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Medication and Dietary Compliance Beliefs in Heart Failure[1]

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Patients with heart failure are required to comply with a medication regimen and dietary sodium restrictions. The objectives of this study were to determine the most frequently perceived benefits of and barriers to compliance with medication and dietary sodium restrictions and evaluate the relevancy of these scale items for testing in tailored intervention studies. Data were collected as part of two studies that evaluated the psychometric properties of two questionnaires. The most frequently identified benefit of medication compliance was decreasing the chance of being hospitalized, and the most commonly reported barrier was disruption of sleep. Patients were knowledgeable about the benefits of compliance with dietary sodium restrictions, and the poor taste of food on the low sodium diet was the most common barrier. Heart failure patients perceive benefits of and barriers to compliance with therapeutic regimens that are likely to be amenable to tailored interventions designed to enhance compliance.

Keywords: *health beliefs; computerized tailored interventions; compliance; heart failure*

Heart failure is a disabling condition nearing epidemic proportions in the United States. Estimates are that almost 5 million persons have heart failure, and 500,000 new cases are reported annually (American Heart Association, 2003). It is associated with high mortality rates, frequent and costly hospitalizations, and poor health-related quality of life (American Heart Association, 2003; Bennett et al., 2003; Riegel, Moser, et al., 2002). Compliance with the medication regimen and with dietary sodium restrictions is a critical component of self-management for patients with heart failure that can lengthen life, reduce hospitalizations, and improve quality of life (Adams et al., 1999). Lack of compliance with taking medications and following dietary sodium

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restrictions is known to be a problem among patients with heart failure and has been associated with the exacerbation of symptoms and increased hospitalizations (Bennett et al., 1998; Evangelista, Berg, & Dracup, 2001; Ghali, Kadakia, Cooper, & Ferlinz, 1988; Happ, Naylor, & Roe-Prior, 1997; Monane, Bohn, Gurwitz, Glynn, & Avorn, 1994). Medication noncompliance among patients with coronary heart disease was associated with increased mortality in a review of 20 studies (McDermott, Schmitt, & Wallner, 1997). In previous studies among heart failure patients, noncompliance with medications has ranged from 10% to 88%, and noncompliance with dietary sodium restrictions has ranged from 35% to less than 75% (Bennett et al., 1998; Bohachick, Burke, Sereika, Murali, & Dunbar-Jacob, 2002; Dunbar-Jacob, Bohachick, Mortimer, Sereika, & Foley, 2003; Monane et al., 1994). One reason for noncompliance is patients' beliefs about the benefits of and barriers to compliance. In this study, beliefs about compliance with medication and dietary regimens are evaluated for frequency and relevancy to design computerized, tailored interventions for testing in randomized clinical trials.

BELIEFS ABOUT MEDICATION AND DIETARY COMPLIANCE

Theoretical Framework

The health belief model (Becker, 1974; Janz & Becker, 1984) provided the theoretical framework for the study. The model can be used to systematically measure beliefs that may improve compliance with health behaviors such as medication taking and dietary recommendations. The model proposes that a person's beliefs about a specific health behavior will influence the likelihood that the person will perform the behavior. Beliefs are the perceptions an individual has about the (a) susceptibility to a condition, (b) seriousness of the condition, (c) benefits of performing the health behavior, and (d) barriers to performing the behavior (Becker, 1974; Janz, Champion, & Strecher, 2002). In the present study, the benefits of and barriers to compliance were assessed to evaluate heart failure patients' beliefs about compliance with medications and dietary sodium restrictions. Benefits are defined

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as the beliefs a person has about the efficacy of a specific health behavior for reducing the risk or minimizing the seriousness of the effect of a disorder (in this case, consequences of not being medication or diet compliant), and barriers are the beliefs a person has about the costs, both tangible and psychological, of a specific health behavior (Janz et al., 2002).

Perceived benefits of and barriers to compliance with specific therapeutic recommendations provide distinct targets that are amenable to interventions aimed at improving compliance behaviors. Increasing patients' perceptions of the benefits of compliance while at the same time reducing the barriers to compliance increases the likelihood that patients will perform the desired behavior. Empirical studies have demonstrated that the variable of perceived barriers is particularly robust and is the strongest predictor of health-related behaviors across health belief model studies (Janz et al., 2002). In past studies, benefits and barriers have predicted compliance with a range of behaviors including receiving a mammography screening (Champion, 1994), complying with low cholesterol dietary recommendations (Brownell & Cohen, 1995), and ceasing smoking (Rimer et al., 1994).

Tailored Interventions

Patient-centered interventions are on a continuum from personalized to individualized interventions (Lauver et al., 2002). Personalized interventions contain standardized information that is personalized by using patients' names in some way. Individualized interventions are those interventions that involve nurse-patient interactions. Tailored interventions are one type of patient-centered intervention on the continuum of interventions that are between personalized and individualized interventions. Tailored interventions are customized for each person based on her or his unique characteristics obtained from individual assessment (Kreuter, Farrell, Olevitch, & Brennan, 2000). These interventions are often based on information obtained from a preestablished library of information and are guided by a protocol for selection of information (DeVries & Brug, 1999), and therefore they are different than individualized interventions that involve nurse-patient interactions (Lauver et al., 2002). Because the tailored interventions are guided by protocols with preestablished information based on individual assessment, they can be computerized using algorithms and delivered to larger numbers of patients with less nursing personnel time than individualized interventions.

Tailored message interventions are currently being implemented to alter beliefs and change behavior to promote compliance with recommended health behaviors. Successful tailored interventions that increased compliance with mammography screening (Champion & Huster, 1995), increased use of hearing protection among factory workers (Lusk et al., 2003), and improved functioning after coronary artery bypass graft surgery (Brennan et al., 2001) have been reported. In a review of 20 studies using tailored interventions, Ryan and Lauver (2002) found that tailored interventions were more effective than standardized interventions in 50% of the studies and as effective as the standardized interventions in most of the remaining studies, probably because they are relatively more salient to the individual and based on individualized assessments. Prior to testing tailored message interventions in clinical trials, these authors recommend that investigators clearly delineate the characteristics that are most important in relation to the tailored content and identify factors that may moderate the effectiveness of tailored interventions.

Although effective individualized intervention programs using specialized care providers and/or multidisciplinary clinics exist for improving heart failure outcomes (Naylor et al., 1999; Phillips et al., 2004; Riegel, Carlson, et al., 2002; Stewart, Marley, & Horowitz, 1999), these are not currently available to all of the almost 5 million patients with heart failure. Approximately 76% of patients with heart failure received care solely from primary care physicians from 1989 to 1997 (McCullough, Cinglreddy, Philbin, & Weaver, 1999), and these physicians typically deal with patients with multiple complex chronic problems, only one of which is heart failure. The current shortage of registered and advanced practice nurses may further limit the care available to patients with heart failure. Computerized, tailored interventions based on valid, reliable, and salient instruments may provide an innovative and feasible alternative to improving compliance behaviors by using information technology to extend nursing care (Bennett, Hays, Embree, & Arnould, 2000).

Beliefs About Medication and Dietary Compliance in Heart Failure

The medication regimen for heart failure is complex, requiring patients to take multiple medications each day (Adams et al., 1999). Many heart failure patients are elderly and may be taking medications for comorbid conditions, which further increases the complexity of the regimen (Happ et al., 1997; Premen, 1996). Adhering to a sodium-restricted diet is a complex and challenging behavior that requires patients to understand the sodium content in foods, to purchase and prepare food properly, and to follow these restrictions on a daily basis for the remainder of their lives (Bennett, Hackward, & Blackburn, 2001). In previous studies, patients have reported noncompliance with medications because of urinary frequency and urgency caused by diuretics, sleep disruptions, difficulty in remembering, having to take too many pills, needing to restrict activities to manage effects of medication, and lack of adequate medication supply (Bennett, Cordes, Westmoreland, Castro, & Donnelly, 2000; Bennett, Milgrom, Champion, & Huster, 1997; Happ et al., 1997; Riegel & Carlson, 2002). Patients have reported noncompliance with dietary sodium restrictions because of poor taste, lack of availability of foods that are low in sodium, difficulty eating at restaurants and at social activities, preparation time, and cost (Bennett et al., 1997). These studies were limited because data were collected in small samples during focus groups or individual, semistructured interviews without the use of valid, reliable measures.

We previously reported on the psychometric evaluation of two questionnaires based on the health belief model: the Beliefs About Medication Compliance Scale (BMCS) and the Beliefs About Dietary Compliance Scale (BDCS; Bennett et al., 1997; Bennett, Perkins, et al., 2001). These scales were developed specifically for heart failure patients to assess the perceived benefits of and barriers to compliance with medications and dietary sodium restrictions and in turn to guide tailored interventions aimed at improving compliance behaviors, with the ultimate desired outcome being improved quality of life (Bennett, Hays, et al., 2000).

PURPOSE

The purpose of the present study was to determine the most frequently perceived benefits of and barriers to medication and dietary compliance among two samples of patients with heart failure. This knowledge will provide support for the relevancy of the scale items for future testing of tailored interventions in large-scale clinical trials to improve compliance and health-related quality of life among patients with heart failure.

DESIGN

The design of the first study was descriptive and cross-sectional. The second study was a randomized controlled trial testing a new diuretic medication.

SAMPLE

Demographic and clinical characteristics of the samples are presented in Table 1. In the first study, a convenience sample of 101 patients with chronic heart failure was recruited (Bennett et al., 1997). Potential participants were contacted by nurses from the clinic or private practices by telephone or during a regularly scheduled visit and were informed about the study. Of the 101 patients, 84% were men, and the mean age was 64 years (*SD* = 11; range = 35-92). According to the New York Heart Association (NYHA), 8% of the patients were in functional Class I, 29% were in Class II, 51% were in Class III, and 12% were in Class IV. A total of 98 of the 101 patients completed the BMCS (3 patients who were not taking diuretics did not complete this scale), and all 101 patients completed the BDCS. Patients were recruited from a multidisciplinary outpatient heart failure clinic affiliated with a Veterans Affairs medical center (*n* = 61; 60%) and from private cardiology practices (*n* = 40; 40%) as part of a larger project to evaluate feasibility of a medication delivery method.

The second sample was obtained from 205 patients who were enrolled in a randomized clinical trial to evaluate diuretic therapy (Murray et al., 2001). Potential participants were identified by the computerized medical records systems at the study sites and were recruited while hospitalized on inpatient units. The patients were invited to complete the BMCS and the BDCS at baseline and at 8 and 52 weeks after baseline (Bennett, Perkins, et al., 2001). This sample was 51% female and 53% African American. The mean age was 64 years (*SD* = 12; range = 28-89). Of the participants, 12% were in NYHA Class I, 28% were in Class II, 28% were in Class III, and 30% were in class IV. Patients were recruited during hospitalization at an urban county hospital (*n* = 166; 81%) or a Veterans Affairs medical center (*n* = 39; 19%). Of the 205 patients, 196 completed the BMCS at baseline, 154 at 8 weeks, and 104 at 52 weeks. A total of 162 patients completed the BDCS interviews at baseline, 125 at 8 weeks, and 93 at 52 weeks. Patients who had not been instructed by their physicians to follow a low sodium diet were not asked to complete the BDCS.

The data from the two samples were analyzed individually in the present study, rather than combined into one sample, for three reasons. First, the purpose was to determine the beliefs in the two groups by comparing and contrasting results. Second, the demographics and methods used in the original studies were different. Patients in the two samples were similar in age but differed on other demographic variables (see Table 1). In Study 1, 84% of the patients were men, whereas in Study 2, approximately half of the

TABLE 1: Demographic and Clinical Characteristics of 306 Patients With Heart Failure

Variable	*Study 1*[a]	*Study 2*[b]
Sex (%)		
Women	16	51
Men	84	49
Race (%)		
African American	Not collected	53
White	Not collected	47
Other		
Age (years)		
M	64	64
SD	11	12
New York Heart Association Class (%)		
I	8	12
II	29	28
III	51	28
IV	12	30
Recruitment site (%)		
Inpatient units of county hospitals		81
Inpatient units of Veterans Affairs hospitals		19
Veterans Affairs outpatient heart failure clinic	60	
Private cardiology practices	40	

a. $n = 101$.
b. $n = 205$.

patients were women. Data on ethnicity were not collected in the first study. Data collection methods and the time frame of data collection differed for the two samples. Finally, the first sample was collected from sites in which patients received care from cardiologists and heart failure specialists with multidisciplinary clinics, whereas in the second study, patients received care from primary care physicians. The natural history of heart failure may be different for these two groups of patients.

METHOD

Guidelines for the protection of human participants were followed. For patients who agreed to participate, a time was scheduled for them to provide informed consent and complete the questionnaires during face-to-face interviews. The research project coordinators or a graduate nursing student contacted eligible patients and invited their participation. Patients who agreed to participate provided informed consent and completed the BMCS and the BDCS as part of a series of questionnaires during face-to-face baseline interviews during the hospitalization. Participants then completed the BMCS and the BDCS by telephone interviews at 8 and 52 weeks after baseline.

INSTRUMENTS

BMCS

The BMCS is a 12-item instrument with 5-point response scales (1 = *strongly disagree*, 5 = *strongly agree*) designed to measure perceived benefits of and barriers to medication compliance among patients with heart failure (Bennett et al., 1997). Items on the scales were developed from a review of the literature, including the Health Belief Scales by V. Champion (personal communication, September 1, 1995) and interviews with patients with heart failure. The items are focused on diuretic therapy compliance because the side effects of diuretic therapy are commonly reported by patients as problematic and interfering with daily living. Lack of compliance with diuretic therapy may be associated with dyspnea and swelling with one or two missed doses among patients with heart failure. Five items assess perceived benefits of medication compliance, and seven items assess barriers to medication compliance. A benefits score and a barriers score are obtained by summing the responses to the items on each subscale. Higher scores on the benefits subscale indicate more perceptions of benefits, whereas higher scores on the barriers subscale indicate a greater number of perceived barriers. In past studies with these two samples, the internal consistency reliability, estimated by Cronbach's alpha coefficient, was .87 and .63 to .71 (three time points) for the benefits subscale and .91 and .65 to .71 (three time points) for the barriers subscale. Some of the reliability estimates were lower than .70, which could be because of the heterogeneous nature of the items, particularly on the barriers subscale (Bennett et al., 1997; Bennett, Perkins, et al., 2001; Janz et al., 2002), the patients' illness level, the literacy level of patients, or the relatively low numbers of items on the scales. Construct validity was evaluated by principal components factor analysis, and two factors of benefits and barriers were supported. The benefits and barriers subscales explained 43% and 41% of the total variance in the factor analysis. Mean scores of the BMCS in these previous studies indicated that, overall, perceptions of both perceived benefits of and barriers to medication compliance were moderately high.

BDCS

The BDCS is a 12-item questionnaire with 5-point response scales (1 = *strongly disagree*, 5 = *strongly agree*) that was designed to measure perceived benefits of and barriers to compliance with dietary sodium restrictions among heart failure patients (Bennett et al., 1997). On the BDCS, 7 items measure perceived benefits of dietary compliance, and 5 items measure barriers to compliance with dietary sodium restrictions. A score for benefits and a score for barriers are obtained by summing responses to the items for each subscale, with higher scores indicating more perceptions of benefits and more barriers, respectively. Internal consistency reliability was estimated using Cronbach's coefficient alpha and was .84 and .83 to .88 (three time points) for the benefits subscale and .68 and .66 to .77 (three time points) for the barriers subscale. Principal components factor analysis supported the two subscales of benefits and barriers, which accounted for 52% and 50% of the total variance, respectively (Bennett et al., 1997; Bennett, Perkins, et al., 2001). Mean scores on the BDCS indicated that patients in both samples were knowledgeable about the benefits of adhering to dietary sodium restrictions but that barriers were high.

ANALYSIS OF DATA

Statistical analysis was completed using the SPSS Version 11 computer program for Study 1 and the SAS Version 8.2 computer program for Study 2. Frequency counts were computed for all items on the scales for both samples to determine the most commonly perceived benefits of and barriers to medication and dietary compliance and to identify the percentage of patients in each sample who would have been eligible for a computerized, tailored message intervention as indicated by responses of *strongly disagree*, *disagree*, or *undecided* for benefits items and *strongly agree*, *agree*, or *undecided* for barriers items. In the psychometric studies, one item was deleted from both the BMCS and the BDCS because of the item's low item-to-total correlations or factor loadings. All scale items were included in the present study to more thoroughly evaluate specific benefits and barriers.

FINDINGS

The most frequently perceived benefits of medication compliance were decreasing chances of hospitalization and reducing swelling (see Table 2). Other benefits, such as reducing worry, maintaining quality of life, and helping patients to breathe more easily, were identified as benefits but less often. A total of 64% of the patients in Study 1 and 68% (baseline) in Study 2 reported that a benefit of taking water pills was helping them to breathe more easily. One third of the patients did not report or recognize this benefit of water pills. Responses to each of the five items on the final benefits scale suggested a need to better educate patients about the benefits of medication compliance, with 10% to 61% of patients eligible to receive tailored message interventions, as evidenced by responses of *strongly disagree*, *disagree*, or *undecided* for particular items. There were no items that all patients identified as a benefit of medication compliance.

The most commonly reported barriers to medication therapy were that taking water pills interrupted night sleep and, to a somewhat lesser extent, made traveling difficult (see Table 2). A total of 65% of the patients in Study 1 and 78% (baseline) and 83% (52 weeks) of the patients in Study 2 reported that water pills disrupted their sleep. Approximately one third of the patients (31% Study 1; 38% Study 2 at baseline and 51% Study 2 at 52 weeks) said that taking water pills made it difficult for them to go away from home. Taking water pills was unpleasant, as reported by 15% of the patients in Study 1 and 21% (baseline) of the patients in Study 2. Less commonly reported barriers were having difficulty remembering to take the pills, having to take too many pills each day, and worrying about heart disease when taking pills, with 6% to 18% of patients reporting each of these as barriers. Each of the seven items was identified as a barrier by at least some patients. If implementing a tailored message intervention to reduce barriers to medication compliance, 31% to 83% of the patients across groups were eligible for interventions targeting the two most frequently reported barriers. Depending on the particular barrier, 6% to 83% of the patients would have been eligible for tailored message interventions to reduce barriers, as evidenced by the number of patients responding to the barriers items with *strongly agree*, *agree*, or *undecided*.

The most frequently identified benefits of complying with dietary sodium restrictions were "Salty food is not good for me," "Eating a low salt diet will keep my heart healthy," and "Eating a low salt diet will keep my swelling down" (see Table 3). Most patients (96% and 95% in Studies 1 and 2, baseline, respectively) agreed with the statement "Salty food is not good for me."

TABLE 2: Frequency of Patients Identifying Items as Benefits and Barriers to Medication Compliance

(Baseline)	*Study 1*[a] %	*Study 2*[b] %
Benefits (% of patients responding *agree* or *strongly agree*)		
If I take my water pills as I am told, I will decrease my chances of being hospitalized.	88	81
Taking my water pills lessens my swelling.	82	77
When I take my water pills, I do not worry as much about my heart disease.	69	60
Taking my water pills helps me breathe more easily.	64	68
Taking my medicine helps me maintain my quality of life.	39	84
Barriers (% of patients responding *agree* or *strongly agree*)		
Taking water pills causes me to wake up at night.	65	78
Taking water pills makes it hard to go away from home.	31	38
Taking water pills is unpleasant.	15	21
I have to take too many water pills each day.	12	17
Taking water pills makes me worry about my heart disease.	10	13
Taking water pills is hard to remember.	8	13
I forget to take my water pills.	6	14

a. $n = 98$.
b. $n = 196$.

Almost one third of the patients did not report the benefit of feeling better or breathing more easily when following a low salt diet. For each of the seven items on the BDCS, some patients (4% to 31%) would have been eligible for a tailored message intervention, as evidenced by item responses of *strongly disagree*, *disagree*, or *undecided*.

Barriers to dietary sodium restrictions were common in both groups of patients (see Table 3). The poor taste of food on the low sodium diet was by far the most frequent barrier to compliance, cited by patients in both Studies 1 (62%) and 2 (76%, baseline). The next most common barrier was being unable to go to restaurants and other places away from home to eat, reported by 49% and 44% of the patients in the two samples. The cost of low sodium diets and time to follow the dietary restrictions were identified as barriers by approximately one fourth of the patients in both samples. Even the least frequently reported barrier, that the sodium-restricted diet was hard to understand, was reported by 14% to 21% of the patients. Depending on the item, 14% to 76% of the patients across groups would have been eligible for tailored message interventions, as evidenced by responses of *strongly agree*, *agree*, or *undecided*.

TABLE 3: Frequency of Patients Identifying Items as Benefits and Barriers to Dietary Sodium Restrictions

(Baseline)	*Study 1*[a] %	*Study 2*[b] %
Benefits (% of patients responding *agree* or *strongly agree*)		
Salty food is not good for me.	96	95
Eating a low salt diet will keep fluid from building up in my body.	93	89
Eating a low salt diet will keep my swelling down.	86	90
Eating a low salt diet will keep my heart healthy.	84	92
Eating a low salt diet will keep me healthy.	87	86
When I follow my low salt diet, I feel better.	69	83
Eating a low salt diet will help me breathe more easily.	69	72
Barriers (% of patients responding *agree* or *strongly agree*)		
Food does not taste good on the low salt diet.	62	76
I cannot go out to many places to eat because of the low salt diet.	49	44
Following a low salt diet costs too much money.	28	24
Following a low salt diet takes too much time.	25	22
Following a low salt diet is too hard to understand.	14	21

a. $n = 101$.
b. $n = 162$.

A comparison of the benefits of and barriers to medication and dietary compliance scores demonstrated that, overall, the results were strikingly similar in the two samples and over the 52 weeks in Study 2. A review of Study 2 responses shows that the rank order and the actual scores on the belief scales were similar at the three time points, supporting the stability of these beliefs over time without a behavioral intervention. Although not reported in the present article, the data for the 8- and 52-week time points are available on request from the authors.

DISCUSSION

The results of this study provide knowledge about the frequency of the beliefs that patients with heart failure have about compliance with medication and diet therapy and the relevancy of the items for use in designing tailored interventions. The 306 patients in the two study samples were knowledgeable about some of the benefits of their medications, recognizing that medications could reduce hospitalizations and prevent swelling. The surprising finding that more than one third of patients did not recognize the beneficial role of diuretics in decreasing dyspnea represents an opportunity for increasing patients' knowledge and compliance with medications and may offer some explanation for lack of compliance. If patients do not recognize or experience the sensation of easier breathing in response to medications such as diuretics, they understandably may not be motivated to comply with the therapeutic regimen. These results may also be influenced by the fact that dyspnea is the most frequent symptom of heart failure and can be difficult to manage.

Sleep disruption and restriction of social activities were other barriers to medication compliance. Sleep disturbances may represent an even bigger problem because of recent findings that sleep disturbances, particularly sleep apnea, are associated with negative heart failure outcomes in a large number of patients (Naughton, 2003).

The results from the BMCS in these samples were consistent with past studies in which investigators identified common problems in heart failure medication management (Artinian, Magnan, Sloan, & Lange, 2002; Brooten, Youngblut, Deatrick, Naylor, & York, 2003; Riegel & Carlson, 2002). For example, among the 9,486 problems reported by 139 elderly patients with cardiac medical and surgical diagnoses, 6,145 (64%) dealt with surveillance for physical and emotional symptoms, medication administration, sickness care, or problems or issues in mobility and nutrition (Brooten et al., 2003). A number of problems with medications and noncompliance including bothersome side effects, skipped dosages of medications, too many pills to take, difficulty going away from home, and anxiety were noted in a sample of 26 heart failure patients (Riegel & Carlson, 2002). The findings of the present study are unique because they provide knowledge about beliefs and reasons for compliance using valid, reliable instruments.

Poor compliance with dietary sodium restrictions is common (Bennett, Cordes, et al., 2000; Evangelista, Dracup, & Doering, 2000; Evangelista et al., 2001), and the results of the current study provide additional knowledge about the difficulties in following these restrictions. Almost one third of the patients did not report feeling better or breathing more easily when following a low sodium diet. This may explain in part the poor compliance associated with low sodium diets. The sodium-restricted diets have high barriers common to many patients, and at least one third of patients had not noticed personal benefits from these restrictions. As with medications, the result may be associated with the severe dyspnea experienced by patients.

Barriers to following a sodium-restricted diet offer challenges for patients. Two thirds of the patients reported the poor taste of these restrictions as a barrier. Eating at restaurants and other places away from home was difficult for almost half of the patients. Other reported problems related to the low sodium diet included the cost of the diet, the time for preparation, and lack of understanding, reported by 14% to 21% of patients.

Anxiety appears to be a problem for some patients, as indicated by their reporting that both taking medications and following dietary restrictions actually increased their worry. Anxiety is known to contribute to sympathetic activation in heart failure and may be physically and emotionally harmful to these patients.

The health belief model constructs of benefits and barriers provide a useful framework to guide interventions (Becker, 1974; Janz et al., 2002). The results were remarkably consistent across the 306 patients in the two samples despite differences in demographics and data collection procedures, supporting that the items on the scales are appropriate as bases for future tailored interventions.

The results of this study were limited by use of convenience samples recruited from special types of settings. The BMCS deals primarily with diuretic medications and was developed prior to clinical trials, demonstrating the effectiveness of beta adrenergic antagonists (Adams et al., 1999). Patients with heart failure may now be experiencing barriers to medication compliance associated with beta adrenergic antagonists.

In summary, this study provides new knowledge about the frequency of the benefits of and barriers to medication and dietary compliance among patients with heart failure and supports the relevancy of the items on the BMCS and BDCS. The scales are appropriate for use in guiding computerized, tailored interventions.

NOTE

1. Regarding the contributions of each coauthor, Kathleen A. Lane analyzed the data and assisted with the interpretation of the results. Janet Welch assisted with the interpretation of the results. Susan M. Perkins analyzed the data and assisted with the interpretation of the results. D. Craig Brater, principal investigator of the larger study, formulated the design of the larger study, assisted with the coordination of this substudy, recruited and enrolled patients, and oversaw the study. Michael D. Murray, co-principal investigator of the larger study, oversaw the entire larger study, assisted with the substudy, and assisted with the interpretation of the results. The authors acknowledge Phyllis Dexter, Ph.D., R.N., Lesley Milgrom, M.S.N., R.N., Jennifer Embree, M.S.N., R.N., Victoria Champion, D.N.S., R.N., and Ms. Laura Parker. This study was supported in part by Indiana State Department of Health, NIH Grants R01 AG07631, R01 AG19105, and DK37994 and by Boehringer-Mannheim.

REFERENCES

Adams, K. F., Baughman, K. L., Dec, W. G., Elkayan, U., Forker, A., Gheorhiade, M., et al. (1999). HFSA guidelines for the management of patients with heart failure caused by left ventricular systolic dysfunction–Pharmacological approaches (A report of the Guidelines Committee and the Executive Council of the HFSA). *Journal of Cardiac Failure*, *5*, 357-382.

American Heart Association. (2003). *Heart and stroke facts*. Dallas, TX: Author.

Artinian, N. T., Magnan, M., Sloan, M., & Lange, M. P. (2002). Self-care behaviors among patients with heart failure. *Heart & Lung*, *31*, 161-172.

Becker, M. H. (1974). *The health belief model and personal health behavior.* Thorofare, NJ: Charles B. Slack.

Bennett, S. J., Cordes, D. K., Westmoreland, G., Castro, R., & Donnelly, E. (2000). Self-care strategies for symptom management in patients with chronic heart failure. *Nursing Research*, *49*, 139-145.

Bennett, S. J., Hackward, L., & Blackburn, S. (2001). Nutrition management of the patient with heart failure. In D. Moser & B. Riegel (Eds.), *Improving outcomes in heart failure: An interdisciplinary approach* (pp. 99-123). Gaithersburg, MD: Aspen.

Bennett, S. J., Hays, L. M., Embree, J. L., & Arnould, M. (2000). Heart messages: A tailored message intervention for improving heart failure outcomes. *Journal of Cardiovascular Nursing*, *14*, 94-105.

Bennett, S. J., Huster, G. A., Baker, S. L., Milgrom, L. B., Kirchgassner, A., Birt, J., et al. (1998). Characterization of the precipitants of hospitalization for heart failure decompensation. *American Journal of Critical Care*, *7*, 168-174.

Bennett, S. J., Milgrom, L. B., Champion, V., & Huster, G. A. (1997). Beliefs about medication and dietary compliance in people with heart failure: An instrument development study. *Heart & Lung*, *26*, 273-279.

Bennett, S. J., Oldridge, N. B., Eckert, G. J., Embree, J. L., Browning, S., Hou, N., et al. (2003). Comparison of quality of life measures in heart failure. *Nursing Research*, *52*, 207-216.

Bennett, S. J., Perkins, S. M., Lane, K. A., Forthofer, M. A., Brater, D. C., & Murray, M. D. (2001). Reliability and validity of the compliance belief scales among patients with heart failure. *Heart & Lung*, *30*, 177-185.

Bohachick, P., Burke, L. E., Sereika, S., Murali, S., & Dunbar-Jacob, J. (2002). Adherence to angiotensin-converting enzyme inhibitor therapy for heart failure. *Progress in Cardiovascular Nursing*, *17*, 160-166.

Brennan, P. F., Moore, S. M., Bjornsdottir, G., Visovsky, C., Jones, J., & Rogers, M. (2001). HeartCare: An Internet-based information and support system to facilitate patients' home recovery after coronary artery bypass graft (CABG) surgery. *Journal of Advanced Nursing*, *35*, 699-708.

Brooten, D., Youngblut, J. M., Deatrick, J., Naylor, M. D., & York, R. (2003). Patient problems, advanced practice nurse (APN) interventions, time and contacts among five patient groups. *Journal of Nursing Scholarship*, *35*, 73-79.

Brownell, K. D., & Cohen, L. R. (1995). Adherence to dietary regimens 2: Components of effective interventions. *Behavioral Medicine*, *20*, 155-164.

Champion, V. (1994). Beliefs about breast cancer and mammography by behavioral stage. *Oncology Nursing Forum*, *21*, 1009-1014.

Champion, V., & Huster, G. (1995). Effect on interventions on stage of mammography adoption. *Journal of Behavioral Medicine*, *18*, 169-186.

DeVries, H., & Brug, J. (1999). Computer-tailored interventions motivating people to adopt health promoting behaviors: Introduction to a new approach. *Patient Education & Counseling*, *36*, 99-105.

Dunbar-Jacob, J., Bohachick, P., Mortimer, M. K., Sereika, S., & Foley, S. M. (2003). Medication adherence in persons with cardiovascular disease. *Journal of Cardiovascular Nursing*, *18*, 209-218.

Evangelista, L., Berg, J., & Dracup, K. (2001). Relationship between psychosocial variables and compliance in patients with heart failure. *Heart & Lung*, *30*, 294-301.

Evangelista, L., Dracup, K., & Doering, L. (2000). A closer look at compliance research in heart failure patients in the last decade. *Progress in Cardiovascular Nursing*, *15*, 97-103.

Ghali, J. K., Kadakia, S., Cooper, R., & Ferlinz, J. (1988). Precipitating factors leading to decompensation of heart failure. *Archives of Internal Medicine*, *148*, 2013-2016.

Happ, M. B., Naylor, M. D., & Roe-Prior, P. (1997). Factors contributing to rehospitalization of elderly patients with heart failure. *Journal of Cardiovascular Nursing*, *11*, 75-84.

Janz, N. K., & Becker, M. H. (1984). The health belief model: A decade later. *Health Education Quarterly*, *11*, 1-47.

Janz, N. K., Champion, V. L., & Strecher, V. J. (2002). The health belief model. In K. Glanz, B. K. Rimer, & F. M. Lewis (Eds.), *Health behavior and health education* (3rd ed., pp. 45-66). San Francisco: Jossey-Bass.

Krueter, M., Farrell, D., Olevitch, L., & Brennan, L. (2000). *Tailoring health messages*. Mahwah, NJ: Lawrence Erlbaum.

Lauver, D. R., Ward, S. E., Heidrich, S. M., Keller, M. L., Bowers, B. J., Brennan, P. F., et al. (2002). Patient-centered intervention. *Research in Nursing & Health*, *25*, 246-255.

Lusk, S. L., Ronis, D. L., Kazanis, A. S., Eakin, B. L., Hong, O., & Raymond, D. M. (2003). Effectiveness of a tailored intervention to increase factory workers' use of hearing protection. *Nursing Research*, *52*, 289-295.

McCullough, P. A., Cinglreddy, U., Philbin, E. F., & Weaver, W. D. (1999). Secular trends in the management of congestive heart failure by primary care physicians and cardiovascular specialists. *JACC*, *33*(Suppl. A), 247A.

McDermott, M. M., Schmitt, B., & Wallner, E. (1997). Impact of medication nonadherence on coronary heart disease outcomes. *Archives of Internal Medicine*, *157*, 1921-1929.

Monane, M., Bohn, R. L., Gurwitz, J. H., Glynn, R. J., & Avorn, J. (1994). Noncompliance with congestive heart failure therapy in the elderly. *Archives of Internal Medicine*, *153*, 433-437.

Murray, M. D., Deer, M. M., Ferguson, J. A., Dexter, P. R., Bennett, S. J., Perkins, S. M., et al. (2001). Open-label randomized trial of torsemide compared with furosemide therapy for patients with heart failure. *American Journal of Medicine*, *111*, 513-520.

Naughton, M. T. (2003). Sleep disorders in patients with congestive heart failure. *Current Opinions in Pulmonary Medicine*, *9*, 453-458.

Naylor, M. D., Brooten, D., Campbell, R., Jacobsen, B. S., Mezey, M., Pauley, M., et al. (1999). Comprehensive discharge planning and home follow-up of hospitalized elders: A randomized clinical trial. *Journal of the American Medical Association*, *281*, 613-620.

Phillips, C. O., Wright, S. M., Kern, D. E., Singa, R. M., Shepperd, S., & Rubin, H. R. (2004). Comprehensive discharge planning with postdischarge support for older patients with congestive heart failure. *Journal of the American Medical Association*, *291*, 1358-1367.

Premen, A. J. (1996). Research recommendations for cardiovascular aging research. *Journal of the American Geriatrics Society*, *44*, 1114-1117.

Riegel, B., & Carlson, B. (2002). Facilitators and barriers to heart failure self-care. *Patient Education and Counseling*, *46*, 287-295.

Riegel, B., Carlson, B., Kopp, Z., LePetri, B., Glaser, D., & Unger, A. (2002). Effect of a standardized nurse case-management telephone intervention on resource use in patients with chronic heart failure. *Archives of Internal Medicine*, *162*, 705-712.

Riegel, B., Moser, D. K., Glaser, D., Carlson, B., Deaton, C., Armola, R., et al. (2002). The Minnesota Living with Heart Failure Questionnaire. *Nursing Research*, *51*, 209-218.

Rimer, B. K., Orleans, C. T., Fleisher, L., Cristinzio, S., Resch, N., Telepchak, J., et al. (1994). Does tailoring matter? The impact of a tailored guide on ratings and short-term smoking-related outcomes for older smokers. *Health Education Research*, *9*, 69-84.

Ryan, P., & Lauver, D. R. (2002). The efficacy of tailored interventions. *Journal of Nursing Scholarship*, *34*, 331-337.

Stewart, S., Marley, J. E., & Horowitz, J. D. (1999). Effects of a multidisciplinary, home-based intervention on unplanned readmissions and survival among patients with chronic congestive heart failure: A randomized controlled study. *Lancet*, *354*, 1077-1083.