any member of the healthcare team, from a licensed provider (e.g. physician, nurse practitioner, physician assistant) to unlicensed medical personnel who have been trained in this technique. Furthermore, this focused attention on self-efficacy during a routine office visit is likely to result in greater patient engagement than interventions that are more time and resource intensive, requiring more action on the part of the patients (Heisler et al., 2013; Riegel and Carlson, 2004). Longitudinal studies comparing a brief motivational interviewing-based intervention to more typical self-management support interventions, evaluating effects on self-care adherence as well as patient engagement, is an important next step.

Finally, future investigators should be aware of the conceptual ambiguity in the published literature related to the terms *self-efficacy* and *confidence* and of the fact that the theory-based construct of self-efficacy differs from the

colloquial term “confidence” (Bandura, 1997), although these terms are often used interchangeably. For example, the authors of the SCHFI have defined the dimension of self-care confidence as “self-efficacy in self-care or perceived ability to perform the specific task of self-care” in one publication (Dickson et al., 2013b) and in another publication define self-efficacy as “the confidence that HF patients have in each phase of the self-care process” (Vellone et al., 2013). In their situation-specific theory of HF self-care, from which the SCHFI was derived, the authors address the importance of using consistent terms to facilitate better communication around self-care; thus, future work adding to the conceptual clarity and consistency would be an important addition to the current body of knowledge of self-care in patients with HF.

Limitations

This study has some limitations. Our sample was not representative of the HF population in that our sample was relatively young with a mean age of 60 years and the majority was White (81%) and male (71%). The cross-sectional design of this study is also a limitation as these variables may not be stable over time, and thus, longitudinal studies are needed to further examine these relationships. It would also be of interest to understand how self-efficacy as a mediator may differentially affect subgroups, such as those defined by race, ethnicity, or socioeconomic status. Finally, results presented were derived from secondary analyses of existing data sets and are thus limited. Future research with more diverse samples is needed to validate and expand these findings.

Conclusion

Given the high rates of non-adherence among patients with HF and the significant impact poor self-care can have on health and economic outcomes, there is an urgent need for evidence-based interventions that can improve self-care and prevent HF-related readmissions. An

important step toward this goal is the recognition of key factors that must be addressed and will give the highest yield in selected interventions. The findings from this study highlight the premier role of self-efficacy in self-care adherence behaviors. Future study is warranted to test the hypothesis that improving self-efficacy can improve self-care adherence even in the presence of high depressive symptoms or poor social support.

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