Published in final edited form as:

Diabetes Educ. 2012 ; 38(5): 673–684. doi:10.1177/0145721712450923.

Educational Needs for Improving Self-care in Heart Failure Patients with Diabetes

Eun Seok Cha, RN, PhD, MPH, MSN [Assistant Professor],
Nell Hodgson Woodruff School of Nursing, Emory University

Patricia C. Clark, RN, PhD, FAHA, FAAN [Professor],
Byrdine F. Lewis School of Nursing & Health Professions, Georgia State University

Carolyn Miller Reilly, RN, PhD, CHFN [Assistant Professor],
Nell Hodgson Woodruff School of Nursing, Emory University

Melinda Higgins, PhD [Research Associate Professor],
Nell Hodgson Woodruff School of Nursing, Emory University

Maureen Lobb, RN, PhD [Clinical Research Nurse],
Nell Hodgson Woodruff School of Nursing, Emory University

Andrew L. Smith, MD, and
School of Medicine, Emory University

Sandra B. Dunbar, RN, DSN, FAAN, FAHA [Professor]
Nell Hodgson Woodruff School of Nursing, Emory University

Abstract

Purpose—To explore the need for self-monitoring and self-care education in heart failure patients with diabetes (HF-DM patients) by describing cognitive and affective factors to provide guidance in developing effective self- management education.

Method—A cross-sectional correlation design was employed using baseline patient data from a study testing a 12 week patient and family dyad intervention to improve dietary and medication-taking self-management behaviors in HF patients. Data from 116 participants recruited from metropolitan Atlanta area were used. Demographic and co-morbidities, physical function, psychological distress, relationship with health care provider, self-efficacy (medication taking and low sodium diet), and behavioral outcomes (medications, dietary habits) were assessed. Descriptive statistics and a series of chi-square tests, t-tests or Mann Whitney tests were performed to compare HF patients with and without DM.

Results—HF-DM patients were older, heavier, had more co- morbidities, and took more daily medications than HF patients. High self-efficacy on medication and low sodium diet was reported in both groups with no significant difference. Although HF-DM patients took more daily medications than HF, both groups exhibited high HF medication taking behaviors. The HF-DM patients consumed significantly lower total sugar than HF patients, but clinically higher levels of sodium.

Conclusions—Diabetes educators need to be aware of potential conflicts of treatment regimens to manage two chronic diseases. Special and integrated diabetes self-management education

programs which incorporate principles of HF self-management should be developed to improve self-management behavior in HF-DM patients.

Introduction

Currently an estimated 2.5 million Americans have both heart failure (HF) and diabetes mellitus (DM) which represents 30%–47% of the total HF patients.^{1,2} The prevalence of HF-DM, unfortunately, is projected to increase over the next decade for several reasons.^{3–5} A study which reviewed 14 randomized clinical trials between 1989 and 1999 (n=34,633) found a dramatically growing prevalence of DM in the HF patients. While a 54 % increase of diabetes prevalence is found in the general population, a 360% increase was reported in persons with HF.³ As consequence, HF patients become a very high risk group for developing DM concurrently.

The increasing prevalence of diabetes, especially Type 2 diabetes (T2DM), will also cause a surge in the HF-DM population. In diabetes care, poor glycemic control is a big concern, and patients with uncontrolled diabetes are at 2.5 times higher risk to develop HF.^{6,7} In 2009, about 8% of Americans have diabetes, and it is estimated that the prevalence will double by 2050.⁸ With every 1% increase in A1C, the risk of development of HF is increased by 17% – 32%.^{9,10}

It is well known that the obesity epidemic increases vulnerability to cardiovascular diseases and T2DM. Two-thirds of Americans are overweight or obese¹¹ and strong relationships between obesity, high blood pressure, dyslipidemia, and T2DM have been identified.^{7,12–14} For instance, each 1% of weight gain corresponds to an increase of 1 mm Hg systolic and 2 mm Hg diastolic blood pressure, and every 2.2 pound (1Kg) gain in body weight results in a 1% increase in low density lipoprotein cholesterol.¹⁵

The aging U.S. population contributes to an increasing prevalence of HF, DM or HF-DM since age is a significant risk factor for developing HF and/or DM. In the US, adults aged 65 and over are the fastest growing age group. The first “baby boomers” (adults born between 1946 and 1964) turn 65 in 2011. By 2030, 18% of Americans will be 65 years and over, and this percentage will continue to grow.¹⁴ Without a doubt, patients with concomitant HF-DM are a growing population in the U.S.

When patients have HF and DM concurrently, self-care demands mount considerably. Their treatment regimens are frequently added to, changed, or adjusted, requiring these patients to make new accommodations in order to optimally manage their symptoms and to reduce potential for future health problems. Clearly, patients’ knowledge, confidence, skills, and self-management behaviors are key to achieving new treatment goals.

Treatment goals for HF patients are to control hypertension and dyslipidemia, avoid fluid retention (i.e., less than 2 pound body weight changes in a day or 5 pounds in a week), and monitor and manage symptoms (i.e., dyspnea, coughing, fatigue, dizziness).¹⁶ Treatment goals for persons with diabetes are to control blood glucose (A1C <7.0%), blood pressure (<130/80 mmHg), and cholesterol (lipid cholesterol <100mg/dL) to prevent acute/chronic diabetes complications.⁷ For the HF-DM patients, a combined treatment regimen with many life style changes and self monitoring is required to control these two separate diseases concomitantly. Treatment regimens for persons with HF, DM and HF-DM patients share similarities, the individual regimens, however, differ. For instance, both DM patients and HF-DM patients are asked to control glucose, but optimal glucose levels are different.¹⁷ Studies found that moderate glycemic control (an A1C of 7.1%–7.8%) is more beneficial than tight glycemic control (A1C< 7%) for HF-DM patients to reduce mortality rate.^{6,18}

Another issue unique to persons with HF-DM is the self-management of symptoms requiring the differentiation of etiologies. While fatigue and feeling tired or weak is common in HF patients due to inadequate perfusion, hyperglycemia may be a cause in persons with HF-DM.⁶ Similarly, dizziness can be a symptom from hypoglycemia or may be a side effect of beta-blockers or other medications. Without an accurate understanding about overlapping symptoms and appropriate self-management, patients may lack the confidence and skills to successfully manage symptoms or blame them on side effects of treatment regimens. This may result in non-adherence, hospitalization, worsening health, and the patient feeling overwhelmed and depressed about managing these two diseases.

Dietary recommendations also differ between persons with HF, DM, and combined HF-DM. While caloric and carbohydrate restricted diets to control blood glucose are critical for persons with DM, a sodium restricted diet is necessary for persons with HF to limit fluid accumulation.^{7,19} For HF-DM patients, a sodium restricted diet would be strictly prescribed because of a possible relationship between sodium intake, hypertension, and insulin resistance.^{12,20,21} Fluid restriction may also be recommended for some persons with HF, whereas thirst from increased glucose levels may trigger fluid intake in those with DM. In both groups, recommendations to limit dietary cholesterol and increase consumption of foods rich in omega-3 fatty acids are recommended to limit further cardiovascular complications.^{7,19} Consequently, this area of diet self management can be very difficult for those with HF-DM to juggle, and considerable and continued education with strong emotional supports, therefore, are necessary for them who have fewer food choices remained.

Researchers, recently, have focused attention to the reciprocal relationship between the HF and DM.^{9,22} In the failing heart, there are increased demands for oxygen and energy, which is further complicated by a loss in the ability to use glucose appropriately due to insulin resistance. To improve these conditions, many medications (e.g., diuretics, beta-receptor blockers, ACE-Inhibitor, calcium channel blockers, oral hypoglycemic agents, insulin) are prescribed. However, these medications, often, generate other health problems related to side effects. For instance, Thiazolidinediones (TZDs), which increase insulin sensitivity especially in adipose tissue, are contradicted for the HF patients due to the propensity for fluid retention.^{20,23} The biguanide, Metformin, is a very effective and economical medication to control diabetes and to reduce cardiovascular related complications in patients with DM. However, it has a “black-box” warning for HF-DM patients.^{6,24} Diuretics, particularly thiazide diuretics, decrease glucose tolerance.²⁵ Long term use of beta-adrenergic blockers, high dosages of calcium channel blockers, and multiple agents generate increased risk for developing DM.^{25,26}

Given these formidable challenges for the HF-DM patients, evidence-based self-management support is vital to provide opportunities for patients to become active self-managers to control their chronic disorders.^{6,22} The factors associated with good self management outcomes include knowledge,^{22,27} self efficacy,^{28,29} and provider support.²⁹ Depressive symptoms and lack of motivation may be also related to reduced or ineffective self management behaviors for both HF and DM.^{30,31} Very limited information, however, is available to design effective self-management education program for HF-DM patients.

The purpose of this study was to explore the need for self-monitoring and self-care education for HF-DM patients by describing cognitive and affective factors that are theoretically related to self management. Specific aims were to compare difference between persons with HF alone and with DM on: (1) socio-demographic and clinical characteristics including health status, co-morbid conditions, and recent health resource use that have been linked to self-management behaviors, (2) measures of cognitive and affective factors

describing self-management behavior (knowledge, relationships with health care provider, depression, self-efficacy), and (3) current self-management behaviors.

Methods

Study Design

A cross sectional, correlational design was used to analyze baseline participant data from a study testing a 12-week family-focused intervention to improve dietary and medication-taking self-management behaviors in persons with HF.

Sample and setting

Between 2005 and 2008, 117 NYHA Class II & III persons with HF were recruited from the metropolitan Atlanta areas. Inclusion criteria for participants were the ability to read, write and speak English, telephone access, medication regimens that include Angiotensin-Converting Enzyme Inhibitors (ACE-Is) or Angiotensin Receptor Blockers (ARBs) and diuretics or documented contraindications to these, a low sodium diet, ambulatory, adequate renal function documented by a glomerular filtration rate >30. Prior to the study, an approval from the Institutional Review Board of Emory University was obtained, and all participants gave written informed consent.

Measures and variables

Variables were derived from an integrated theoretical framework developed to guide HF self care studies.³² The framework articulates the relationships among factors considered antecedent to performing self care (which include certain demographic factors and co-morbidities, physical function, psychological factors, social support such as the relationship with health care provider, self-efficacy for medication taking and low sodium diet), and behavioral outcomes (medications, dietary habits). These variables were assessed in the study.

Demographic and the co-morbidity were assessed with items regarding age, gender, ethnicity, marital status, education, living arrangement, perceived health, NYHA classification, health insurance status, smoking and alcohol use, and current medications. With regard to co-morbidity, the Charlson Comorbidity Index used to assess co-morbid conditions. This scale was originally developed to quantify risk of death from co-morbid disease using the number of co-morbidity and weights. The possible total scores range from 0 to 37.³³

Physical function was assessed with the 6 minute walk test. Distance walked in the 6 minute time frame correlates moderately with symptom score and NYHA class, and independently and strongly predicts one year mortality and hospitalization in patients with advanced HF.³⁴ Participants were asked to walk as far as possible along a level hallway in the Clinical Research Center marked off in 100 feet increments for 6 minutes. Then, the distance walked in feet and meters was calculated with the monitoring of heart rate, blood pressure and respiratory rate, and perceived exertion.^{35,36}

Health care resource use was assessed with a Health Resources Utilization Questionnaire (HRUQ) with items regarding numbers of hospitalizations for HF and non-HF causes, and emergency department visit in the past 4 months.

Previous HF education was measured with 8 yes/no questions. Participants were asked whether they had received prior HF education about fluid restriction, daily weight, symptom management, medication, anxiety, diet, alcohol use and smoking cessation.

Depressive symptoms were measured using the Beck Depression Inventory II (BDI-II) that consists of 21 items rated on a 0–3 scale which ask participants' feelings in the past two weeks.³⁷ Higher score indicates greater depressive symptoms. This self-reported scale has been widely used in HF patients and the reported Cronbach's alpha in this population was .86 – .89.³⁸

Patients' perceived support from health care provider with HF specialty was measured with Health Care Climate Questionnaire (HCCQ) consisting of 15 items. Higher score indicates a greater perception of supportive relationships with their health care providers. "The Cronbach's alpha was previously reported as .9539 and was .91 in this study

HF Knowledge was assessed with a 27-item scale using multiple choice questions. HF knowledge regarding pathophysiology, nutrition, behavior, symptom, and medication was assessed. The instrument is scored according to the percent of questions answered correctly. This scale demonstrated good reliability ($\alpha=.84$) and validity.²²

Medication taking self-efficacy and low sodium diet self-efficacy were measured by two self-efficacy scales derived from the perceived competence scales developed by Williams and colleague.²⁹ Each scale consists of 4 items rated on 1–7 Likert scale (1=strongly disagree to 7=strongly agree to which the participant responded their degree of confidence in ability to perform actions related to low sodium diet and medication management. Obtained Cronbach's alpha was .95 and .93 for diet and medication scales, respectively.

Medication taking behavior was measured by subjective and objective scales. An 8-item Morisky was used to assess items related to heart failure medications behavior. The first seven items use dichotomous responses of yes =1 or no =0; the last item uses a 5-point Likert scale (never [1] to all the time [5]). The possible range of scores for this instrument is 1 to 12. The Medication Event Monitoring System (MEMS) is an electronic monitoring device which records cap opening. Based on the records, researchers can obtain days and numbers of medication taking. For this study, % of days of ACE-I and diuretic adherence for a two week baseline period were measured.

Dietary intake was assessed with a three-day food record maintained by the participant who recorded all meals and snacks including beverages over three days, preparation techniques, and details of condiments. The records were reviewed by the study research dietician, blinded to group assignment, who prompted the participant for greater details on food preparation, portions, and discretionary salt use. The diet record information was analyzed with a computerized food composition software program (Nutritionist V®, First Databank, San Bruno, CA) for macro and micronutrients consumed and averaged for the three days.

Data analysis

The data were analyzed using SPSS for Windows version 18.0 (SPSS Inc, Chicago, IL). Prior to analysis, all the data were examined for the accuracy of data entry, missing values, and missing patterns. Of the 117 participants, one participant who self-reported having diabetes but was missing data for oral hypoglycemic agents and insulin was excluded. Thus, 116 participants remained for the final data analysis. To answer specific aim 1, descriptive statistics and/or chi-square tests were used. To answer specific aims 2 and 3, a series of t-tests or Mann Whitney tests were used based on data distributions.

Results

Of the total sample, a majority of participants were male ($n=73$, 62.9%) and African Americans ($n=67$, 57.8%). The mean age was 55.8 ± 10.5 years (median age: 56.0 years;

range: 28–78 years), and 40.5 % (n= 47) of the participants had high school or lower level of education. The majority of the participants were diagnosed with HF for at least 5 years, but about 30% learned of their HF in the past two years. Approximately, 40% (n = 46) of the participants had HF as well as DM. The average number of years diagnosed with diabetes was 11.55 (SD= 8.86; median: 8.50 years; range: 2–38 years).

Nearly three-fourths of participants (n=84, 72.4%) had a NYHA classification II. Although most of the participants were non-smokers (i.e., never smokers: 51.72% (n=60); former smoker: 36.21% (n=42), former and current smokers had long smoking history. For the 55 smokers (current, recent, former), the average number of packs per year was 36.25 (SD: 29.19), median 30 packs/year, range from < 1 pack/year to 141 packs/year. No significant difference on the pack year in HF- patients with and without DM was identified. Interestingly, alcohol consumption was significantly lower in HF-DM patients (9 HF subjects drank 2 or more per week compared to 0 HF-DM subjects). About half of participants in both groups reported their perceived health conditions were fair or poor (See Table 1).

Differences in Health related conditions

Although there was no significant difference on the NYHA classification between patients with/without DM, HF-DM patients were older, heavier, had more co- morbidities, and took more daily medications than HF patients without DM. HF-DM patients reported more frequent hospitalizations (Range HF 0–4, HF-DM 0–15) and longer lengths of stay (4.86 ± 12.31 vs. 1.82 ± 3.80) for HF in the prior four months; but there were no statistically significant differences between groups. With regard to the level of physical function, the majority of participants were able to perform the 6 minute walk test without difficulty or adverse symptoms, though HF-DM patients walked less distance at 3 minutes and 6minutes, this difference was not statistically significant.

HF-DM patients reported significantly higher rates of hypertension, sleep apnea, and had a larger percent with history of depression than those with HF alone. Of HF-DM patients, about one half took daily insulin and one-third took oral hypoglycemic agents to control blood glucose with few taking both oral hypoglycemic agent and insulin (See Table 2).

Cognitive and affective factors describing self-management behavior

Table 3 shows the mean differences on the cognitive and affective factors describing self-management behavior between HF patients with and without DM. There were no significant differences between the groups on the perceived support from health care providers with regard to managing HF conditions, level of depressive symptoms, diet self-efficacy or medication self-efficacy. Overall, patients reported slight to moderate levels of the support from health care providers to manage their HF conditions.

Self-management behavior

To address specific aim 3, HF-DM participants were compared with HF alone on the specific self-care behaviors of medication taking and dietary habits (Table 4). The participants reported good medication-taking adherence on the self-reported and electronic measures. Total calorie consumption was relatively low when considering patients' BMI and national nutrition guidelines.⁴⁰ HF-DM patients consumed higher saturated fat, protein, dietary fibers, and lower carbohydrate than HF patients without DM, although there were no statistically significant differences on these dietary components. None of patient groups achieved the recommended nutrition goals. HF-DM patients had significantly lower sugar intake than HF-patients. In a separate detailed analysis reported elsewhere, this difference of lower sugar intake in HF-DM patients was found in men and not women.⁴¹ Of importance

clinically, HF-DM patients ingested higher levels of sodium at a mean of greater than 250 mg each day more than those without DM (See Table 4).

Discussion

The demands of self-care are synergistically escalated when patients have HF and DM simultaneously. The requested self-care regimens, often, are overlapped and/or conflicted because an exacerbation of one condition may trigger the other condition to become uncontrolled. Without support to improve their knowledge, skills and confidence to manage these demanding co-morbidities, patients may experience greater symptoms, and are vulnerable to feeling overwhelmed and depressed.⁴²

In the current study, HF-DM patients reported higher co-morbidities and a greater number of medications than those who had HF and no DM. They also reported higher depression history and sleep apnea although BDI-II showed no significant difference in depressive symptoms. Since psychological distress (e.g., depressive symptoms) is significantly related to medication adherence and disease progression in patients with a chronic disorder,^{30,31} patients' depressive symptoms and coping mechanisms should be carefully evaluated. Then, appropriate support programs to treat depressive symptoms, as well as develop problem solving and coping skills could be offered to promote effective healthy behavior in patients with HF and HF-DM.⁴³

With regard to the education in managing HF symptoms, the majority of patients reported they had received previous education on fluid retention, medication and symptom management. Their self-efficacy on managing medications and following a low-sodium diet was very high as well. However, these findings should be carefully interpreted before planning and implementing education to the HF-DM patients since the reported confidence may be "wishful thinking" rather than actual confidence: patients may not realize the actual difficulties and barriers until they encounter a situation.⁴⁴ Therefore, nurse educators need to realize this gap and assess patients' current knowledge, confidence, skills and behaviors related to the requested treatment regimens for both conditions. Based on this assessment, strategies to solve problems and barriers should be included in the self-management education.⁴³

Although the diabetic diet is important for HF-DM patients to control blood glucose, only 70% of the HF-DM patients reported that they were on a diabetic diet. Accordingly, many potential educational areas in relation to dietary habits were identified. When patients have HF, DM or both, they have a higher likelihood of experiencing a cardiovascular event (e.g., stroke or cardiac arrest) as complications. Thus, low fat and low-cholesterol diet are strongly recommended to reduce these risks.⁷ Notable is the fact that both groups reported diets high in saturated fat. Thus, reduced consumption of saturated fat and cholesterol should be a part of HF-DM patient education.

Reduced sodium consumption should be strongly emphasized in both groups. In the current study, our patients consumed excessive amounts of sodium in their reported diet. In particular, HF-DM patients consumed almost double the amount of recommended sodium. The HF-DM patients consumed significantly lower sugar intake than HF patients, though. This may be related to the availability of feedback measures to assess their sodium and glucose levels. While patients can get more immediate feedback using simple home glucose testing, they meet difficulties to accurately measure sodium intake on the diet. This finding also may be related to previous diabetes self-management education, which emphasizes carbohydrate counting. Further study may yield important information related to how patients learn about dietary regimens and how they make food selection decisions.

Interestingly, the HF-DM patients consumed less alcohol than the HF patients in the current study. Again, this may be related to previous diabetes self-management education. Medical Nutritional Therapy (MNT), which is a main component of Standards of Medical Care in Diabetes, emphasizes limiting alcohol intake because of carbohydrate-counting (i.e., one drink per day or less for women and two drinks per day or less for men).⁷ This information is frequently addressed in any diabetes education materials. Thus, HF-DM patients may be exposed on the MNT guidelines, and their knowledge about alcohol may, as a consequence, influence actual drinking behavior. A future study needs to revisit these findings to explore the powers of specific and achievable objectives and to develop standardized dietary guidelines for HF-DM patients.⁴⁵

Despite the study significance, there are several limitations in this study. First, the study only examined a cross sectional description of variables related to self-care, which may not reflect patterns or relationships over time. Second, the study did not assess either previous diabetes self-management education history or current diabetes self-management behaviors such as glucose monitoring and current glycemic control status. Also, we limitedly obtained information about which chronic condition initially comes first. Therefore, it is difficult to explain reasons for dietary differences in patients with HF and HF-DM. Third, we monitored two heart failure drugs, not diabetic medications using electronic measure regardless of their current chronic conditions. Not surprisingly, HF-DM patients would take multiple medications to control their health conditions, and route and time of administration of each medication are often different (e.g., before/after meal, injection/oral medication). Thus, it is possible that HF-DM patients may adhere well for one oral medication but not for other medications such as insulin. Also, they schedule medications based on the knowledge of a single drug rather than understanding of drug interactions. Finally, increasing familywise error rate may be a concern in the findings since we analyzed the data using multiple t-tests and Mann Whitney tests. However, this study is an initial step to describe the relative differences between HF and HF-DM patients in order to raise diabetes educators' awareness of potential conflicts of treatment regimens and provide a basis for the development of education protocols for this specific population. Thus, this concern should be minimized.

Implications for Practice

Study findings indicated a need to develop and test a comprehensive and integrated education program for HF-DM patients who experience synergetic self-care needs to manage two chronic conditions. Single disease specific education may not provide effective information to confront the self-care needs for patients with multiple chronic disorders. Rather, they may receive more benefit from a multi-disease perspective with an individualized and comprehensive approach. This should include when and who best to contact when HF and/or DM symptoms flare up, how to effectively communicate with multiple health care providers, and how to appropriately use available community and financial resources.⁴² Partnership between proactive patients and a well prepared health care team is essential to achieve optimal care for HF-DM patients who require frequent regimen adjustments. Also, an opportunity to develop a systemic and standardized protocol for HF-DM patients should be explored with collaboration between heart failure team and certified diabetes educators.

Acknowledgments

This study was supported by: (1) A Family Partnership Intervention for Heart Failure", (R01 R08800) National Institute of Nursing Research, NIH 07/01/04-11/30/09, PI: S. Dunbar, (2) in part by PHS Grant M01 RR0039 from the General Clinical Research Center program, National Institutes of Health, National Center for Research Resources and PHS Grant UL1 RR025008 from the Clinical and Translational Science Award program, National

Institutes of Health, National Center for Research Resources, and (3) Nitromed for unrestricted educational grant. We also acknowledge the Atlanta Veteran's Administration Medical Center for their support.

References

1. Greenberg BH, Abraham WT, Albert NM, et al. Influence of diabetes on characteristics and outcomes in patients hospitalized with heart failure: a report from the Organized Program to Initiate Lifesaving Treatment in Hospitalized Patients with Heart Failure (OPTIMIZE-HF). *Am Heart J*. 2007; 154(2):277 e271–278. [PubMed: 17643576]
2. Masoudi FA, Inzucchi SE. Diabetes mellitus and heart failure: epidemiology, mechanisms, and pharmacotherapy. *Am J Cardiol*. Feb 19; 2007 99(4A):113B–132B. [PubMed: 17196473]
3. Kamalesh M, Nair G. Disproportionate increase in prevalence of diabetes among patients with congestive heart failure due to systolic dysfunction. *Int J Cardiol*. Mar 10; 2005 99(1):125–127. [PubMed: 15721510]
4. American Diabetes Association. [Accessed April 5, 2009.] Total Prevalence of Diabetes & Pre-diabetes. n.d. <http://www.diabetes.org/diabetes-statistics/prevalence.jsp>
5. National Center for Health Statistics. [Accessed May 3, 2008.] Health, United States, 2007. 2007. <http://www.cdc.gov/nchs/data/hs/hs07.pdf#074>
6. Giamouzis G, Triposkiadis F, Butler J. Metformin Use in Patients With Diabetes Mellitus and Heart Failure: Friend or Foe? *J Card Fail*. 2010; 16(3):207–210. [PubMed: 20206894]
7. American Diabetes Association. Standards of medical care in diabetes-2011. *Diabetes Care*. 2011; 34(Suppl 1):S11–S61. [PubMed: 21193625]
8. Boyle JP, Thompson TJ, Gregg EW, Barker LE, Williamson DF. Projection of the year 2050 burden of diabetes in the US adult population: dynamic modeling of incidence, mortality, and prediabetes prevalence. *Population Health Metrics*. 2010; 8(29) <http://www.pophealthmetrics.com/content/8/1/29>.
9. Ashrafian H, Frenneaux MP, Opie LH. Metabolic mechanism in heart failure. *Circulation*. 2007; 116:434–448. [PubMed: 17646594]
10. Nichols GA, Gullion CM, Koro CE, Ephross SA, Brown JB. The incidence of congestive heart failure in type 2 diabetes: an update. *Diabetes Care*. 2004; 27:1879–1884. [PubMed: 15277411]
11. Center for Disease Control and Prevention. [Accessed July 30, 2011.] Overweight and Obesity. 2009. <http://www.cdc.gov/nchs/fastats/overwt.htm>
12. Fujita T. Insulin resistance and salt-sensitive hypertension in metabolic syndrome. *Nephrol Dial Transplant*. Nov; 2007 22(11):3102–3107. [PubMed: 17602196]
13. Brunzell JD, Davidson M, Furberg CD, et al. Lipoprotein management in patients with cardiometabolic risk: consensus statement from the American Diabetes Association and the American College of Cardiology Foundation. *Diabetes Care*. Apr; 2008 31(4):811–822. [PubMed: 18375431]
14. HealthyPeople.gov. [Accessed March 2, 2011.] Healthy People 2020. n.d. <http://www.healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicid=21>
15. Orzano AJ, Scott JG. Diagnosis and treatment of obesity in adults: an applied evidence-based review. *J Am Board Fam Pract*. Sep-Oct;2004 17(5):359–369. [PubMed: 15355950]
16. Hunt SA, Abraham WT, Chin MH, et al. 2009 focused update incorporated into the ACC/AHA 2005 Guidelines for the Diagnosis and Management of Heart Failure in Adults: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines: developed in collaboration with the International Society for Heart and Lung Transplantation. *Circulation*. Apr 14; 2009 119(14):e391–479. [PubMed: 19324966]
17. Gerstein HC, Miller ME, Genuth S, et al. Long-term effects of intensive glucose lowering on cardiovascular outcomes. *N Engl J Med*. Mar 3; 2011 364(9):818–828. [PubMed: 21366473]
18. Aguilar D, Bozkurt B, Ramasubbba K, Deswal A. Relationship of hemoglobin A1C and mortality in heart failure patients with diabetes. *J Am Coll Cardiol*. 2009; 54:422–428. [PubMed: 19628117]

19. American Heart Association. [Accessed March 24, 2011.] Diet and Lifestyle Recommendations. n.d. http://www.heart.org/HEARTORG/GettingHealthy/NutritionCenter/HealthyDietGoals/Dictionary-of-Nutrition_UCM_305855_Article.jsp
20. McCance, K.; Huether, SE.; Brrashers, V.; Rote, NS. Pathophysiology: The Biologic Basis for Disease in Adults and Children. 6. Missouri: Mosby; 2010.
21. Melander O, Groop L, Hulthen UL. Effect of salt on insulin sensitivity differs according to gender and degree of salt sensitivity. *Hypertension*. 2000; 35:827–831. [PubMed: 10720602]
22. Reilly CM, Higgins M, Smith A, et al. Development, Psychometric testing, and revision of the Atlanta Heart Failure Knowledge Test. *J Cardiovasc Nurs*. 2009; 24(6):500–509. [PubMed: 19858959]
23. Tang WHW, Maroo A. PPAR α agonist: safety issues in heart failure. *Diabetes Obes Metab*. 2007; 9:447–454. [PubMed: 17587386]
24. Tahrani AA, Varughese GI, Scarpello JH, Hanna FWF. Metformin, heart failure, and lactic acidosis: is metformin absolutely contraindicated? *BMJ*. 2007; 335(7618):508–512. [PubMed: 17823192]
25. Andren L. General considerations in selecting antihypertensive agents in patients with type II diabetes mellitus and hypertension. *Am J Med*. Dec 8; 1989 87(6A):39S– 41S. [PubMed: 2688413]
26. Gress TW, Nieto FJ, Shahar E, Wofford MR, Brancati FL. Hypertension and antihypertensive therapy as risk factors for type 2 diabetes mellitus. Atherosclerosis Risk in Communities Study. *N Engl J Med*. Mar 30; 2000 342(13):905–912. [PubMed: 10738048]
27. Koelling TM, Johnson ML, Cody RJ, Aaronson KD. Discharge education improves clinical outcomes in patients with chronic heart failure. *Circulation*. Jan 18; 2005 111(2):179–185. [PubMed: 15642765]
28. Riegel B, Carlson B. Facilitators and barriers to heart failure self-care. *Patient Educ Couns*. 2002; 46(4):287–295. [PubMed: 11932128]
29. Williams GC, Freedman ZR, Deci EL. Supporting autonomy to motivate patients with diabetes for glucose control. *Diabetes Care*. 1998; 21(10):1644–1651. [PubMed: 9773724]
30. Morgan AL, Masoudi FA, Havranek EP, et al. Difficulty taking medications, depression, and health status in heart failure patients. *J Card Fail*. 2006; 12(1):54–60. [PubMed: 16500581]
31. Lin EH, Katon W, Rutter C, et al. Effects of enhanced depression treatment on diabetes self-care. *Ann Fam Med*. Jan-Feb;2006 4(1):46–53. [PubMed: 16449396]
32. Dunbar SB, Clark PC, Quinn C, Gary RA, Kaslow NJ. Family influences on heart failure self-care and outcomes. *J Cardiovasc Nurs*. 2008; 23(3):258–265. [PubMed: 18437068]
33. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chronic Dis*. 1987; 40(5):373–383. [PubMed: 3558716]
34. Shah MR, Hasselblad V, Gheorghiade M, et al. Prognostic usefulness of the six-minute walk in patients with advanced congestive heart failure secondary to ischemic or nonischemic cardiomyopathy. *Am J Cardiol*. 2001; 88(9):987–993. [PubMed: 11703994]
35. Guyatt GH, Pugsley SO, Sullivan MJ, et al. Effect of encouragement on walking test performance. *Thorax*. Nov; 1984 39(11):818–822. [PubMed: 6505988]
36. Bittner V, Weiner DH, Yusuf S, et al. Prediction of mortality and morbidity with a 6-minute walk test in patients with left ventricular dysfunction. SOLVD Investigators. *JAMA*. Oct 13; 1993 270(14):1702–1707. [PubMed: 8411500]
37. Beck AT, Steer RA, Ball R, Ranieri W. Comparison of Beck Depression Inventories -IA and -II in psychiatric outpatients. *J Pers Assess*. 1996; 67(3):588–597. [PubMed: 8991972]
38. Gutierrez RC, Davis T. Assessing depression in patients with congestive heart failure. *Can J Cardiovasc Nurs*. 1999; 10(4):29–36.
39. Williams GC, Deci EL. Internalization of biopsychosocial values by medical students: a test of self-determination theory. *J Pers Soc Psychol*. Apr; 1996 70(4):767–779. [PubMed: 8636897]
40. U. S. Department of Agriculture and U. S Department of Health and Human Service. Dietary guidelines for American 2010. 7. Washinton DC: US Government Printing Office; Dec. 2010

41. Hill, JM.; Nucci, AM.; Frediani, J.; Hopkins, B.; Dunbar, S. Nutrition Theses Paper 10. Respiratory Therapy, Georgia State University; Atlanta, GA: 2011. The Relationship between Diet Quality and the Comorbidity of Diabetes in Adults with Heart Failure.
42. Bodenheimer T, Wagner EH, Grumbach K. Improving primary care for patients with chronic illness. JAMA. 2002; 288(14):1775–1779. [PubMed: 12365965]
43. Lorig, K.; Sobel, D.; Gonzalez, V.; Minor, M. Living a Healthy life with Chronic Conditions: Self-management of Heart Disease, Arthritis, Diabetes, Asthma, Bronchitis, Emphysema and others. 3. Boulder, CO: Bull Publishing; 2006.
44. Resnick, B. Self-efficacy. In: Peterson, SJ.; Bredow, TS., editors. Middle Range Theories: Application to Nursing Research. New York: Lippincott Williams & Wilkins; 2004. p. 183-203.
45. Doran GT. There's a S.M.A.R.T. way to write management's goals and objectives. Management Review. 1981; 71(11):35–36.

Table 1

Comparison of Socio-demographic Characteristics between HF and HF-DM patients

	HF (n=70)	HF-DM (n=46)	Tests for Differences
Age (years)	Mean $\pm$ SD	Mean $\pm$ SD	
	54.37 $\pm$ 11.64	58.15 $\pm$ 8.14	t= -2.058, df=114, p=.042
	%(n)	%(n)	χ^2 , df, p-value
Gender (male)	58.6 (41)	69.6(32)	$\chi^2=1.438$, df=1, p=.230
Ethnicity			
Caucasians	42.9 (30)	41.3 (19)	$\chi^2=.027$, df=1, p=.868
African Americans	57.1(40)	58.7 (27)	
[§] Education			
<8 th	1.4 (1)	6.5(3)	$\chi^2=.091$, df=1, p=.763
high school (HS)	37.1 (26)	37.0 (17)	
Technical school	14.3(10)	6.5 (3)	
college	35.7 (25)	41.3 (19)	
post graduate	11.4 (8)	8.7 (4)	
NYHA classification			
NYHA II	72.9 (51)	71.7 (33)	$\chi^2=.017$, df=1, p=.895
NYHA III	27.1(19)	28.3(13)	
^{§§} Perceived health condition			
Poor	12.9 (n=9)	17.4% (n=8)	$\chi^2=.591$, df=1, p=.442
Fair	38.6% (n=27)	41.3%(n=19)	
Good	44.3%(n=31)	41.3% (n=19)	
Excellent	4.3% (n=3)	0.0% (n=0)	
^{§§§} Smoking habits			
Current	11.4%(n=8)	8.7%(n=4)	$\chi^2=.006$, df=1, p=.937
former	37.1%(n=26)	39.2%(n=18)	
never	51.4%(n=36)	52.2%(n=24)	
Smoking (packs/year) (# of smokers; Median;[Range])	35.49 $\pm$ 31.22 (33;26.25; [0–141])	37.40 $\pm$ 26.51 (22;32.50; [0–112])	MW, Z= -0.146, p=0.884
Alcohol consumption *			
None	68.6% (n=48)	80.4%(n=37)	Fisher's Exact Test, p=.011
1 drink/wk	18.6% (n=13)	19.6% (n=9)	
2–7 drinks/wk	11.4% (n=8)	0.0% (n=0)	
8 drink/wk	1.4% (n=1)	0.0% (n=0)	

*
p< .05[§]Chi-Square test was performed to examine a difference between those had high school or lower level of education (8th, high school, and technical school) and college or higher education (college and post graduate).^{§§}Chi-Square test was performed to examine a difference between the poor/fair group and good/excellent group.

§§§ Chi-Square test was performed to examine a difference between smokers/ex-smokers and never-smokers.

Table 2

Comparison of Health related conditions between HF Patients with and without DM

	HF (n=70)	HF-DM (n=46)	Test for Differences
	Mean $\pm$ SD	Mean $\pm$ SD	Mann Whitney
Length of DM (yrs)	N/A	11.55 $\pm$ 8.86	NA
Body mass index *	32.19 $\pm$ 8.59	35.86 $\pm$ 7.67	Z= -2.596, p=.009
Charlson total Score	2.64 $\pm$ 2.08	3.70 $\pm$ 3.13	Z= -3.481, p=.001
# of co-morbidities ***	2.14 $\pm$ 1.21	3.26 $\pm$ 1.37	Z= -4.446, p<.001
Total # daily of med ***	8.21 $\pm$ 2.71	11.59 $\pm$ 3.97	Z= -4.914, p<.001
# of hospitalization	0.58 $\pm$ 0.97	1.48 $\pm$ 3.26	Z= - .749, p=.454
Total # hospital days	1.82 $\pm$ 3.80	4.86 $\pm$ 12.31	Z= - .866, p=.387
Physical function			
Distance walked at 3 minutes	522.42 $\pm$ 177.86	475.18 $\pm$ 150.37	Z= -1.504, p=.133
Distance walked at 6 minutes	1037.53 $\pm$ 348.74	951.13 $\pm$ 315.96	Z= -1.307, p=.191
	% (n)	%(n)	χ^2 , df, p-value
Period of diagnosis of HF			
6months	4.3(3)	10.9(5)	χ^2 = .006, df=1, p=.939
7mos-1.5 yrs	15.9(11)	13.0(6)	< 5yrs vs. >= 5 yrs
1.5yrs-2 yrs	8.7(6)	6.5(3)	
2 yrs or < 5 years	21.7(15)	19.6(9)	
5years	49.3(34)	50.0(23)	
Education history			
Fluid retention	82.9(58)	73.9(34)	χ^2 =1.353, df=1, p=.245
Medication	88.6(62)	84.8%(39)	χ^2 =.354, df=1, p=.552
Symptom management	85.7(60)	82.6%(38)	χ^2 =.204, df=1, p=.651
Smoking cessation	67.1(=47)	56.5(26)	χ^2 =1.342, df=1, p=0.247
Medical history			
Sudden cardiac arrest	21.4(15)	13.3(6)	χ^2 =1.203, df=1, p=.273
CVA or stroke	14.3(10)	6.5 (3)	χ^2 =1.682, df=1, p=.195
HTN *	65.7 (46)	84.8 (39)	χ^2 =5.154, df=1, p=.023
Arrhythmia	54.3(38)	47.8(22)	χ^2 =.000, df=1, p=.994
Sleep Apnea **	20.0 (14)	45.7 (21)	χ^2 =8.670, df=1, p=.003
History of Taking anti-anxiety agent	8.6 (6)	17.4 (8)	χ^2 =2.899, df=1, p=.089
Has Depression history *	25.7 (18)	43.5 (20)	χ^2 =3.977, df=1, p=.046
History of taking anti-depressant medications *	11.6 (8)	30.4 (14)	χ^2 =6.333, df=1, p=.012
Meditation taking and diet elated to Diabetes			
Insulin	N/A	47.8 (22)	NA
Oral Hypoglycemic	N/A	34.8 (16)	NA
Insulin + Oral hypoglycemic	N/A	8.7(4)	NA

	HF (n=70)	HF-DM (n=46)	Test for Differences
	Mean ± SD	Mean ± SD	Mann Whitney
On DM Diet	N/A	69.6 (32)	NA

*
 $p < .05$;

**
 $p < .01$;

 $p < .001$

Table 3

Cognitive affective factors describing self- management behavior

Variables	Measures	HF (n=70)	HF-DM (n=46)		Possible range	Obtained Range	Mann-Whitney Test
		Mean ± SD	Mean ± SD				
Relationship with HCP	HCCQ	5.97±1.35	5.86±1.20		1-7	1.83-7.33	Z= -.888, p=.375
Depression	BDI-II	12.50±8.51	14.14±12.00		0-63	0-52	Z= -.213, p=.832
Self-efficacy	Low sodium diet scale	6.02±1.39	5.93±1.29		1-7	1-7	Z= -.324, p=.746
	Medication taking scale	6.58±1.13	6.47±1.29		1-7	1-7	Z= -.618, p=.536

* HCP refers to health care providers.

Table 4

Current self- management Behaviors

Variables	Recommended guidelines	Mean $\pm$ SD		Mann-Whitney Test
		HF (n=70)	HF-DM (n=46)	
Medication taking behavior				
Morisky (self- reported measure)	NA	10.30 $\pm$ 1.97	10.64 $\pm$ 1.59	Z= -.701, p= .484
# of doses taken correctly by MEMS	NA	ACE-I: 84.97 $\pm$ 22.90 Diuretic: 87.88 $\pm$ 20.93	ACE-I: 87.98 $\pm$ 16.63 Diuretics: 88.95 $\pm$ 16.97	Z= -.413, p= .679 Z= -.393, p= .694
# of days taken correctly (MEMS)	NA	ACE-I: 78.76 $\pm$ 26.80 Diuretic: 81.57 $\pm$ 24.09	ACE-I: 81.73 $\pm$ 22.84 Diuretics: 81.08 $\pm$ 22.58	Z= -.129, p= .898 Z= -.426, p= .670
Dietary habits				
Calories (Kcal)	Adult males: 2,000Kcal–3,000Kcal Adult females: 1,600Kcal–2,400Kcal based on age, gender & physical activity level [†]	1677.30 $\pm$ 652.92	1641.76 $\pm$ 634.11	Z= -.447, p= .655
Calories from Fat (Kcal)	20–35% of calorie [‡]	576.44 $\pm$ 304.66	598.64 $\pm$ 335.38	Z= -.367, p= .714
Calories from Saturated Fat (Kcal)		173.53 $\pm$ 108.29	182.89 $\pm$ 99.58	Z= -.619, p= .536
Protein (g)	10–35% of calorie [‡]	68.91 $\pm$ 27.64	77.00 $\pm$ 25.52	Z= -.1794, p= .073
Cholesterol (mg)	<300mg/day	274.08 $\pm$ 153.65	346.58 $\pm$ 221.69	Z= -.1553, p= .120
Carbohydrate(g)	45–65% of calorie [‡]	207.48 $\pm$ 82.30	187.33 $\pm$ 81.66	Z= -.1461, p= .144
Dietary Fiber (g)	14g/1000Kcal [‡]	14.21 $\pm$ 6.72/total calorie	16.38 $\pm$ 8.90/total calorie	Z= -.1218, p= .223
***Total Sugar(g)	15% of calorie [‡]	91.41 $\pm$ 49.57	64.21 $\pm$ 42.09	Z= -.3112, p= .002
Water (ml)		1660.92 $\pm$ 843.33	1782.49 $\pm$ 692.00	Z= -.1151, p= .250
Sodium (mg)	1500mg/day in those aged 51 and older [‡]	2551.21 $\pm$ 1427.67	2815.43 $\pm$ 1453.74	Z= -.991, p= .321
Potassium (mg)	4700 mg/day [‡]	1732.18 $\pm$ 1021.37	1837.41 $\pm$ 748.78	Z= -.991, p= .321
Calcium(mg)	1000–1300 mg based on age and gender [‡]	541.61 $\pm$ 305.78	534.80 $\pm$ 241.06	Z= -.567, p= .570
Magnesium (mg)	310–420 mg based on age and gender [‡]	157.72 $\pm$ 103.38	173.79 $\pm$ 98.03	Z= -.900, p= .368
* Phosphorus	700	695.69 $\pm$ 341.61	832.76 $\pm$ 380.48	Z= -.2034, p= .042
Iodine		29.46 $\pm$ 20.33	45.34 $\pm$ 37.10	Z= -.1639, p= .101

[†] Nutrition goals according to the 2010 Dietary guidelines recommendations 40

[‡] Recommended saturated fat intake is 7% of total calories according to the 2011 Standards medical Care in diabetes.⁷

* $p < .05$;
** $p < .01$;
*** $p < .001$
MEMS indicates Medication Event Monitoring System