ORIGINAL PAPER

Impact of Provider Self-Management Education, Patient Self-Efficacy, and Health Status on Patient Adherence in Heart Failure in a Veterans Administration Population

To address the need for more information on predictors of adherence to heart failure (HF) self-management regimens, this study analyzed surveys completed by 259 HF patients receiving care at 2 Veterans Affairs hospitals in 2003. Linear multivariable regression models were used to examine general health status, HF-specific health status (Kansas City Cardiomyopathy Questionnaire) self-management education, and self-efficacy as predictors of self-reported adherence to salt intake and exercise regimens. Self-management education was provided most often for salt restriction (87%) followed by exercise (78%). In multivariable regression analyses, education about salt restriction (P=.01), weight reduction (P=.0004), self-efficacy (P=.03), and health status (P=.003) were significantly associated with patient-reported adherence to salt restriction. In a similar model, self-efficacy (P=.006) and health status (P≤.0001), but not exercise education, were significantly associated with patient-reported exercise adherence. Findings suggest that provider interventions may lead to improved adherence with HF self-management and thus improvements in patients' health. (Congest Heart Fail. 2008;14:6–11) ©2008 Le Jacq

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Heart failure (HF) is associated with increased morbidity, mortality, and health care costs.[1–5] To successfully manage their disease, patients need to be adherent with daily self-management behaviors, including medication use, salt restriction, and exercise as well as ongoing monitoring of disease signs and symptoms. Recent studies suggest that such self-management practices may have a greater impact on health than new advances in biomedical treatment.[6,7] In contrast, a lack of knowledge of and adherence to self-care recommendations for the disease, such as dietary sodium intake restriction and level of physical activity, have been identified as risk factors for HF readmission.[8–11] Consequently, the Institute of Medicine has identified patient self-management as a priority area for improving chronic illness care and outcomes,[12] and current guidelines for the management of both systolic and diastolic HF recommend that all patients be provided with self-management education.[13,14]

Despite the current emphasis on the importance of self-management, 2 recent studies conducted in the outpatient setting had shown that patients had inadequate information about their HF and lacked the tools for optimal self-care.[15,16] A national Veterans Health Administration (VHA) study of 104 hospitals evaluating processes of care found that self-management education was provided to only 13% of patients hospitalized for HF.[17] Most patients with HF, however, are seen and managed in outpatient clinics, with each patient making an average of 6 or 7 visits per year vs 1 or 2 hospitalizations per year, which suggests the need to examine the occurrence of self-management education by providers in outpatient settings.[2] Although several studies suggest that self-management is an important component of HF interventions, the outcomes of self-management education have rarely been examined. A systematic review of 6 randomized controlled trials showed that multidisciplinary HF disease management programs, which emphasized dietary counseling and/or sodium intake reduction, improved functional capacity, patient satisfaction, and quality of life.[18] These studies, however, did not specifically examine the role of education on level of patient adherence. Moreover, most care for patients with HF is delivered in primary care and not by disease management programs. Hence, it is important to determine whether self-management education by the patient's provider has an effect on patient adherence. In addition,

given the multiple competing demands for providers' time during clinic visits that limit the ability of the provider to adhere to multiple preventive clinical guidelines,[19] it is crucial that there is evidence to support provider self-management education. Thus, more data are needed on the outcomes associated with specific and targeted self-management education related to salt intake and physical activity.

The importance of patient characteristics is also increasingly being emphasized as a clinical model for promoting adherence in chronic disease management.[20] For example, self-efficacy has been associated with health-promoting behaviors, such as cessation of smoking,[21] adherence to medication,[22] and increasing physical activity.[23] Thus, any analysis on the outcomes of patient adherence should include patient characteristics such as self-efficacy.

Finally, patients' health status measures undoubtedly play a critical role in the clinical care of patients with HF and their ability to adhere to treatment recommendations; the measures have been shown to have independent prognostic value in mortality and readmission among outpatients with HF.[24–26]

The objectives of this study, therefore, were to examine whether (1) self-management education by providers, (2) patient self-efficacy, and (3) health status were associated with patient-reported adherence with salt intake and exercise regimens.

Methods

Design. This was a cross-sectional survey of patients with HF in 2003. The study and survey procedures were approved by the institutional review boards of the Ann Arbor and Indianapolis Veterans Affairs (VA) Medical Centers, the University of Michigan, and Indiana University.

Sample and Recruitment. Participants included in the surveys were patients with HF, being treated with HF medication therapy, who received care from 2 tertiary hospitals that were part of a Midwestern network of VHA hospitals. To be eligible for the study, patients had to have HF as defined by *International Classification of Diseases, Ninth Revision* codes (428.xx) in the electronic record. Records for potential participants were further reviewed to determine whether they had systolic or diastolic dysfunction. Systolic dysfunction was defined by a history or documentation of left ventricular ejection fraction (LVEF) ≤40% (or fractional shortening ≤20% if LVEF was not documented),[26–28] and diastolic dysfunction was defined as a current diagnosis, history, and/or physical findings/symptoms of diastolic dysfunction (not related to restrictive cardiomyopathy, obstructive and nonobstructive hypertrophic cardiomyopathy, or infiltrative cardiomyopathies).[29,30] In addition, patients had to (1) have a current diagnosis or history of HF and (2) be able to independently read and complete the questionnaire. Patients were excluded if they had a diagnosis with an associated life expectancy of ≤6 months (eg, metastatic cancer, hospice care), had renal failure with a creatinine level >5.0 mg/dL, or were receiving palliative or nursing home care at the time of enrollment.

Procedures. In September 2003, each patient was mailed a cover letter, a copy of the survey, and a self-addressed stamped envelope. As per the modified Dillman technique,[31] all patients received a reminder letter approximately 1 week after the first mailing. In addition, nonrespondents were sent a second (follow-up) survey 2 weeks after the reminder letter.

Data Sources. Information regarding outpatient visits and diagnosis was obtained from the outpatient clinic file. Data for this study are based on survey questions from existing instruments covering areas related to self-management education by providers, patient self-efficacy, health status, symptoms, and adherence (described below). These questions were asked as part of a survey administered 1 year following patients' enrollment in a study evaluating a nurse case management model for HF.

Independent Measures. Independent measures included (1) self-management education from providers, (2) patient self-efficacy (confidence), and (3) patient HF-specific health status. We also controlled for patients' general health status, age, sex, and level of education.

Self-Management Education by Providers. We asked patients whether they had received any self-management education from their providers regarding dietary salt restriction, exercise, weight reduction, fluid restriction, calorie restriction, heart rate, and blood pressure monitoring.[32] We focused our analyses on domains related to lifestyle changes—salt restriction, weight reduction, fluid restriction, and exercise. Answers were coded as binary variables depending on whether patients reported counseling in the specific domains from providers.

Self-Efficacy. Patients' confidence in managing their HF was assessed by a validated 6-item scale.[33] Responses were graded on a 10-point Likert-type scale ranging from not at all confident to totally confident in managing HF. The patient was asked to rate his or her level of confidence in (1) managing his or her condition, (2) judging when to see a doctor, (3) doing tasks needed to reduce the need to see a doctor, (4) reducing the emotional distress caused by his or her condition, (5) doing things other than taking medication to change the effect HF has on everyday life, and (6) running his or her life the same as if he or she didn't have HF. A self-efficacy score was created by taking the mean of the sum of the individual confidence questions and converting it to a 0 to 100 scale.

Health Status. General health status was a single-item validated question on the overall health status from the short-form 36 (SF-36) health sur-

Table I. Characteristics of Respondents (N=259)

	No. (%) or Mean ± SD
Age, y	67.2±10.0
Male	250 (98.8%)
Race	
Black	37 (14.6)
White	208 (82.2)
Other	8 (3.2)
Education level	
Some college or more	90 (36)
High school or less	160 (64)
Health status	
Very good or excellent	14 (5.2)
Good	67 (27.1)
Fair or poor	166 (67.2)
HF-specific health status	51.2 (23.0)
Self-efficacy	7.2 (2.2)
Adherence to a low-salt diet	4.9 (2.8)
Adherence to exercise	2.2 (2.5)

Table II. Model for Adherence With Salt Intake and Self-Management Education, Self-Efficacy, and Health Status

	Coefficient	SE	*P* Value
Educated about salt[a]	1.41	0.57	.015
Educated about fluids[a]	0.44	0.36	.226
Educated about weight[a]	1.39	0.39	.0004
Health status[b]	–0.03	0.01	.003
Self-efficacy[c]	0.20	0.09	.030
Intercept	2.47	0.74	.001

[a]Dichotomous variable indicating whether the patient was educated about the topic. [b]Kansas City Cardiomyopathy Questionnaire overall summary score taking on values from 0 to 100. [c]Self-efficacy scores ranged from 0 to 10.

Table III. Model Predicting Adherence With Exercise and Self-Management Education, Self-Efficacy, and Health Status

	Coefficient	SE	*P* Value
Educated about exercise[a]	0.65	0.40	.103
Educated about weight[a]	–0.33	0.32	.308
Health status[b]	0.04	0.01	<.0001
Self-efficacy[c]	0.23	0.08	.006
Intercept	–1.62	0.58	.006

[a]Dichotomous variable indicating whether the patient was educated about the topic. [b]Kansas City Cardiomyopathy Questionnaire overall summary score taking on values from 0 to 100. [c]Self-efficacy scores ranged from 0 to 10.

vey.[34] HF-specific health was measured by the Kansas City Cardiomyopathy Questionnaire (KCCQ).[35] The KCCQ is a 23-item questionnaire designed to address HF-specific symptoms, as well as the impact of HF on functional activities and quality of life. The overall KCCQ summary score was used to measure HF-related health status. This scale ranges from 0 to 100, with a lower score denoting worse health status. The KCCQ scores would thus adjust for severity of HF, which could affect patient adherence with self-management.

Dependent Measure. We were interested in adherence to self-management—specifically, with diet and exercise. Patients were asked questions about how well they had been able to adhere to recommended treatment protocols for HF over the previous 7 days. These adherence questions have been previously validated in chronic disease self-management.[36,37] Specifically, they were asked how often they were able to maintain a low-salt diet, participate in 30 minutes of physical exercise, and participate in a specific exercise session such as swimming, walking, or biking. Responses ranged from 0 days a week to 7 days a week.

Statistical Analysis. The distributions of the adherence variables (low-salt diet, exercise), self-efficacy score, were examined using descriptive and graphic methods. Next, we examined the relationship between self-management education and the scores for self-efficacy and health status using Pearson's correlation coefficients. Finally, linear multivariable regression analyses were conducted, with adherence as the dependent variable. Separate models were fit for adherence to exercise and salt restriction, with both models controlling for age, sex, and number of years of education. For the adherence with salt-restriction model, the following independent variables were included: individual conceptually related to adherence with low-salt diet self-management education variables including low-salt diet education, fluid education, weight education, congestive heart failure–specific health status, and self-efficacy. For the adherence with exercise model, we similarly included the conceptually related individual self-management education variables of exercise education, weight education, patient self-efficacy, and congestive heart failure–specific health status. All analyses were conducted using SAS software, version 9.0 (SAS Institute, Inc, Cary, NC).[38]

Results

The overall response rate was 80% (388 surveys mailed: 259 returned, 62 not returned; 67 patients deceased). Baseline characteristics of patients are presented

in Table I. The respondents were mostly male (99%) and white (82%), with a mean age of 67 years. The overall cohort had a mean age of 67 years, were 80% white, and 98% male. Thus, there were no differences between respondents and nonrespondents.

Patients most frequently reported that they received education from their providers about salt restriction (87%), followed by exercise (78%), weight management (64%), calorie restriction (59%), and blood pressure monitoring (58%). A smaller number of patients reported receiving education regarding heart rate monitoring (42%) and fluid restriction (44%), while 10 patients (4%) claimed to have received no self-management education.

Patients reported adhering to a low-salt diet for a mean of 4.9 days. In contrast, they reported exercising for a mean of 2.2 days. Overall, patients had high self-efficacy scores, with a mean of 7.2 (SD=2.2) on a scale of 1 to 10. The mean KCCQ overall summary score for the group was 51.2 (23.0) out of a possible score of 100, indicating relatively poor health status.

The results of the regression analysis examining the association between adherence with salt restriction, health status, self-efficacy, and self-management education is listed in Table II. Self-management education for salt restriction and weight reduction were significantly associated with increased adherence to salt restriction. Self-efficacy was also significant in increasing adherence with a low-salt diet (coefficient, 0.20; $P=.03$). Patient health status as measured by the KCCQ overall summary score was negatively associated with adherence.

Table III lists the results of the regression model for adherence with the exercise recommendation. Health status and self-efficacy, but not exercise or weight education, were strongly associated with adherence to exercise.

Discussion

This study found that provider self-management education for salt restriction was most commonly provided to HF patients (87%), followed by exercise (78%). In multivariable regression analyses controlling for self-efficacy and health status, self-management education about salt restriction and weight reduction were significantly associated with patient-reported adherence to salt restriction. Multiple regression analysis also revealed that self-efficacy and health status, but not exercise education, were significantly associated with patient-reported exercise adherence.

Clinical Significance

Lifestyle behaviors such as maintaining appropriate salt intake and regular exercise have been identified as critical in helping persons with HF maintain and improve their health status.[16] The findings from this study concerning the role of provider education in influencing salt restriction suggests that advice by health care providers, which has been well-established as efficacious in discouraging behaviors such as smoking,[21,39] may also play an important role in encouraging essential self-care behaviors for persons with HF. The finding that self-management education about weight was also significantly associated with patient-reported adherence with salt restriction suggests that providers likely discuss dietary salt when counseling patients about weight. This is a plausible explanation given that weight gain in patients with HF is most often due to edema from sodium retention. The previously identified relationship between high sodium levels and hospital readmissions and mortality highlight the urgency of considering education about salt restriction as an important component of provider education.

The finding that provider self-management education for exercise was not significantly associated with exercise adherence when health status and self-efficacy were controlled in the multivariate model suggests the need for additional investigation of the dynamics underlying exercise adherence. Therefore, we conducted further analyses suggesting that patients with higher health status were more likely to be encouraged to pursue an exercise regimen. (The correlation for health status and education about exercise was 0.234 [$P=.0003$].) This suggests that providers may be more likely to promote exercise primarily in patients who are healthier because of provider concerns with the risks of exercise in patients with HF who have poor health status. Substantial evidence from prospective and randomized controlled trials, however, suggests that the health benefits accrued from chronic physical activity outweigh the acute risks to participants.[40–43] Despite this evidence, providers may inappropriately advise against exercise in patients who have poor health status. These findings suggest the need for further research and education regarding the role of mild to moderate physical activity among patients with cardiovascular disease

Comparison of Findings With Recently Published Studies

Our findings concerning patient reports of a high level of provider education on salt intake and exercise from physicians is in contrast with a previous study, which found a low level of self-management education provided for HF patients in inpatient settings.[16] In that study, however, self-management education was based on documentation of education in the electronic record, and in the current study it is based on patient self-report. Quite possibly, documentation of self-management education may not be occurring in a consistent manner. More information is needed from future studies on how to effectively deliver material on salt restriction in both inpatient and outpatient settings.

Findings that patient adherence to self-management behaviors were higher for salt restriction compared with reported adherence for exercise are consistent with previous studies which found that exercise adherence is challenging for most patients.[44–46]

Patients with a higher health status reported higher adherence with

exercise (coefficient=0.56; SE=0.11; $P<.0001$). Certainly, poor health status is a perceived barrier (both by patients and providers) to physical activity, but it is not necessarily a true barrier, as described above. Both patients and providers need to realize that the risks associated with sedentary behavior are greater than those associated with participating in a progressive exercise program emphasizing mild to moderate physical activities. The severity of HF can hinder a patient's ability to understand and adhere to routine exercise and dietary modification without reinforcement from a good support system. Thus, with variable classifications of HF, consideration should be given to individualize education.

Our finding that self-efficacy was significantly associated with patient-reported adherence to exercise and salt restriction is consistent with previous studies, which have shown that high perceived self-efficacy can positively influence outcomes in diabetes[47–49] and coronary artery disease.[50] The present study also found that self-management education had a stronger effect than self-efficacy in predicting adherence with salt restriction, suggesting that it may not be necessary to feel confident about HF management for adhering to a low-salt diet as long as the patient knows what specific food choices to engage in or not. Conversely, self-efficacy appears to be more important for predicting adherence with exercise, which is understandable given the multiple challenges associated with following a regular exercise program. However, since our data show that providers tended to counsel patients who were healthier and more confident, and it is these patients who exercise, we cannot necessarily conclude that self-management education would not be helpful for those patients who are less healthy. Additional research is needed to determine the effect of self-management education specifically for patients who have a high level of health limitations.

Future Directions

Future efforts should focus on educating providers regarding the effect of their education on patient adherence to ensure that it receives a high priority among many other competing priorities during the clinic visit. In addition, providers need to be shown the evidence on the benefits of mild to moderate physical activity, compared with the risks, in patients with cardiovascular disease to encourage exercise promotion in patients with less confidence or poorer health. Additional strategies to provide self-management education through nonclinician providers such as nurse practitioners should also be further explored.

Study Limitations

Several limitations to our study should be noted. First, the survey items that composed the variables for this study were completed at one point in time. Therefore, we can only comment on the associations between the variables and not their directionality or causality. A second limitation is that this study was based on self-report, which can be subject to recall bias, and objective confirmation of provider education and patient adherence with salt restriction and exercise or outcomes of nonadherence such as health care utilization was not available. In addition, participants in survey studies are more engaged in their health care and thus could represent a biased population. We had an 80% response rate, however, which is much higher than in general studies of survey research, and thus the bias may not be that significant. Finally, our study was conducted among predominantly male veterans and may not be generalizable to women or to non-VA health care settings. In particular, having few women in the study may have shifted the outcome concerning the proportion of persons who report adherence following salt-restriction recommendations. VA patients have different characteristics and their costs of care may be less than the general population. Our survey, however, had no questions on costs. Moreover, we did not measure adherence to medication, where it has been clearly shown that out-of-pocket costs play a key role in patient adherence. Hence, the measures of adherence to diet and exercise that we used in our study should not be subject to VA vs non-VA bias.

Despite these limitations, this study provides important information about the potential positive impact of provider education for persons with HF and should be followed-up with future longitudinal studies in a variety of health care settings that include both objective and subjective measures of provider education and adherence.

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References

1 American Heart Association. *Heart Disease and Stroke Statistics—2003* Update. Dallas, TX: American Heart Association; 2002.
2 Ashton CM, Petersen NJ, Souchek J, et al. Rates of health services utilization and survival in patients with heart failure in the Department of Veterans Affairs medical care system. *Am J Med Qual.* 1999;14:55–63.
3 Gottdiener JS, Arnold AM, Aurigemma GP, et al. Predictors of congestive heart failure in the elderly: the Cardiovascular Health Study. *J Am Coll Cardiol.* 2000;35:1628–1637.
4 Stewart S. Prognosis of patients with heart failure compared with common types of cancer. *Heart Fail Monit.* 2003;3:87–94.
5 Mark DB. Economics of treating heart failure. *Am J Cardiol.* 1997;80:33H–38H.
6 Haynes R, McDonald H, Garg A, et al. Interventions for helping patients to follow prescriptions for medications. *Cochrane Database Syst Rev.* 2002;CD000011.
7 Haynes R, McDonald H, Garg A. Helping patients follow prescribed treatment: Clinical applications. *JAMA.* 2002;288:2880–2883.
8 Vinson JM, Rich MW, Sperry JC, et al. Early readmission of elderly patients with Chronic heart failure. *J Am Geriatr Soc.* 1990;38:1290–1295.
9 Chin MH, Goldman L. Factors contributing to hospitalization of patients with

congestive heart failure. *Am J Public Health*. 1997;87:643–648.
10 He J, Ogden LG, Vupputuri S, et al. Dietary sodium intake and subsequent risk of cardiovascular disease in overweight adults. *JAMA*. 1999;282:2027–2034.
11 Ofili EO, Mayberry R, Alema-Mensah E, et al. Gender differences and practice implications of risk factors for frequent hospitalization for heart failure in an urban center serving predominantly African-American patients. *Am J Cardiol*. 1999;83(9):1350–1355.
12 Institute of Medicine. *Priority Areas for National Action: Transforming Health Care Quality*. Washington, DC: National Academy Press; 2003.
13 Hunt SA, Baker DW, Chin MH, et al. ACC/AHA Guidelines for the evaluation and management of chronic heart failure in the adult: executive summary a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to Revise the 1995 Guidelines for the Evaluation and Management of Heart Failure): Developed in collaboration with the International Society for Heart and Lung Transplantation; endorsed by the Heart Failure Society of America. *Circulation*. 2001;104(24):2996–3007.
14 Glassman P, Booss J, Ciraulo D, et al. *Medical Advisory Panel for the Pharmacy Benefits Management Strategic Health Group. The Pharmacological Management of Congestive Heart Failure*. Dept of Vetersans Affairs. Veterans Health Administration. Publication No. 1997;97–0007:1–19.
15 Flynn KJ, Powell LH, Mendes de Leon CF, et al. Increasing self-management skills in heart failure patients: a pilot study. *Congest Heart Fail*. 2005;6:297–302.
16 Baker DW, Asch SM, Keesey JW, et al. Differences in education, knowledge, self-management activities, and health outcomes for patients with heart failure cared for under the chronic disease model: the improving chronic illness care evaluation. *J Card Fail*. 2005;11:405–413.
17 Subramanian U, Sutherland J, McCoy KD, et al. Facility-level factors influencing chronic heart failure care process performance in a national integrated health delivery system. *Med Care*. 2007;45:28–45.
18 Rich MW. Heart failure disease management: a critical review. *J Card Fail*. 1999;5:64–75.
19 Yarnall KS, Pollak KI, Ostbye T, et al. Primary care: is there enough time for Prevention? *Am J Public Health*. 2003;93:635–641.
20 Cameron R, Best JA. Promoting adherence to health behavior change interventions: Recent findings from behavioral research. *Patient Educ Couns*. 1987;10:139–154.
21 Tong EK, Ong MK, Vittinghoff E, et al. Nondaily smokers should be asked and advised to quit. *Am J Prev Med*. 2006;30(1):23–30.
22 Gifford AL, Bormann JE, Shively MJ, et al. Predictors of self-reported adherence and plasma HIV concentrations in patients on multidrug antiretroviral regimens. *J Acquir Immune Defic Syndr*. 2000;23:386–395.
23 Lox CL, Freehill AJ. Impact of pulmonary rehabilitation on self-efficacy, quality of life, and exercise tolerance. *Rehabil Psychol*. 1999;44:208–221.
24 Alla F, Briancon S, Guillemin F, et al. Self-rating of quality of life provides additional prognostic information in heart failure. Insights into the EPICAL study. *Eur J Heart Fail*. 2002;4:337–343.
25 Subramanian U, Eckert G, Yeung A, et al. A single health status question had important prognostic value among outpatients with chronic heart failure. *J Clin Epidemiol*. 2007;60(8):803–811.
26 Heidenreich PA, Spertus JA, Jones PG, et al. Health status identifies heart failure outpatients at risk for hospitalization or death. *J Am Coll Cardiol*. 2006;47:752–756.
27 Myers J, Zaheer N, Quaglietti S, et al. Association of functional and health status measures in heart failure. *J Card Fail*. 2006;12:439–445.
28 Davies M, Hobbs F, Davis R, et al. Prevalence of left ventricular systolic dysfunction and heart failure in the Echocardiographic Heart of England Screening study. *Lancet*. 2001;358:439–444.
29 Kitzman DW, Little WC, Brubaker PH, et al. Pathophysiologic characterization of isolated diastolic heart failure in comparison to systolic heart failure. *JAMA*. 2002;288:2144–2150.
30 Hogg K, Swedberg K, McMurray J. Heart failure with preserved ventricular systolic function; epidemiology, clinical characteristics, and prognosis. *J Am Coll Cardiol*. 2004;43:317–327.
31 Dillman DA. *Mail and Internet Surveys: The Tailored Design Method*. New York, NY: John Wiley and Sons, Inc; 2000
32 Toobert DJ, Hampson SE, Glasgow SE. The summary of diabetes self-care activities measure. *Diabetes Care*. 2000;23:943–950.
33 Lorig KR, Ritter P, Stewart AL, et al. Chronic disease self-management program: 2-year health status and health care utilization outcomes. *Med Care*. 2001;39:1217–1223.
34 Gold M, Franks P, Erikson P, et al. Assessing the health of the nation: The predictive validity of a preference-based measure and self-rated health. *Med Care*. 1996:34:163–177.
35 Green CP, Porter CB, Bresnahan DR, et al. Development and evaluation of the Kansas City Cardiomyopathy Questionnaire: a new health status measure for heart failure. *J Am Coll Cardiol*. 2000;35:1245–1255.
36 Heisler M, Smith DM, Hayward RA, et al. How well do patients' assessments of their diabetes self-management correlate with actual glycemic control and receipt of recommended diabetes services? *Diabetes Care*. 2003;26:738–743.
37 Heisler M, Piette JD, Spencer M, et al. The relationship between knowledge of recent HbA_{1c} values and diabetes care understanding and self-management. *Diabetes Care*. 2005;28:816–822.
38 Neter J, Kutner MH, Nachtsheim C, et al. *Applied Linear Regression Models*. 3rd ed. New York, NY: McGraw-Hill/Irwin; 1990.
39 Stead LF, Perera R, Lancaster T. Telephone counseling for smoking cessation. *Cochrane Database Syst Rev*. 2003;(1):CD002850.
40 Piepoli MF, Davos C, Francis DP, et al. Exercise training meta-analysis of trials in patients with chronic heart failure (ExTraMATCH). *BMJ*. 2004;328(7433)189.
41 Erikssen G, Liestol K, Bjornholt J, et al. Changes in physical fitness and changes in mortality. *Lancet*. 1998;352(9130):759–762.
42 Petrella RJ, Lattanzio CN, Demeray A, et al. Can adoption of regular exercise later in life prevent metabolic risk for cardiovascular disease? *Diabetes Care*. 2005;28(3):694–701.
43 Manini TM, Everhart JE, Patel KV, et al. Daily activity energy expenditure and mortality among older adults. *JAMA*. 2006;296(2):171–179.
44 Mikesky AE, Mazzuca SA, Brandt KD, et al. Effects of strength training on the incidence and progression of knee osteoarthritis. *Arthritis Rheum*. 2006;55(5):690–699.
45 Damush TM, Stump TE, Saporito A, et al. Predictors of older primary care patients' participation in a submaximal exercise test and a supervised, low-impact exercise class. *Prev Med*. 2001;33(5):485–494.
46 Tu W, Stump TE, Damush TM, et al. The effects of health and environment on exercise-class participation in older, urban women. *J Aging Phys Act*. 2004;12(4):480–496.
47 Williams GC, Freedman Z, Deci EL. Supporting autonomy to motivate patients with diabetes for glucose control. *Diabetes Care*. 1998;21:1644–1651.
48 Williams GC, McGregor HA, Zeldman A, et al. Testing a self-determination theory process model for promoting glycemic control through diabetes self-management. *Health Psychol*. 2004;23:58–66.
49 Krein SL, Heisler M, Piette JD, et al. Effect of chronic pain on diabetes self-management. *Diabetes Care*. 2005;28:65–70.
50 Sullivan MD, LaCroix AZ, Russo J, et al. Self-efficacy and self-reported functional status in coronary heart disease: a six-month prospective study. *Psychosom Med*. 1998;60:473–478.