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The relationship between B-type natriuretic peptide levels and hospital length of stay and quality of life in congestive heart failure patients

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The Relationship Between B-Type Natriuretic Peptide Levels and Hospital

Length of Stay and Quality of Life in Congestive Heart Failure Patients

by

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A dissertation submitted in partial fulfillment
of the requirements for the degree of
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Preface

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Finally, and most importantly, I dedicate the glory of this work to JESUS, my GOD. He has provided me the strength, passion and dedication to persevere so I may affect the lives of others in his name.

The Relationship Between B-type Natriuretic Peptide (BNP) Levels and Hospital

Length of Stay and Quality of Life in Congestive Heart Failure Patients

Irma B. Ancheta

ABSTRACT

Previous research on quality of life (QOL) and its relation to BNP levels in heart failure (HF) has been widely studied. However, the impact of physicians' knowledge of BNP levels at time of clinic visit on QOL and hospital length of stay (LOS) has yet to be fully investigated. The purpose of this study were to determine if physicians' knowledge of BNP levels affected a change in QOL scores at 90 days and reduce hospital length of stay among heart failure patients. QOL data from HF clinic patients (N= 108, 67.5 ±12.3, 56% male, ejection fraction 26.5 ± 8.2) were analyzed. QOL was measured at time of clinic visit (T1) and at 90 days (T2) using the Minnesota Living with Heart Failure Questionnaire (MLHFQ). An independent t-test was utilized to compare the two groups. Findings: Both groups were comparable regarding demographic and baseline characteristics. There was no significant association observed between the experimental and control group at 90 days, although the data indicated a decrease in the mean QOL scores at 90 days (37.46 ± 28.67) as compared to the mean QOL scores at baseline (46.87 ± 29.63) for both groups.

Because the QOL scale is reversed, this indicated that there was a positive change in QOL scores during the 90 day time interval. Hospital LOS was similar for both groups (mean=3 days). BNP levels were significantly correlated with both baseline QOL scores (r=.25, p=.01) and physical subscale scores (r=.24, p=.01). Mortality was higher in the control when compared to the experimental group (t=1.99, df=90, p=.04). Conclusion: While physicians' awareness of BNP levels had not shown a significant change in QOL at 90 days, patients' QOL might already have been quite positive. Chronic HF patients may have adapted to their disease and have adjusted their perception of their QOL. Therefore, QOL may be a stable construct at this time. Findings may have been different on newly diagnosed HF patients since they may not have adapted to their health condition.

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Chapter 1

Introduction

This chapter begins by defining congestive heart failure (CHF), discussing the etiology and pathophysiology of heart failure (HF), including the signs and symptoms, stages, and classifications to facilitate understanding of the disease process. This is followed by the presentation of the epidemiology of HF including the prevalence, incidence, risk factors, co-morbid conditions, mortality rates, and economic impact on the healthcare delivery system in the United States. The effect of CHF on hospitalization, effect of CHF on quality of life (QOL) and the role of b-type natriuretic peptide (BNP) in HF will be explained. The statement of the problem, purpose of the study, research hypotheses, and definition of terms will be described. The definition of BNP and BNP-related studies will be discussed. Finally, the underlying assumptions, delimitations, limitations, and significance of the study will be presented.

Definitions of Congestive Heart Failure

The Heart Failure Society of America (HFSA) 2006 Comprehensive Heart Failure Practice Guidelines (Adams et al., 2006) defines congestive heart failure as:

> A syndrome caused by cardiac dysfunction, generally resulting from myocardial muscle dysfunction or loss and characterized by left ventricular dilation or hypertrophy. Whether the dysfunction is primarily systolic or diastolic or mixed, it leads to neurohormonal and circulatory abnormalities, usually resulting in characteristic symptoms such as fluid retention,

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shortness of breath, and fatigue, especially on exertion. In the absence of

appropriate therapeutic intervention, HF is usually progressive at the

levels of cardiac function and clinical symptoms. The severity of clinical

symptoms may vary substantially during the course of the disease process

and may not correlate with changes in underlying cardiac function.

Although HF is progressive and often fatal, patients can be stabilized, and

myocardial dysfunction and remodeling may improve, either

spontaneously or as a consequence of therapy. In physiologic terms, HF

is a syndrome characterized by elevated cardiac filling pressure and/or

inadequate peripheral oxygen delivery, at rest or during stress, caused by

cardiac dysfunction. (p. 14)

The American College of Cardiology/American Heart Association (ACC/AHA)

(2005) provides a scientific statement defining heart failure as

A complex clinical syndrome that can result from any structural or

functional cardiac disorder that impairs the ability of the ventricle to fill with

or eject blood. The cardinal manifestations of HF are dyspnea and fatigue,

which may limit exercise tolerance, and fluid retention, which may lead to

pulmonary congestion and peripheral edema. (p. e160)

Etiology

According to the ACC/AHA guidelines (2005), the underlying causes of HF

in a substantial portion of patients are coronary artery disease, hypertension, and

dilated cardiomyopathy. One-third of HF patients have nonischemic

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cardiomyopathy, which may be caused by hypertension, thyroid disease, valvular disease, alcohol use, or myocarditis (ACC/AHA, 2005).

Pathophysiology of Heart Failure

In HF, there is decreased cardiac output and increased pulmonary pressures consequently leading to pulmonary congestion. Because of this process, the body activates both neurohormonal pathways in order to compensate for low cardiac output. There is increased heart rate and contractility as initiated by the sympathetic nervous system. Catecholamines such as epinephrine and noepinephrine are circulated to cause artrial vasoconstriction and stimulate secretion of rennin from the kidney (ACC/AHA, 2005). These circulating catecholamines may exacerbate ischemia, cause arrhythmias or promote cardiac remodeling. Increased production or stimulation of the renin-angiotensin system (RAAS) results in arterial vasoconstriction, sodium and water retention, and release of aldosterone, leading to sodium and water retention (ACC/AHA, 2005).

On the other hand, nitric oxide and natriuretic peptides are hormones released by secretory granules in cardiac myocytes. Both are produced to counteract the effects of the vasoconstriction caused by catecholamine and rennin-angiotensin production. Nitric oxide and natriuretic peptides, to include b-type natriuretic peptide (BNP), promote systemic and pulmonary vasodilation and increase sodium and water excretion. Continuous neurohormonal stimulation causes the left ventricle to undergo remodeling consisting of left ventricular dilatation, myocyte hypertrophy, and elongation. Enhanced neurohormonal

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stimulation can lead to apoptosis, aggravation of ventricular contractility, and death (ACC/AHA, 2005). Chronic HF refers to the clinical syndrome characterized by signs and symptoms of increased tissue/organ water and decreased tissue/organ perfusion (Zile, 2005). HF is a common outcome for many cardiovascular diseases that results in symptomatic or asymptomatic left ventricular dysfunction (LVD). HF is a vicious cycle if left untreated. Dysfunction begets additional dysfunction that culminates in the demise of the patient (Ramakrishnan, et al., 2005).

Signs and symptoms of heart failure

The ACC/AHA guidelines refer to the cardinal manifestations of heart failure that include dyspnea, fatigue, which may limit exercise tolerance, fluid retention, which may lead to pulmonary congestion and peripheral edema (Hunt et al., 2005). Signs and symptoms of congestive heart failure depend upon the side of the heart affected. Fatigue, orthopnea, wheezing or hacking cough, and shortness of breath during mild exertion are symptoms of left-sided failure.

Pulmonary edema occurs when too much fluid accumulates in the lungs. Since right-sided congestive heart failure reduces the amount of blood returning to the heart, the main symptoms are swelling in the feet, ankles, legs, and abdomen because the tissues throughout the body fill up with excess fluid. Patients with systolic heart failure experience feeling tired more often and have decreased appetite and increased weight gain (HFSA, 2006).

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Stages of Heart Failure

The staging of HF was devised to establish the evolution and progression of this disease. This HF classification was intended to complement but not replace the NYHA functional classification (ACC/AHA, 2005; HFSA, 2002). These levels or stages can only advance; the patient always goes forward not backward. This classification focuses on patients with HF as well as those who are at risk of developing HF (ACC/AHA, 2005). The following are the stages of HF as presented by the ACC/AHA guidelines: Stage A refers to the patient who is at high risk for developing HF but has no structural disorder of the heart (such as, hypertension or coronary artery disease); Stage B refers to an asymptomatic patient with a structural disorder of the heart (such as, LVD either dilation or hypertrophy); Stage C refers to the patient having underlying structural heart disease with past or current symptoms of HF; and Stage D refers to the patient with end-stage disease who requires specialized treatment strategies (Hunt, et al., 2001; Ramakrishnan, et al., 2005). Table 1 illustrates the stages of HF.

Table 1:

Stages of heart failure

American College of Cardiology/American Heart Association Classification of Chronic Heart Failure	
A High risk for developing heart failure	Hypertension, diabetes mellitus, CAD, family history of cardiomyopathy
B Asymptomatic heart failure	Previous MI, LV dysfunction, valvular heart disease
C Symptomatic heart failure	Structural heart disease, dyspnea and fatigue, impaired exercise tolerance
D Refractory end-stage heart failure	Marked symptoms at rest despite maximal medical therapy

Classification of Heart Failure

The New York Heart Association Classification (NYHA) criteria are utilized to assess the functional capacity of HF patients. The staging of heart failure has not replaced but complemented the functional classification of HF as categorized by the NYHA (ACC/AHA, 2005). Listed below is the NYHA classification according to the HFSA (2006). Class 1 refers to no limitation of physical activity. Ordinary physical activity does not cause undue fatigue, palpitation, and dyspnea. Class 2 refers to the presence of slight limitation of physical activity. Comfortable at rest, but ordinary physical activity results in fatigue, palpitation, and dyspnea. Class 3 refers to the marked limitation of physical activity:

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comfortable at rest but less than ordinary physical activity causes fatigue, palpitations, and dyspnea. Class 4 refers to the inability to carry out physical activity without discomfort, and symptoms of cardiac insufficiency at rest. If any physical activity is undertaken, discomfort is increased (HFSA, 2006).

Epidemiology

Prevalence

As an epidemic disease and a major cause of chronic disability, CHF adversely affects the health of millions. Nearly 5 million Americans are living with HF (ACC/AHA, 2005). CHF is the primary reason for 12 to 15 million office visits and 6.5 million hospital days each year. Prevalence of HF in 2002 indicated that there were 4,900,000 of the total population with HF. The total number of males with HF was 2,400,000 (2.6%) and total number of females was 2,500,000 (2.1%) (AHA, 2005). CHF increases with age: 7% of people 65-74 years of age and 10% of people over 75 are affected by HF (CDC, 2005).

Incidence

The incidence of HF showed 550,000 new cases annually or 10 per 1000 after age 65. An estimated 80% of patients hospitalized with HF are more than 65 years old (AHA, 2005). HF is a common Medicare diagnosis-related group with more Medicare dollars spent for the diagnosis, treatment, and management when compared to other diagnoses (ACC/AHA, 2005). Seventy-five percent (75%) of HF cases had a preexisting condition for hypertension. It is estimated that 22% of male and 46% of female patients who experience a myocardial infarction (MI) will most likely be diagnosed with HF within 6 years. According to

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the National Heart Failure Data from the Acute Decompensated Heart Failure National Registry (ADHERE), the mean age of hospitalized HF patients was 71.2 years old, and 52% of them were female (AHA, 2005). Persons diagnosed with high blood pressure greater than 160/90 mm Hg have a twofold risk of having HF as compared to those with blood pressure less than 140/90 mm Hg (AHA, 2005). The annual rates of new HF cases per 1000 of non-black men ages 65-74 are 21.5; ages 75-84 are 43.3; ages 85 and above are 73.1. The annual cases for non-black women ages 65-74 are 11.2; ages 75-84 are 26.3; and ages over 85 are 6.9. The annual rates of new HF cases for black men ages 65-74 are 21.1; ages 74-84 are 52; and over age 85 are 66.7. The prevalence for HF in black women is at 18.9, 33.5 and 48.4, respectively (AHA, 2005).

Risk Factors

The presence of multiple risk factors makes HF a more complicated diagnosis to manage and predisposes patients to frequent hospital admissions. Risk factors include smoking, diabetes, high blood pressure, high cholesterol levels, low high density lipoprotein (HDL) levels, obesity, and sedentary lifestyle (HFSA, 2006). Coronary artery disease, myocardial infarction (MI), hypertension, abnormal or damaged heart valves, damage to the heart muscle caused by alcohol or drug use, overexposure to radiation or viruses, heart defects from birth, severe lung disease, diabetes, severe anemia, overactive thyroid gland or cardiac dysrthymias are all considered causes of heart failure (AHA, 2005). Some reasons for HF are unknown. The most common risk factor for HF is hypertension. Uncontrolled hypertension increases the risk of heart failure by

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200%, and people diagnosed with diabetes have a two- to eight-fold greater risk for developing HF (AHA, 2005).

Mortality

An estimated 53,0000 patients have died of HF as a primary cause, and the mortality of HF has increased despite advances in treatment. in part due to better treatment and saving patients with MI earlier in life (ACC/AHA, 2005). It is estimated that 1 in 5 HF patients will die within one year of diagnosis (AHA, 2005). Worst of all, HF patients suffer sudden cardiac death six to nine times more frequently than the general population (AHA, 2005). According to the AHRERE data, in-hospital mortality was 3.8% (AHA, 2005).

From 1992 to 2002, deaths from HF increased by 35.3%, and death rate increased to 7.7%. In 2000, there were 55,704 deaths occurring from HF; this mortality rate was a 148% increase from 1979 (National Center for Health Statistics, 2004). The age-adjusted death rate was 20.2 (deaths per 100,000 population) in 2000. Death rates were: for white males (21.0), black males (23.2), white females (19.4) and black females (21.3) (National Center for Health Statistics, 2004). The overall death rate for HF in 2001 was at 18.7 %, with 19.6% for white males, 21.7% for black males, 18.1 % for white females and 18.8% for black females (AHA, 2005).

Economic Impact

In 1999, $3.6 billion was paid to Medicare beneficiaries diagnosed with HF (CMS, 2003). For 2005, an estimated direct and indirect cost of HF was $27.9 million (AHA, 2005). The management of HF costs $56 billion a year, with 70%

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due to hospitalization (Bhalla et al., 2004). Thus, HF has an enormous, escalating financial impact on healthcare expenditures (AHA, 2005; CDC, 2005).

Effect of Congestive Heart Failure on Hospitalization

CHF is the most frequent cause for hospital readmissions, higher within the first 30 days after discharge than within 60 to 90 days (AHA, 2005). Hospital discharges increased by 152 percent from 377,000 in 1979 to 970,000 in 2002. According to the ADHERE registry, the mean hospital length of stay for HF patients was 5.8 days (median 4.3 days) (AHA, 2005).

Several studies indicated that CHF is the primary diagnosis in most hospital admissions. In the Medicare study, chronic obstructive pulmonary disease, renal failure, and diabetes were medical conditions listed as other noncardiac comorbidities prevalent in older HF patients. Results of the Medicare study revealed that 40% of patients with HF had five or more noncardiac comorbidities; they accounted for 81% of the total inpatient hospital days. The presence of increased number of comorbidities in this patient population increased the risk of hospitalization (Braunstein et al., 2003). National databases on HF show that several studies have been conducted to reduce CHF hospitalizations. These studies include clinical trials on HF pharmacological management, HF device treatment, and non-pharmacological interventions to improve patient compliance and self-care behaviours (AHA, 2005).

Effect of Congestive Heart Failure on Quality of Life

The treatment of HF is complicated and frequently focused on improvement of quality of life (QOL) rather than on the recovery of the patient.

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Patients with CHF often experience severe symptoms and deterioration of QOL (Moser, 2002; Rector, 2005; Luttik et al., 2005; Lee et al., 2005). To date, there remains confusion about the definition and measurement of QOL. For purposes of this study, QOL is defined as a multidimensional subjective description of the psychological, physical, and social domains of health as measured by the Living with Heart Failure Questionnaire (MLHFQ) (Rector, 2005).

The conceptual model by Rector et al. (2006) is used to guide this study. The model illustrates that the effects of HF on QOL are attributed to symptoms caused by HF. In the Valsartan Heart Failure Trial (VAL-HEFT) study, patients were asked to repeatedly assess several symptoms of HF and complete the MLHWF questionnaire. The purpose of the conceptual model was to assess patients' perceptions of how heart failure affected their QOL. Other pathophysiologic measures were also used to assess the severity and secondary effects of HF. Results from both of these measurements were statistically analyzed to determine whether relationships exist among symptom assessments, pathologic measures, and MLHF scores. Using this secondary analysis of data from the VAL-HEFT study, the authors concluded that a significant proportion of the effects of HF on QOL is explained by the presence of symptoms of HF as measured by the MLWHF score and that the effects of QOL varies with age regardless of symptoms. Results of the study indicated that effects of HF on QOL with HF symptoms depend on HF pathology and that symptoms are the mediating factor on the effects on QOL (Rector et al., 2006).

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Figure 1 illustrates the model as described by Rector (2006).
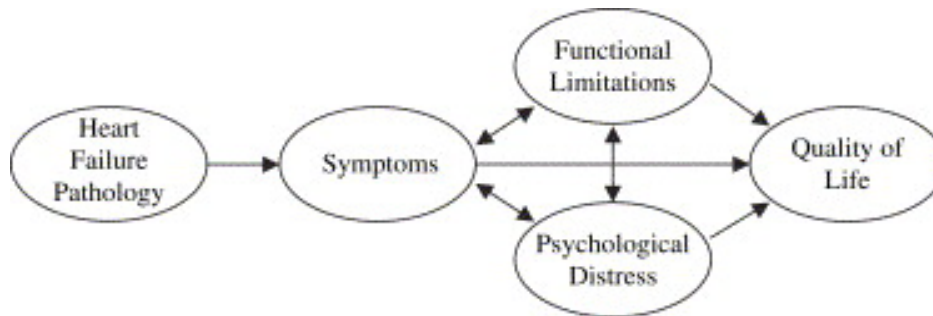
Figure 1: Conceptual model illustrating the effect of heart failure on QOL

This conceptual model shows the effects of HF pathology on QOL, with HF symptoms as the mediating factor (Rector et al., 2006).

A domino effect is initiated from experiencing the physical symptoms leading to functional limitations suffered by HF patients. As HF advances and progresses, the disease prevents patients from living as they would have wanted. (Rector et al., 2006). Ordinary daily activities and recreational hobbies become difficult to perform without getting short of breath, lacking energy, or becoming easily fatigued. Patients with HF give up their independence since they must depend on others for menial tasks. This situation causes a variety of feelings such as frustration, hopelessness, depression, being a burden to the family, loss of self-control, and lowered self-esteem (Rector et al., 2006; Rector, 2005; Brostrom et al., 2004; Lee et al., 2005; Moser, 2002).

Literature reviewed on QOL indicates infrequency of treatment for psychological factors despite their role in the outcomes of heart failure, its association to QOL and to hospital admissions. It has been suggested that perception of life situation, psychosocial adjustment to illness, and functional

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limitations are multi-dimensional areas that affect the QOL among heart failure patients. The perception of a life situation included how HF patients feel about their disease condition (Costelo & Boblin, 2004). Psychological adjustment to illness describes how depression, anxiety, social support, meaning, coping style, and spiritual beliefs affect QOL. The physical dimension includes functional limitations and HF symptomatology, self-care management strategies, and patient education in coping with a lifelong chronic condition. Amelioration of physical symptoms may improve functional status, which may improve QOL. An increased awareness of HF patients' life situations may lead to patients adapting to their CHF. Increased knowledge and ability to perform self-care may keep patients out of a vicious cycle of limitation and resignation. QOL, therefore, should be targeted as a relevant outcome measure when dealing with HF patients (Brostrom et al., 2004; Lee et al., 2005; Moser, 2002).

Role of B-Type Natriuretic Peptide (BNP) in Heart Failure

CHF is a complex progression of domino effects involving cardiac and neurohormonal systems. BNP is a 32-amino acid hormone that was first found in the porcine brain. Subsequent studies found that b-type natriuretic peptide (BNP) level is a neurohormone produced by the left ventricle in response to fluid overload and released to the body's systemic circulation (Masson et al. 2006; Brenden et al. 2006; HFSA,2006).

BNP is a biomarker of HF, and early detection of increased BNP levels may lead to early diagnosis and treatment of CHF, thereby decreasing readmissions and improving patients' quality of life (QOL) (Heidenrich et al.,

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2004; Maisel et al., 2001; MacMahon et al., 2002). BNP is released in a pulsatile manner, approximately every 30 to 90 minutes in both healthy individuals and those with HF. However, in the presence of volume overload, there is a rapid elevation of BNP levels as evidenced by an increase in its pulsatile release (White, 2005). BNP inhibits sodium reabsorption in the distal tubules, increases globular filtration, and is involved in the regulation of diuresis. BNP antagonizes the vasoconstricting effects of the renin angiotensin-aldosterone system (RAAS), thereby regulating blood pressure and fluid balance (Chiong & Miller, 2002). BNP levels are elevated with cardiac overload and increased ventricular volume; they are sensitive to increased ventricular stretch (Mark & Felker, 2004). Ventricular volume expansion and fluid overload are evident in the early phases of CHF, thus becoming a marker for heart failure (Jiang et al., 2001; Maisel et al., 2002; Cheng et al., 2001; Ishii et al., 2003; Tabbizar et al., 2002; Anand et al., 2002).

Activation of the neurohormonal system leads to progressive myocardial dysfunction and heart failure (Eichhorn & Bristow, 2001; Venugopal, 2001; Chiong & Miller, 2002). In the presence of volume overload, the cardiac ventricles stimulate BNP production and electrophysiologic arrthymias, suggesting the relationship between BNP and sudden death. Increased BNP levels are therefore a strong predictor of sudden death (Berger et al, 2002). Currently, BNP levels are not routinely tested during clinic visits (CMS, 2003), nor are they part of current CHF guidelines (HFSA, 2006; Howie, Caldwell & Dracup, 2003).

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Studies of BNP in Heart Failure

The following research studies have shown how BNP levels are an indicator and a useful diagnostic tool for early stages of HF (Morrison et al. 2002, Ninuma et al., 1998; Wieczorek et al., 2002; Lubarsky & Mandell, 2004; Hirata et al., 2001; Teboul et al., 2004; Sagnella, 1998; Vanderheyden et al., 2004; Heidenreich et al., 2004; Mair et al., 1999). Taniguchi et al. (2006) conducted a study investigating the relationships between BNP and (QRS) duration to determine the prognostic value in HF patients. QRS duration and BNP levels were measured after patients (n = 93) were treated in the emergency department. Results showed that sudden death (6 patients, 348 ± 128 pg per ml) for progressive heart failure (9 patients, 390 ± 97 pg per ml), and readmission for worsening heart failure in (20 patients, 354 ± 79 pg per ml) occurred in 35 patients. The authors concluded that high levels of BNP and prolonged QRS duration was associated with poor prognosis regardless of any type of cardiac events. The study also suggested that a combination of both BNP levels and QRS duration may be useful in predicting the prognosis of HF patients.

Masson et al. (2006) investigated the prognostic value of BNP and amino terminal probrain natriuretic peptide (NT-proBNP) levels in stable, chronic HF patients. Baseline BNP and NT-proBNP levels were drawn from 3,916 patients enrolled in the Val-HEFT study. Findings reported that receiver-operator characteristic curves for all-cause mortality (area under the curve (SD) was BNP 0.665 (0.011) vs. NT-proBNP 0.679 (0.011), p = 0.0734). Sensitivity and specificity ranged from 0.590 to 0.696. The authors concluded that both BNP and

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NT-proBNP showed slight differences in their relation to clinical characteristics and prognostic performance as a diagnostic tool in a large HF population and were the most powerful independent markers of outcome in HF.

Cardarelli and Lumicao (2003) conducted an extensive literature review on the prognostic and therapeutic monitoring value of BNP levels. They concluded that symptomatic patients without a history of CHF had BNP levels proportional to the severity and survival in CHF patients (BNP 80 pg per ml, sensitivities 93%-98%, PV- 92%-98%). Those with BNP levels over 256.9 pg per ml deteriorated within the ensuing 12 months as compared to those with a BNP level of 42.4 - 8.6 pg per ml who remained improved in their functional class. Another study by Berger et al. (2002) indicated that with cut-off point of BNP 130 pg per ml Kaplan-Meier survival rates were significantly higher in those patients with lower BNP levels than in those with values higher than the cut-off score (n = 452, $p = .0001$).

Wieczorek et al. (2002) investigated the performance of the BNP rapid assay as a diagnostic tool in CHF, evaluating it in inpatient, outpatient, and healthy control subjects (n = 1050). Participants were classified into categories of those without CHF (n = 473), those with hypertension but no cardiovascular disease (n = 168), NYHA Class I (n = 73); Class II (n = 135); Class III (n = 141); and Class IV (n = 60). Using receiver operator characteristic (ROC) curves, results indicated that with a cut-off of 100 pg per ml, the assay showed a sensitivity of 82% and a specificity of 99%, validating the usefulness of BNP in the diagnosis of CHF and staging the severity of HF.

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The seven-site, international Breathing Not Properly Multinational Study (Maisel, 2002) examined if BNP was useful in predicting CHF patients with acute dyspnea in 1586 emergency department (ED) patients. Two independent cardiologists were blinded to patients' BNP measurements. A receiver operator characteristic was used to illustrate various BNP levels. With a cut-off value of 100 pg per ml, diagnostic accuracy of 83.4%, predictive negative value (PV-) of 96% at 50 pg per ml, findings were: BNP alone was more accurate than any historical or laboratory values in predicting CHF as a cause of dyspnea. At least a non-systolic CHF patients showed significantly lower BNP levels than those with systolic heart failure (413 pg per ml vs. 821 pg per ml, p <0.001 for each pairwise comparison). The study concluded that, used in conjunction with other clinical assessment, BNP is useful in establishing or excluding the diagnosis of CHF.

Morrison et al. (2002) enrolled 321 ED patients with dyspnea and determined if BNP levels could differentiate cardiac from pulmonary causes of dyspnea. Two physicians blinded to the BNP levels were asked to give their opinions on the probability of the patient having HF and their final diagnosis. The area under the ROC, which plots sensitivity and specificity of BNP levels differentiating cardiac from pulmonary, was .96 (p< 0.001). Results revealed that CHF patients (n = 137) had high BNP levels (758 to 798 pg per ml) as compared to those with pulmonary diseases (n = 85, 61 to 10 pg per ml).

Hirata et al. (2001) examined the utility of BNP levels for early diagnosis of CHF and severity of the disease process in daily clinical practice. For 415 heart-

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disease patients and 65 control-group subjects, comparison of BNP and atrial natriuretic peptide (ANP) levels using nonparametric Tukey type multiple comparison showed that BNP was higher than ANP (.864 vs. .787, p = 0.06). The area under the ROC curve (AUC) was used to evaluate the usefulness of both levels. With cut-off values of 15 pg per ml, BNP sensitivity was 74% and specificity of 83% in patients with cardiac disease. BNP levels correlate well with LVD, pulmonary artery wedge pressures, left ventricular hypertrophy, and systolic/diastolic dysfunction; levels higher than 100 pg per ml are highly suggestive of heart failure (ACC/AHA, 2001).

BNP levels not only accurately confirm the diagnosis of CHF but differentiate HF from other diseases (McCullough et al., 2003; Maisel et al., 2002). A study conducted by Ninuma et al. (1998) examined if atrial natriuretic peptide (ANP) and BNP are effective methods of predicting heart disease irrespective of LVD. Examining 481 patients, the study concluded that BNP was effective for screening asymptomatic patients with left ventricular dysfunction (BNP<13 pg per ml gave a predictive negative value of 100%). The area under the receiver operating curve (ROC) for BNP was significantly greater when compared to ANP (0.94 vs. 081; p = .001). Knowing the role the neurohormones play in the pathophysiology of HF makes for a better understanding and appreciation of BNP levels as a valuable test in the diagnosis of heart failure.

Statement of the Problem

Few studies have examined the relationship between clinicians' knowledge of BNP levels and hospital length of stay (LOS) and quality of life in

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heart failure (HF) patients. Troughton et al. (2000) concluded that current treatment strategies in the clinic ignore plasma neurohormone concentrations (BNP), even though they are independent markers of cardiac status and prognosis of heart disease including heart failure. Recent CHF guidelines do not target any hemodynamic criteria such as BNP levels prior to hospital discharge since most efforts have been focused on the use of pharmacological therapy and CHF management clinics (Troughton et al., 2000). Therefore, the goal of this study is to compare two CHF clinic groups: one with and one without clinicians' knowledge of BNP levels and examine the relationship of physician knowledge to hospital LOS and QOL.

Purpose of the Study

The purpose of this study is [1] to determine if clinicians' knowledge of BNP levels would make any difference in the QOL scores between the experimental and control groups at 90 days and [2] to determine if physicians' knowledge or lack of knowledge of BNP levels at time of CHF clinic visit affect hospital LOS on all hospital admissions regardless of how many hospital admissions occur in 90 days.

Research Hypotheses

The effects of the study will be assessed by testing the following hypotheses:

Hypothesis 1: It is hypothesized that clinicians' knowledge or lack of knowledge of BNP levels at time of clinic visit makes a difference in the quality of life scores

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between the experimental group and the control group at 90 days. An independent t-test between experimental and control groups was used to compare their mean QOL scores at 90 days.

Hypothesis 2: It was hypothesized that clinicians' knowledge or lack of knowledge of BNP levels at time of CHF clinic visit would affect hospital LOS on all hospital admissions of CHF patients within 90 days. A comparison of means for both experimental and control groups was used to examine the relationship between BNP levels and hospital LOS within 90 days.

Definition of Terms

For the purpose of the study, the following terms are identified:

[1] Congestive heart failure: a complex clinical syndrome that can result from any structural or functional cardiac disorder that impairs the ability of the ventricle to fill with or eject blood (ACC/AHA, 2005). The cardinal manifestations of HF are dyspnea and fatigue, which may limit exercise tolerance, and fluid retention, which may lead to pulmonary congestion and peripheral edema (ACC/ AHA, 2005).

[2] Systolic dysfunction: a defect in the ability of the cardiac muscles to shorten against a volume load. The ventricle loses its ability to eject blood into the aorta, and the LV systolic properties become abnormal (Zile et al., 2005).

[3] Diastolic dysfunction: the inability of the cardiac muscle to rapidly or completely return to a resting state. At this point, the ventricle cannot accept blood at low pressures, and ventricular filling is slow or incomplete unless atrial pressure increases (Zile et al., 2005).

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[4] B-type natriuretic peptide (BNP): a cardiac neurohormone secreted from the cardiac ventricles as a response to ventricular volume expansion and fluid overload, evident in the early phases of congestive heart failure (Maisel, 2001; Mark & Felker, 2004).

[5] Hospital length of stay: number of days a patient stays in the hospital from time and date of admission to time and date of discharge. Portions of a day were considered as one day of hospital stay.

[6] Quality of life: a multidimensional subjective description of the psychological, physical, and social domains of health as measured by the Living with Heart Failure Questionnaire (MLHFQ) (Rector, 2005).

Underlying Assumptions

The proposed study has some assumptions that are specific to the population of interest. The first assumption is that there is a correlation between BNP and HF. The second assumption is that early detection and knowledge of BNP levels may enable physicians to provide more aggressive treatment and titration of medications. The third assumption is that increased levels of BNP are directly related to poor QOL scores among heart failure patients. The fourth assumption is that timely detection and knowledge of BNP levels decreases hospital LOS.

Delimitations

The sample included patients diagnosed with congestive heart failure. They had a wide range of ethnicity; were over 21 years of age; able to read, write and speak English; and had serum creatinine levels not greater than 2.5.

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Limitations

The limitations of the study included those that are generally experienced with quantitative study. First of all, the study population is focused on one clinic center, thereby limiting any generalization of findings to other geographical areas. Secondly, the participants of the study may have already been exposed to the same questionnaire in the past. Thirdly, there is a possibility of having measurement error in the study questionnaire. Lastly, there is a possibility of having random error in the BNP rapid assay machine.

Significance of the Study

Congestive heart failure is becoming one of the most chronic, debilitating, and progressive diseases in the United States. Numerous factors have been implicated in the disease, including coronary artery disease, hypertension, high cholesterol levels, diabetes, smoking, and diet and lifestyle behaviors. Despite a high level of public awareness of this disease, the majority of the population are unaware of their risks of having HF. By contributing to the body of knowledge concerning HF management, this study is intended to increase the understanding of the various factors that affect the success of managing HF patients. By measuring BNP levels, researchers will know how important the link is between BNP levels and QOL. By examining the relationship of B-type natriuretic peptide levels on CHF hospital LOS and QOL, this study may provide suggestions for future interventions that would allow patients to properly and timely treat the syndrome of HF.

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The research study may result in formulating and developing protocols that could provide heart failure patients with self-management strategies, allowing them more autonomy despite their health conditions, decreased hospital LOS, and enhanced QOL. The study furthers the science of nursing in that it seeks to investigate how clinicians' knowledge of BNP levels affect hospital LOS and QOL among patients with HF.

Chapter 2

Review of Literature

Chapter 2 describes an overview of congestive heart failure (CHF) as it relates to the study. The first area of the literature review describes quality of life (QOL) as experienced by heart failure patients. The second area of the literature review describes the effect of CHF on hospitalization. The third area discusses the role of b-type natriuretic peptide (BNP) in CHF hospitalization. Finally, physicians' knowledge of BNP levels predicting heart failure (HF) treatment will be discussed.

Introduction

Congestive heart failure (CHF) is the end stage of heart disease (AHA, 2005). It is a common diagnosis among elderly people who have multiple risk factors and co-existing illnesses and are on multiple medications. It is a chronic, disabling disease that causes patients to become dependent on others for their daily needs. Heart failure patients experience symptoms characterized by shortness of breath, edema, easy fatigability, and decreased physical endurance; these symptoms deter patients from activities that they enjoy. The prognosis is poor; patients experience deterioration of quality of life and frequent and regular hospital readmissions. The following is literature reviewed on QOL as experienced by patients living with heart failure, the effect of CHF on hospitalization, the role of BNP in CHF hospitalization, and physicians' knowledge of BNP levels predicting treatment.

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Quality of Life as Experienced by Heart Failure Patients

Quality of life (QOL) among HF patients is a subjective, multi-dimensional, concept that includes the physical, psychosocial, emotional, and spiritual aspects of life that change with time. It includes [a] the perception of life situation; [b] psychosocial adjustment to illness; [c] functional limitations of HF; [d] HF self-care management programs; and [e] patient education in HF (Brostrom et al., 2004; Sneed et al., 2001; Lee et al., 2005; Bosworth et al., 2004). Research correlating CHF and QOL indicate that the psychological factors are as important as the physiological factors (Moser, 2002; Riegel, 2006; Rector et al., 1993; Bennett et al., 1997; Clark et al., 2003; Konstam et al., 1996).

[A] Perception of Life Situation

The empirical literature has found that several factors affect how QOL may be influenced by one's perception of life situation: gender differences, HF patients' and spouses' perception of QOL, HF patients' subjective perception of QOL, and objective evaluation of the severity of HF (Martensson et al., 2005; Costelo & Boblin, 2004; Luttik et al., 2005).

Gender differences regarding perception of QOL in heart failure

Several studies show conflicting results regarding gender differences in the perception of QOL in HF. In a qualitative study conducted by Costelo and Boblin (2004), open, semi-structured interviews were used for clinic CHF patients (n = 6, 3 men and 3 women) with New York Heart Association (NYHA) Classes III–IV, with ages ranging from 37 to 87 years old. The objective of the study was to identify whether gender differences influence QOL, treatment, and survival.

Data collection focused on the experience of the women and men with CHF; the two sources were those individuals with CHF and a family member for each participant. The study utilized a semi-structured one-on-one interview that lasted for one hour and occurred at the patients' homes or in the CHF clinic. Open-ended research questions were used to explore participants' responses. Results revealed a total of 13 themes: burden to others, frustration, loss, acceptance, hope of the future, fatigue, maintaining independence, fear, physical symptoms, confusion due to lack of knowledge, isolation, depression, and shock and disbelief.

Three themes were identified from the subjects' responses. First, the psychosocial impact of CHF is greater than the physical impact. The author recommended that in addressing this issue, emphasis should be geared toward time for patients to verbalize their feelings and more time provided for the nurse to promote holistic assessment and to develop a therapeutic rapport with the patient. Second, men experienced more social isolation and loss, while women experienced fear. They recommended that healthcare providers should be aware of gender differences since men and women respond differently in coping with or accepting their illness. Third, the depression experienced by patients with HF is influenced by age. The younger patients experience more physical limitations and depression when compared to older subjects. Nursing implications from this study included using depression scales as part of nursing assessment and thoroughly performing a comprehensive and holistic evaluation of the patients.

On the other hand, Riegel et al. (2003) using secondary analysis from a previous study, examined 320 CHF men and women (N = 640) with matched functional status, age, ejection fraction, and marital status. Results showed minimal gender differences in QOL in patients with HF. Data from a convenience sample of nine experimental or quasi-experimental studies conducted in eight sites were used for the study. The MLWHF questionnaire was used to assess QOL between the treatment and control groups. The survey was administered at baseline and at 3 months. Results indicated that QOL was statistically significant and that QOL was minimally worse among women when compared to men (1-3 points) at baseline and at 3 months. Emotional dimensions of QOL were lower in women than in men at baseline ($p<0.03$) but were small and statistically nonsignificant in 3 months. Therefore, the study concluded that gender differences in the perception of QOL are minimal in patients with HF.

QOL as perceived among male heart failure patients

In 1997, Martensson et al. conducted a qualitative study describing how male patients with heart failure perceive their life situations. Once again, the phenomenographic approach was the method utilized for the study. Open semi-structured questions were used for the interview. Twelve men diagnosed with CHF, with ages ranging from 48 to 80 years old, were enrolled in the study. Interview questions targeted the biophysical, socio-cultural, emotional, intellectual, and spiritual-existential dimensions. The data analysis compared different statements with similarities and differences. Six themes were identified: [1] a belief in the future that gave CHF patients a feeling of expectancy or being

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self-influential; [2] gaining awareness was conceived of as being able to adapt to the symptoms and make the best of the situation; [3] feeling support from the environment; [4] feeling limitations was perceived as either social or physical limitation; [5] feeling a lack of energy was described as mental and physical inabilities of setting about doing things that needed to be done; and [6] feeling resignation was conceived of as indifference, in which death was the only thing expected, or as powerlessness to influence their life situation. Recommendations from the study included patient education regarding CHF and its symptoms and focusing on self-care and other possibilities.

QOL as perceived among women with heart failure

Martensson et al. (1998) conducted a study that showed how women with HF have a different perception of their life situation. The phenomenographic approach was utilized as the research design, describing something from a second person's perspective (the patient's experience of something or how something appears to someone). Methods used were open, semi-structured interviews based on the five dimensions of the holistic theory of Savrimaki and Stenbock-Hult (1993). The five dimensions were: biophysical, socio-cultural, emotional, intellectual, and spiritual-existential. Subjects were 12 CHF patients between 65 and 85 years old with various etiologies of heart failure. The study found that risk factors were different in women than in men.

Five categories or themes were identified: [1] feeling content with one's past and present life; [2] a sense of support was conceived of as feeling abandoned or having a sense of devotion; [3] a sense of limitation was conceived

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of as physical or social limitation; [4] feeling anxiety ranged from insecurity in relation to one's self or in relation to one's surrounding; and [5] powerlessness was perceived to be a feeling of worthlessness or being a burden. In this study, women were likely to experience guilt, anxiety, and decreased self-worth. Recommendations for future studies include nursing interventions that would focus on self-care abilities, setting realistic goals and expectations, providing a hopeful perspective, and empowering patients to have self-control and improved self-esteem.

QOL as perceived by both heart failure patients and their partners

Ekman et al. (2002) described health related quality of life (HRQOL) and sense of coherence (SOC) in a group of elderly HF patients with moderate to severe heart failure in comparison to a healthy control group (n = 94). Methods used included matching HF patients to healthy control subjects. The SF-36 health survey was used to assess QOL health status, and the Antonovsky Sense of Coherence Scale (SOC) measured overall orientation toward demanding life situations. Significant differences were found between men and women. Male subjects diagnosed with HF scored higher in the physical dimension of the SF-36 (33 vs. 45, p = 0.0005) vs. healthy controls (57 vs. 77, p = 0.036).

Findings revealed that old-age and severe heart failure were associated with lower levels of HRQOL scores as compared to healthy controls. The study claimed that a state of tension occurs when a stressor in life is present and that successful coping or management of stress can lead to better health. This means that the presence of an individual's social, cultural, and historical contexts is

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helpful in making stressors in life more manageable, comprehensible, and meaningful.

Luttik et al. (2005) conducted an explorative study of QOL as perceived by HF patients and QOL as perceived by their partners. The study enrolled 38 heart failure couples, 31 male and 7 female patients. The Cantril Ladder of Life instrument was used to assess the QOL. Results indicated that the mean QOL scores for QOL (present) for HF patients was 6.8 as compared to partners at 5.0 ($p<0.025$). Mean QOL (past) scores for HF patients was 4.9 as compared to partners at 6.1 ($p<0.03$). In this study, HF patients experienced a poor QOL both in the past and in the present as compared to their partners. However, the QOL expectation scores 3 years in the future did not differ significantly (6.7 vs. 6.4, $p = 0.60$).

Subjective perception of QOL and objective evaluation of the severity of heart failure

Grigoni et al. (2003) studied the distance between patients' subjective perception of QOL and objective evaluation of the severity of HF. The study investigated the relationship between QOL (what patients are most interested in) and objective parameters of CHF severity (largely physician care). QOL was evaluated using the MLWHF questionnaire; objective clinical indicators used were the electrocardiographic, echocardiographic, hemodynamic and functional capacity. Results revealed that sinus rhythm ($p = 0.007$), NYHA class ($p<0.001$), and the distance covered with the 6-minute walk test ($p<0.001$) were correlated with QOL. Therefore, the study recommended the possibility of cost-effective

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non-pharmaceutical therapeutic approach in improving QOL heart-failure management as a much needed approach in the management of heart failure.

[B] Psychosocial Adjustment to Illness

The empirical review found that psychological factors such as depression, anxiety, and coping styles affect QOL in HF patients (Zambroski et al., 2005; Artinian et al., 2004; Carels, 2004; Martensson et al., 2003; Dracup et al., 1992). Depression in CHF has been well documented in several studies of heart failure (Johansson et al., 2006; Turvey et al., 2006; Konstam et al., 2005; Costelo & Boblin, 2004). An estimated $5 billion of the total $20 billion cost associated with heart failure may be associated with depression. The prevalence of depression among hospitalized HF patients ranged from 15% to as high as 77.5%; outpatients with HF and depression ranged from 13% to 42% (Gottlieb et al., 2004). The summary of the cross-sectional studies conducted by Havranek et al. (1999), Majani et al. (1999), and Koenig et al. (1998) indicated the presence of higher levels of depression in the heart failure population. The longitudinal study conducted by Murberg et al. (1999) revealed that depressed mood is a significant indicator of mortality at 2-year follow-up of CHF patients (MacMahon & Lip, 2002).

Depression as experienced among heart failure patients

Evangelista et al. (2006) studied the relationship of depression and obesity on health related quality of life (HRQOL) in patients from a tertiary HF clinic (n = 358). The Beck Depression Inventory (BDI), MLWHF questionnaire, and body mass index were utilized in measuring the variables of the study. The authors reported BMI results in relation to overall MLWHF, physical subscale, and

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emotional subscale scores were significant ($p<0.001$). The study concluded that obese HF patients have significantly poorer HRQOL, physical health, and emotional well-being; they also have more depressed symptoms.

Lesman-Leegte et al. (2006) evaluated depressive symptoms among elderly hospitalized HF patients (n = 572). Depression was measured using the Center for Epidemiological Studies Depression Scale (CES-D). Findings reported that 41% had symptoms of depression, women more than men (48% vs. 36%, X^2 = 8.1, $p<0.005$). Multivariable logistic regression showed that women had more depressive symptoms (OR.68, 95% CI 1.14-2.48), COPD (OR 2.11, 95% CI 1.35-3.30), sleep disturbance (OR 3.45, 95% CI 2.03-5.85) and loss of appetite (odds 2.61, 95% CI 1.58-4.33). The authors concluded that depression was more prevalent in elderly women than in elderly men hospitalized with HF.

Martensson et al. (2003) conducted a study on CHF patients and spouses regarding different levels of depression and health related quality of life (HRQOL). The study used a two-group comparative design and enrolled 48 couples with all men diagnosed with heart failure. Depression was assessed using the Beck Depression Inventory (BDI), and HRQOL was assessed using the SF-12 health survey. Results revealed gender differences regarding the presence of depression. Patients with HF had significant differences in depressive symptoms, with men having a mean of 10.5 ± 7.3, whereas their spouses had a mean of 7.0 ± 5.6 ($p<0.006$). The authors recommended strategies and interventions that would include enhancing education and communication between the couples (patients and spouses).

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Sullivan et al. (2002) conducted a study evaluating 1,098 health maintenance organization patients categorized into three groups. Group 1 includes those with no depression (n = 672; cost of $7,474 per patient per year), group 2 includes those with antidepressant prescription only (n = 312; cost, $11 012 per patient per year), and group 3 includes those with antidepressant prescription and depression diagnosis recorded (n = 114; cost, $9550 per patient per year). Healthcare costs were 26% higher in group 2 (antidepressant prescription only), 29% higher in group 3 (antidepressant prescription and depression diagnosis) as compared to the no-depression group 1 ($p<.001$), suggesting that healthcare costs are significantly higher for patients with depression.

Moser et al. (2005) studied the prevalence of psychological, social, and behavioral risk factors in patients recently hospitalized with HF. The randomized study recruited participants from three community hospitals (n = 202). The modifiable risk factors measured were depression, QOL, assessment of symptoms, health, and medical compliance. The Multiple Adjective Affect Checklist was utilized to measure depression and anxiety. The MLWHF questionnaire was used to measure HRQOL. The dyspnea and fatigue index was used to measure symptom status. Health compliance was measured by analyzing the documentation of the intervention nurse. Using the Multiple Adjective Affect Checklist, a score > 7 represented presence of anxiety and a score of > 11 indicated presence of depression. Results showed that the mean anxiety level was 7.8 ± 4.6 (median 7.0, range 0-21) and mean depression level was 15.6 ± 8.4

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(median 16, range 1-37). Anxiety was present in half of the participants (50%), and 5% had double the anxiety levels from the cut-off point. The authors concluded that the presence of psychological, social, and behavioral risk factors are prevalent among discharged HF patients.

[C] Functional Limitations

The lack of mental and physical energy may cause CHF patients to have functional limitations. These limitations may cause patients with heart failure to lose hope and feel a sense of resignation that neither they nor their environment can influence their medical predicament (Martensson, 1997). Symptoms of congestive heart failure include shortness of breath, fluid retention, which may lead to pulmonary congestion and peripheral edema, fatigue that limit exercise tolerance, and general body malaise that limit daily activities (Hunt et al., 2005).

Symptom severity and symptom burden

Insomnia and sleep disordered breathing are the most severe and burdensome symptoms of HF associated with poor QOL (Zambroski et al., 2005; Konstam et al., 2005; Brostrom et al., 2004). Sleep disordered breathing (SDB) is a cardinal symptom of HF associated with poor QOL (Ferrier et al., 2005; Trupp et al., 2004; Brostrom et al., 2004). SDB is inclusive of both central sleep apnea (CSA) and obstructive sleep apnea (OSA).

Zambroski et al. (2005) conducted a study regarding symptom severity, prevalence, and burden on QOL among patients with heart failure (n = 58). The method used for the study was a cross-sectional descriptive design. Physical and emotional symptoms were assessed using the Memorial Symptom Assessment

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Scale-Heart Failure. Functional status was assessed using the Dyspnea Fatigue Scale and NYHA classification. HRQOL was assessed by the MLWHF questionnaire.

Total mean scores reported for the MLWHF questionnaire were 60.1± 21.5. Results indicated that there was a high symptom prevalence of shortness of breath (2.7 ± 1.0), lack of energy (2.9 ± 0.1), dry mouth (2.5 ± 1.1), feeling drowsy (2.4 ± 1.0), and difficulty sleeping (3.0 ± 1.0). The prevalence of psychological symptoms included difficulty of concentrating, worry, sadness, nervousness, and irritability. Difficulty sleeping was rated as the most frequent and severe symptom at 94% and 98%, respectively. When compared to chest pain, difficulty sleeping was the most burdensome symptom (2.1 ±1.1 vs. 2.8 ± 0.8, $p<0.001$).

Results included both the total prevalence score and the total burden score. The four variables explained 67% of the variance for the HRQOL model; age ($b = -.30$, $p < .01$), NYHA functional class ($b = .22$, $p = .02$), total burden ($b = .32$, $p < .01$), and finally, total prevalence ($b = .32$, $p = .01$). This meant that younger patients and those with higher NYHA classification had greater symptom burden and greater symptom prevalence and therefore predicted a worse QOL. The study concluded that patients with HF experience high levels of symptoms and symptom burden that affect their QOL. The authors recommended thorough assessment, identification, and treatment of sleep disorder symptoms as crucial steps in providing a better QOL.

Brostrom et al. (2004) conducted a study describing the relationship of self-assessed sleep difficulty, daytime sleepiness to HRQOL in HF, and

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compared to the healthy population. A cross-sectional design was used for the study. Outcome measures were assessed using the Uppsala Sleep Inventory-Chronic Heart Failure, Epworth Sleepiness Scale, SF-36 and the Minnesota Living With Heart Failure Questionnaire (MLWHFQ). For the study, 223 CHF patients with NYHA Classes II-IV were recruited. Results revealed that sleep was shorter for women ($p<0.05$) while men had an increased number of sleep awakenings ($p<0.001$). Patients who had a difficult time maintaining sleep, initiating sleep, and had early morning awakenings reported lower HRQOL as compared to the normal population ($p<.05$-$p<.001$). The most significant difference were in the areas of general health, vitality, and social functioning ($p<0.001$). The MLWHF questionnaire total was 37.4 ± 21.9 for men vs. 39.9 ± 25.6 for women. The score on the physical subscale was 16.3 ± 10.3 for men as compared to 17.9 ± 9.8 for women, and on the emotional subscale 6.8 ± 6.3 for men as compared to 6.0 ± 5.4 for women. The number of frequent awakenings per night were significantly more in men ($p<.001$), and the ratio of habitual sleep to the amount of estimated need for sleep was significantly shorter in women ($p<.05$).

Sleep apnea can stimulate neurohormonal and hemodynamic changes in HF. Fifty percent (50%) of HF patients have sleep apnea and significantly worse outcomes when compared to those HF patients who do not have SDB. Daytime tiredness is the most prominent symptom of sleep apnea (Brostrom et al., 2004). HF patients suffering from SDB have poorer HRQOL, as seen in significant decrease in seven to eight domains measured by the SF-36 (n = 223, $p <.05$ to

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p<.001) as compared to the normal population (Brostrom at al., 2004). Patients suffering from difficulties initiating sleep (DIS), difficulties maintaining sleep (DMS), early morning awakenings (EMA), and excessive daytime sleepiness (EDS) showed significantly decreased HRQOL as measured by MLWHF. Total MLWHF score in HF patients with DIS was 49.0 ± 24.1 (n = 42); 51.2 ± 22.9 (n = 48) in HF patients with DMS; 54.9 ± 22.4 (n = 33) in HF patients with EDS; and 47 ± 21.7 (n = 47) with EDS. HF patients suffering from DIS, DMS, EMA, and EDS had significantly decreased HRQOL, measured by MLWHF, compared to the whole group of patients with HF (*p*<.05 to *p*<.001).

Physical symptoms as indicators of heart failure are not obvious when compared to patients with diabetes (Kodiath, 2005). For example, diabetic patients can monitor their blood glucose levels, but when HF patients gain 3 to 5 pounds, they are already ill. Empowering HF patients to become active participants rather than passive observers of their health situation is, therefore, critical and essential.

[D] Self-Care Management

Disease state management is an evidenced-based program designed to provide prevention, screening, and monitoring of patients' health and education, thereby increasing compliance and autonomy regarding patients' control of their health (ACC, 2001; HFSA 2006). Disease state management follows ACC/AHA guidelines in the use of beta blockers, diuretics, digoxin, and angiotensin converting enzyme (ACE) inhibitors for patients with left ventricular systolic dysfunction with or without symptomatic heart failure, and the use of

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spironolactone in patients with severe heart failure. It is a systematic, proactive case management model that utilizes an organized approach in providing early intervention and an active patient self-care participation for optimum health maintenance (ACC/ AHA, 2005; HFSA, 2006).

The empirical literature review indicated that non-pharmacologic interventions such as a supportive nursing intervention may be an effective tool in improving QOL in the HF patient population (Riegel, et al., 2006; Karlsson et al., 2005; Harrison et al., 2002; Jaarsma et al., 2000). Home care nursing influences self-care and self-efficacy in the HF population by providing the following: a supportive familiar environment wherein patients can perform physical activities (performance mastery); encouragement and support (verbal persuasion); guidance and sharing of vicarious experiences; and a realistic approach and evaluation of individual abilities (physiologic state) (Borsody et al., 1999).

Riegel et al. (2006) conducted a mixed method, pretest posttest design evaluating the motivational intervention program to improve HF self-care. Both quantitative and qualitative data were used to analyze participants' responses. Participants (n = 15) received a motivational intervention designed to help patients increase their intention to change behavior by changing attitude about change. An advanced practice nurse trained in motivational interviewing and counseling did an average of 1.5 to 3.0 home visits over a 3-month period to HF patients. Self-care was measured using the Self-Care of HF Index (SCHFI), designed specifically for HF patients. The authors reported that both qualitative and qualitative analysis showed participants improved their self-care behaviors

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after receiving intervention by 71.4% (10 of 14). The study concluded that motivational intervention programs provided to HF patients improve HF self-care.

Karlsson et al. (2005) conducted a nurse-based outpatient clinic study that randomized HF patients to either the intervention group (followed up at a nurse-based outpatient clinic; n = 103) or the control group (followed up at the primary healthcare clinic; n = 105). Patients' cognitive functioning was assessed using the Mini Mental State Examination (MMSE) at baseline and at 6 months. Results revealed that men knew more about CHF at baseline as compared to women ($p<0.01$). However, women in the intervention group increased their knowledge regarding self-care between baseline and 6 months as compared to the women in the control group ($p<0.05$). The study concluded that women gained more than men from a nurse-based management program. Patients with cognitive dysfunction who had low scores on the MMSE (<24) presented lower scores on knowledge of CHF as compared to those with higher (>24) at baseline ($p<0.001$). Differences in scores disappeared after intervention was given. The authors, therefore, recommended that patients with cognitive dysfunction should not be discouraged from participating in the program.

Harrison et al. (2002) conducted a prospective randomized study of a nurse-led intervention focused on the transition from hospital-to-home and supportive care for self-management 2 weeks after hospital discharge. The purpose of the study was to find out if providing a nurse-led intervention would promote a better QOL. The study enrolled patients (n = 75 per group) randomized to either the transitional care or the usual care. Three months after discharge,

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31% of the usual care patients were readmitted as compared to 21% of the transitional care groups. Emergency department visits were higher in the usual care group at 46% as compared to the transitional care group at 29% (t = 4.86, df = 1, p<0.03). Results showed that at baseline, physical dimension mean scores for the usual care were 25.45 (SD = 9.77) and transitional care mean score was 25.46 (SD = 9.55). At 6 weeks after hospital discharge, the total MLHFQ score was better among the transitional care patients (27.2 ± 19.1) than among the usual care patients (37.5 ± 20.3, p = 0.002). The MLWHF questionnaire total score in 12 weeks for the usual care had a mean score of 38.39 (SD = 18.24); the transitional care had a mean score of 25.76 (SD = 19.44) (p<0.001). The study concluded that significant improvements in health-related quality of life (HRQL) were associated with transitional care and decreased visits to the emergency rooms were noted.

Jaarsma et al. (2000) conducted a study to test the effectiveness of a supportive nursing intervention regarding self-care abilities, self-care behavior, and QOL in CHF patients (n = 179). An experimental design with random assignment to two groups, an intervention group and a treatment control group. Outcome measures on self-care abilities utilized the Appraisal of Self-Care Scale. Three dimensions of QOL were measured. These included functional capabilities, symptoms, and psychosocial adjustment to illness. Functional capabilities were measured using the Heart Failure Functional Status Inventory. Symptoms were measured using a ten-point scale questionnaire. Psychosocial adjustment to illness was measured using the Psychosocial Adjustment to Illness Scale (PAIS).

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Overall well-being was measured utilizing the Cantril's Ladder of Life Survey. Education took place at the hospital and at home. The home visit was scheduled a week after discharge. Data collected included self-care abilities, self-care behavior, hospital readmissions, visits to the emergency department, and use of other healthcare resources.

Findings indicated that the intervention group reported better compliance as compared to the control group at 3 months (12.2 vs. 10.6; t = 2.9, p = .005) but was not significant different at 9 months (11.2 vs. 10.3; t = 1.6, p = .11). Symptoms decreased significantly in both groups, from 3.9 at baseline to an average of 1.9 symptoms in the control group versus 2.2 symptoms in the intervention group at 3 months of follow-up (p <.001).). Total PAIS scores for both groups decreased significantly, indicating better psychosocial adjustment to illness (control: t = 2.3, p = .03; intervention: t = 2.3, p = .03). There was no difference demonstrated between the two groups at the three points in time. Heart failure self-care behavior correlated slightly with the overall score of well-being only at 9 months after discharge (r = 0.24, p <.05). The study concluded that education from a nurse provided at the hospital and at home significantly increased self-care behavior for both groups at one month but was significantly increased in the intervention group (control: 12.2 – 2.9 vs. 13.8-3.4, p<0.001).

[E] Patient Education

Kuztleb and Reiner (2006) conducted a prospective quasi-experimental multi-center study on the impact of nurse-directed patient education on QOL and functional capacity in people with HF. Patients were grouped to either the nurse-

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directed care (NC) (n = 13) and the routine care (RC) (n = 10). The NC group received comprehensive disease state management education and weekly telephone follow-up while the RC received protocol-driven medical management. Both groups were followed up to 12 months. QOL was measured using the Ferrans and Powers (1992) Psychometric Tool. This QOL instrument consists of two parts. The first part measures satisfaction with various aspects of life, and the second part measures the significance of those aspects. Scores were measured for overall QOL and in four domains: health and functioning, psychological and spiritual, social and economic, and family. Scores range from 0 to 30, and a significant correlation exists between higher QOL and higher scores. Findings showed that the domains of total QOL were significantly improved in the NC group (F = 13.569, p = 0.000), health and function (F = 3.995, p = 0.003), social and economic (F = 14.109, p = 0.000), psychological and spiritual (F = 13.212, p = 0.000) and family (F = 2.384, p = 0.048). The study concluded that a nurse-directed patient education improved QOL and improved functional capabilities.

Gonzalez et al. (2005) conducted a prospective study to evaluate if a nurse-guided education changes self-care behavior in an outpatient HF population. The study utilized a questionnaire given to HF patients at time of visit and at one year; it evaluated how the nurse electronic-guided education changed self-care behavior in regard to knowledge of the disease and treatment, and weight and blood pressure monitoring (n = 298). Results indicated that initially only 28% of patients understood the disease, but 55% understood the disease after one year of follow-up ($p<0.001$). Awareness of more than three symptoms

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increased from 66.5% to 85.5% (*p*<0.001). Medication knowledge increased from 33% to 44% (*p*<0.001). Weight monitoring compliance increased from 21% to 39% (*p*<0.001), and weekly blood pressure monitoring increased from 28.5% to 43% (*p*<0.001). Results reported that only 30% understood HF and 56% understood the disease at one year (*p*<0.001, N = 298). Knowing signs and symptoms of HF increased from 66.5% to 86.5% (*p*<0.001). Knowledge of medications increased from 33% to 44% (*p*<0.001). Initially, 63% monitored their weight only at clinic visit, and 21% monitored their weight at least once a week. After one year, these percentages were 16% and 39% respectively (*p*<0.001). Initially, only 45% were monitoring their blood pressure and 28% checked it once a week. At one year these percentages were 12% and 43% respectively (*p*<0.001).

Kodiath et al. (2005) conducted a one-group design study. The purpose of the study was to find out if behavioral self-management enhances health-related quality of life (HRQL). The behavioral intervention was implemented among a sample of HF patients (n = 58) to help participants establish healthy behaviors that would improve their quality of life. The intervention consisted of 2-hour group classes and telephone call follow-up over a period of 15 weeks. Patients were to change one of the following behaviors: diet, exercise, smoking, sodium, or alcohol consumption. The method incorporated the components of the Information Motivation Behavioral (IMB) Skills Model that included information, motivation, and behavioral skills. Feedback forms were given to all who attended at the end of all classes. Major themes were described such as depression, satisfaction with

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the intervention, participants' lack of understanding of HF, denial or disbelief concerning the diagnosis, the influence of age, confusion regarding access to care, lifestyle changes, and depression. The study concluded that in this patient population (CHF patients), choosing to change a health behavior was difficult because the physical indicators (such as weight gain) following the change were not obvious (Kodiath et al., 2005).

Effect of CHF on Hospitalization

Heart failure is significantly related to increased hospitalization (AHA, 2005). In the data from 1980 to 2002, reported from the Center for Disease Control and Prevention (CDC) on heart failure as a first-listed diagnosis, the average length of stay (LOS) of hospital discharges decreased by 6.6 days (from 11.9 to 5.3 days). The data reported a trend in the decreased average LOS among all ages, regardless of sex and race. Hospital discharges with heart failure as first diagnosis accounted for more than 1.8 million days of hospital stay, for an average LOS of 5.3 days (Center for Disease Control (CDC), 2005). The age-specific rates of hospital discharges for heart failure patients when listed as first diagnosis for all age groups increased during the 1980s and mid 1990s. From 1998 to 2002, age-specific rates leveled off in the 0-64 age group and declined in people aged 75 and older (CDC, 2005). Age-adjusted hospital discharge rates were similar for men and women throughout the time period of 1980-2002.

Role of B-Type Natriuretic Peptide (BNP) in CHF Hospitalization

Managing CHF costs $56 billion a year, with 70% due to hospitalization (Bhalla et al., 2004). Increased predischarge levels of BNP predicts hospital LOS

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after decompensated CHF (Cheng et al., 2001; Mueller et al. 2004). Conversely, BNP levels provide a measurable guide for the estimation of timely diagnosis of heart failure (Prahash & Lynch, 2004; Maisel et al., 2001; Wieczorek et al., 2002; Troughton et. al., 2000). Thus early intervention can alleviate symptoms and delay or halt disease progression; regular clinic visits and management can potentially decrease hospital LOS by 3 days (Mueller et al., 2004).

Clinical studies indicating relationship between BNP levels and CHF hospitalization

Hogenhuis et al. (2006) conducted a study investigating the prevalence and characteristics of HF patients (n = 601) with BNP levels <100 pg per ml and categorized using NYHA Class II-IV. Patients were enrolled in the study following hospital discharge with diagnosed heart failure. Results showed that patients with BNP levels < 100 pg per ml had higher left ventricular ejection fraction compared with those with BNP levels > or = 100 pg per ml (0.41 ± 0.14 vs. 0.33 ± 0.13, $p < .001$). The authors concluded that clinically stable patients with a recent admission for decompensated HF, and with low BNP levels seemed to have less severe HF and preserved systolic function as compared to those patients who had BNP levels > or = 100 pg per ml.

Valle et al. (2005) conducted a study that measured BNP levels in ambulatory patients with HF with preserved left ventricular ejection fraction (LVEF), including how BNP levels can predict the occurrence of cardiovascular events in 6 months. BNP levels were drawn on HF outpatients (n = 233). Outcome measures included cardiovascular death (n = 15) or hospital

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readmission (n = 33). Results revealed that BNP levels were a strong predictor for subsequent events (ROC, area under curve = 0.84; CLI = 0.78-0.88). BNP cut-off levels of 200 pg per ml found in 67% of patients (HR = 2.2, $p< 0.4$) predicted 9% event rate within 6 months. BNP levels of 500 pg per ml or more found in 10% of the patients (HR = 5.8, $p < .001$) predicted 74% of unfavorable events. The study concluded that BNP levels are strong and accurate predictors of cardiovascular mortality and early readmission in patients with HF. The authors recommended that BNP levels might be used successfully for patient follow-up after an event of HF decompensation.

Maisel et al. (2004) conducted the Rapid Emergency Department Heart-Failure Outpatient Trial (REDHOT), and examined the association between BNP levels, perceived severity, clinical decision-making, and outcomes (hospital LOS and mortality) in CHF patients presenting to the emergency department (ED). Physicians were blinded to the actual BNP level and subsequent BNP measurements, and patients were followed to 90 days after discharge. Of the 464 patients enrolled, 90% were hospitalized. The overall hospitalization rate was 90.3% although physicians intended to admit 68.3%. The ED doctors' intention to admit or discharge a patient had no influence on 90-day outcomes, but the BNP level was a strong predictor of 90-day outcome (22%). Findings indicated a disconnect between ED physicians' perceived severity of CHF and severity as determined by BNP levels. Discharged patients were likely to die or be readmitted (19 out of 45 or 42.2%) compared to admitted patients (110 of 425 or 25.9%) within the 90-day follow-up ($p = 0.02$). The study concluded that BNP

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levels predicted outcomes and was a valuable tool in making the decision whether to admit or discharge a CHF patient.

Heidenreich et al. (2004) studied how BNP-guided treatment is associated with decreased cost of care. This study evaluated the cost effectiveness of screening patients with BNP to classify those with LVD. The study screened 1,000 asymptomatic CHF patients with abnormal BNP levels. Those with abnormal BNP levels were followed up by echocardiography to assess left ventricular function. Results indicated that such screening increased lifetime cost of care ($176,000 for men; $101,000 for women) and improved outcome (7.9 quality-adjusted life years for men (QALY); 1.3 QALYs for women), resulting in a cost /QALY of $22,300 for men, $77,700 for women. The study concluded that screening populations with 1% decreased LVD with BNP followed by echocardiography may provide a health benefit cost equal to or less than other accepted interventions.

Mueller et al. (2004) conducted a study on how BNP-guided decision making is associated with decreased hospital LOS. In this study, 75% of the BNP group were hospitalized as compared to 85% of the standard group (p = 0.0008). A cumulative frequency distribution was used to track for time to discharge of patients in the BNP group as compared with the control group. Hospital LOS was reduced from 11 days in the standard group (n = 227) to 8 days in the BNP group (n = 225). A total cost of care decreased from $ 7,264 to $ 5,410 (p = 0.006). Troughton et al. (2000) found that the BNP group had fewer hospital admissions as compared to the clinical group (n = 69, 17 vs. 46, p = 0.02).

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Latini et al. (2002) studied the long-term effects of angiotensin receptor blockers (Valsartan) on BNP and norepinephrine (NE). The Valsartan Heart Failure Trial randomized 4,284 CHF patients to either Valsartan or placebo. BNP levels were measured at baseline, 4, 12, and 24 months. In the placebo group, BNP levels rose over time; in the Valsartan group, BNP levels showed a sustained decrease. Results showed that Valsartan significantly reduced the risk for both mortality and morbidity by 13.2%, for hospitalizations for HF by 27.5%, but not for mortality alone. BNP was the strongest predictor of outcome (hospitalization, death) when compared with other clinical markers (p = .0001).

The findings of Richards et al. (2002) supported the relationship of BNP levels and CHF hospitalization. The study enrolled 69 symptomatic CHF patients (NYHA II-IV) randomized to receive drug treatment guided by BNP or standard clinical assessment. Treatment was guided by the use of a treatment target score according to modified Framingham criteria of <2. When the target score was < 2, medical treatments were intensified until scores were met. Using the t-test statistic, the study reported that using BNP levels for decision-making (19 vs. 54 clinical events) reduced time of first cardiovascular event hospitalization (p = .034) and death (p = .049).

Cheng et al. (2001) studied a convenience sample of 72 veteran patients admitted from March to December 1999. Participants were enrolled to determine if BNP level predicts outcomes of patients admitted with decompensated CHF. The authors also examined whether an association existed between initial BNP level measurement, pre-discharge BNP measurement and outcomes of death,

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and a 30-day readmission rate. A t-test statistic was used to compare two groups; the BNP group and the control group. BNP levels were measured daily. Daily BNP levels were drawn within 24 hours after admission and within 24 hours prior to discharge or death (in case of death, last drawn BNP levels were considered). Of 13 deaths and 9 readmissions, the last measured BNP level was the single variable most strongly associated with patients experiencing one of the pre-specified end points of death in hospital, death within 30 days after discharge, or hospital readmission within 30 days. Mean BNP levels were significantly greater in patients experiencing end points (1,801 ± 273 pg per ml standard error of the mean [SEM] vs. 690 ± 103 pg per ml SEM) compared to patients with successful treatment of CHF ($p < 0.001$). Patients who died or were readmitted had higher BNP levels (mean increase = 233 pg per ml, $p<0.001$) than those who lived or were not readmitted (mean decrease = 215 pg per ml). The subgroup of patients surviving to discharge, using the NYHA classification, was the most significant predictor of readmission ($p = 0.0002$); discharge BNP was associated with readmission within 30 days (AUC (C-statistic) = 0.72, $p = 0.02$). The last measure of BNP was strongly associated with both death and hospital readmission (area under the receiver operator curve of 0.73) and therefore suggested that BNP levels could be successfully used to guide treatment for patients with decompensated heart failure.

It is important, therefore, to understand the role of BNP in CHF hospitalization for the early detection and identification of CHF symptoms and for

potentially reducing hospital admissions, decreasing hospital LOS, and lowering healthcare costs.

Knowledge of BNP Levels Predicting Treatment

Preclinical recognition of increased BNP levels improves prognosis compared to treatment after onset of severe symptoms (Hennekens, 1987). In August 2003, the Food and Drug Administration (FDA) approved two indications for BNP as a point-of-care rapid assay for the diagnosis of CHF. These included (1) distinguishing cardiac cause of acute dyspnea from pulmonary or other non-cardiac causes and (2) distinguishing decompensated CHF from exacerbated chronic obstructive pulmonary disease (COPD). However, Medicare does not reimburse routine use of BNP assays to assess the effectiveness of CHF therapy, for the titration of therapy of heart failure, or for prognostic uses (Center for Medicare & Medicaid Services, 2003). The ACC/AHA 2005 Practice guidelines indicated that high BNP levels are predictive of HF but should be used in conjunction with other clinical assessment. The Heart Failure Society of America (HFSA) 2006 Practice Guidelines state that BNP levels are not recommended as a routine part of HF evaluation for patients at-risk but without signs and symptoms of HF. This means that BNP levels are useful in the diagnosis of HF, but physicians are cautioned not to depend solely on this laboratory assay but to use it as an additive tool in the diagnosis of HF.

Studies on Knowledge of BNP Levels Predicting Treatment

Aspromonte et al. (2006) evaluated whether BNP levels associated with echocardiography would effectively stratify patients with new symptoms as a part of a cost-effectiveness program. The study enrolled patients suspected of CHF (n = 357) referred to the cardiology clinic by primary physicians. All patients were clinically examined. Blood was drawn for BNP levels and a transthoracic echocardiography was performed. Findings reported high BNP levels at 469-505 pg per ml (n = 240) on those diagnosed with HF, compared to those without HF, 43-105 pg per ml (n = 117, p = 0.001). BNP cut-off level was at 80 pg per ml (sensitivity 84%, specificity 91%). The authors' findings indicated that cost analysis at this cut-off level might provide a cost savings of 31%. The study concluded that BNP levels drawn from patients suspected of CHF are cost effective and are helpful in stratifying CHF patients.

Daniels et al. (2006) conducted a multi-center site study to determine if there was a disconnect between perceived severity of HF by physicians and the severity of HF as determined by BNP levels. Patients (n = 151) were enrolled if they were seen, treated, or admitted through the emergency department (ED). BNP levels were drawn and treating physicians were blinded to BNP levels. After clinical assessment, ED physicians classified the patients according to the NYHA functional classifications I-IV. ED physicians were asked whether the initial disposition of these patients would warrant hospitalization. Patients were followed up after 90 days. Results showed that of 90% of those hospitalized, 32.5% were white and 63.4% were black. African Americans discharged from the ED had a

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higher median of BNP levels compared to white (1,295 vs. 533, p = 0.004). African-American HF patients who were discharged had a higher mean BNP levels as compared to African-American HF patients who were admitted (1,293 pg per ml vs. 769 pg per ml, p = .04). This finding was not the same for whites (692 pg per ml vs. 533 pg per ml, p = .09). The authors concluded that a disconnect in perceived severity of HF and in severity using BNP levels is more evident in African Americans. This means that the perceived severity of HF by ED physicians did not often correlate highly with BNP levels. In the original REDHOT study, patients who were sent home from the ED had higher BNP levels than those who were admitted. In this study, BNP levels were stronger predictors of outcome than was perceived severity of CHF (Maisel et al., 2004).

Mueller et al. (2004) studied the usefulness of BNP-guided treatment in ED patients. Participants (n = 452) were randomized to a diagnostic strategy of measuring BNP levels (n = 225) or to standardized treatment (n = 227). Of the BNP group, 15% required intensive treatment; of the standard group, 24% (p = 0.01). The 30-day mortality rates were lower (p = 0.45) in the BNP group (10%) than in the standard group (12%). The study concluded that BNP levels used with other clinical information improves evaluation and treatment of ED CHF patients with acute dyspnea. The mean cost of treatment in the BNP group was $5,410 compared to $7,264 in the control group (p = .006). Using BNP values in decision-making decreased treatment cost and reduced hospitalization in the treatment group (p = .001). Another purpose of the same study (Mueller et al., 2006) was to find out the cost effectiveness of BNP-guided testing in the ED

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patients. Results showed that total treatment cost was significantly reduced in the BNP group ($7,930 vs. $10,503 in the control group; *p*<0.004). The authors concluded that BNP guidance is cost effective in patients with acute dyspnea.

Ishii et al. (2003) determined whether cardiac troponin T and BNP would stratify CHF patients (NYHA Classes III and IV) after initiation of treatment. Enrolling 100 consecutively admitted patients, the study included 54 CHF patients categorized as NYHA Class III and 46 CHF patients categorized as Class IV. Serum cardiac troponin T (cTnT) and plasma BNP were measured on admission and then 2 months later when the number of patients classified as NYHA Class III decreased to 40 and those classified as Class IV decreased to 3; and 54 patients decreased to NYHA Class II. Using the Mann Whitney U test for continuous variables, the results showed a decrease in cTnT (0.023 vs. 0.063) and BNP levels (249 vs. 753), significantly improved NYHA functional class (2.5 vs. 3.5), and improved left ventricular ejection fraction (13% vs. 12%, *p*< 0.01) two months after treatment as compared to admission. Thus, a combination of both cardiac troponin T and BNP-guided level treatments may prove to be highly effective in risk stratification.

Troughton et al., (2000) reported that pharmacotherapy guided by BNP would produce better outcomes than therapy guided by standard clinical assessment. Patients were recruited after hospital admission with decompensated CHF. During clinic visits, patients were double-blind randomized to treatment guided by BNP measurements or standard clinical assessment. An objective scoring system (with a score of 2 or more indicating decompensated

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heart failure) was used. If target scores (less than 2) were not achieved, early treatments were intensified according to a rigid predetermined protocol at 2-week intervals until target scores were achieved. Utilizing the Mann Whitney U test, the study found a 50% reduction in total cardiovascular events in comparison to the control group. Patients not receiving BNP-guided treatment experienced more cardiovascular-event hospitalizations and deaths (78%) than those receiving BNP-guided treatment (22%). Death rates and hospital admissions were less in the BNP-guided group than in the clinical group (19 vs. 54, p = .02). Thus, BNP became a preventive strategy targeting a more intensive pharmacological treatment, allowing for tailored therapy and follow-up of patients (Troughton et al., 2000).

Summary

In summary, the literature review revealed that QOL is influenced by how individuals perceive their life situations. QOL of patients with heart failure is affected directly or indirectly by their functional limitations and psychological needs. Studies show that physical symptoms of HF such as shortness of breath, peripheral edema, and easy fatigability cause functional and social limitations that affect the QOL in HF patients. The review of literature suggests that the presence of symptoms, severity, and symptom burden such as insomnia and sleep disordered breathing are also associated with poor QOL. Clinical studies demonstrate that treating the psychological symptoms of depression, having a strong social support, finding meaning in life, achieving perceived control, and having spiritual faith and beliefs are an integral part of the psychosocial

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adjustment to any disease condition.

　　According to the AHA (2005), HF patients' frequent and regular hospital admissions have a tremendous impact on the economic burden of the healthcare system in the United States. The review of the literature supports the view that CHF is a chronic debilitating disease that is associated with increased hospitalization. Reduction in HF admissions and hospital LOS, therefore, may result in lowered social and economic costs and decreased healthcare expenditures. Numerous studies indicate that when physicians are aware of patients' BNP levels, HF patients have shorter hospital LOS and fewer hospital admissions. BNP is a biomarker that provides a measurable guide in the diagnoses of HF. The literature review supports the concept that recognition and knowledge of BNP levels during ED visits may be critical for patients to receive timely diagnosis and early relief of the symptoms of HF. Current research shows that the drawing of blood for BNP levels in HF clinics is not routine, and evidence does not support its general use. HF patients may benefit from having BNP levels drawn as part of a clinic visit assessment. Therefore, there is a need to examine whether knowledge of BNP levels influences physicians' treatment of HF. This study will examine whether physicians' knowledge of BNP levels and treatment of HF at time of clinic visit influences CHF patients' QOL and hospital LOS.

Chapter 3

Methods

Introduction

Chapter 3 outlines the research methods and procedures for this study. The discussion of the research design is followed by a description of the sample and its inclusion and exclusion criteria. Next comes a description of the setting, instruments used, procedures, institutional review board (IRB) approvals, and informed consent. Finally the data analysis procedures are presented.

Design

The research used a randomized controlled trial assigning participants into two clinic groups. The participants were randomly allocated to a group, one having the physician informed and the other, not informed of patients' BNP levels. The experimental group was composed of subjects whose BNP levels were disclosed to the physician. The control group included those subjects whose BNP levels were not disclosed to the physician. Subjects were not informed of their BNP levels. The specific aims of the study were: (1) to determine if physicians' knowledge of BNP levels would make any difference in the quality of life scores between the experimental and control group at 90 days and (2) to determine if physicians' knowledge or lack of knowledge of BNP levels at time of CHF clinic visit would affect hospital LOS on all hospital admissions, regardless of how many hospital admissions occurred in 90 days.

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Figure 2 illustrates the hypothesized logic model of the relationship of BNP levels and hospital length of stay and quality of life. The logic model illustrates that knowledge of BNP was the independent variable, and CHF hospital LOS and QOL were the two dependent variables of the study. BNP levels were measured using the Triage BNP Immunoassay Kit (Biosite, San Diego, CA), and QOL was measured by the Minnesota Living With Heart Failure (MLWHF) questionnaire. Hospital LOS was documented on the medical information form, and hospital charts were reviewed to verify hospital admission and diagnosis.

Input	Intervention	Outcome
CHF/BNP	Physician knowledge of BNP leading to early treatment	Hospital length of stay
Demographic data	Withholding physician knowledge of BNP leading to standard care	and
QOL		QOL at 90 days
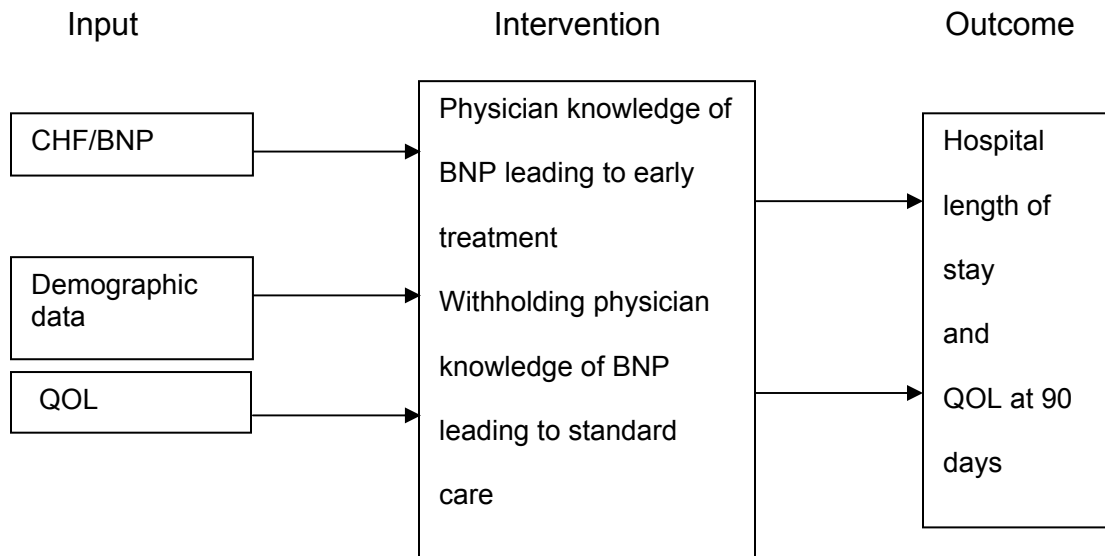
Figure 2. Logic model: Relationship between disclosed BNP levels to hospital LOS and quality of life in patients treated for heart failure.

Setting

The research took place at Shands Jacksonville Cardiovascular Center located at Jacksonville, Florida. The heart failure clinic is located on the fifth floor of the Ambulatory Care Center. This Center offers numerous

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national and international clinical trials and state-of-the-art diagnostic, therapeutic, and rehabilitative cardiac services. The cardiovascular center includes: examining rooms, stress testing labs, electrocardiographic and quantitative 2-D echocardiographic labs, patient and family education libraries, catheterization laboratories, a technologically advanced observation unit for patients undergoing outpatient heart catheterization, and electrophysiology laboratories. The 24,000-square-foot Center annually serves approximately 500 to 600 heart failure patients per year, whose estimated ethnic/racial composition is 54% Caucasian, 45% African-American, and 1% other minorities.

The heart failure clinic has a triage/laboratory room, physician offices, and nine examining rooms. The clinic schedule for heart failure patients was Monday and Friday each week. At times, HF clinics were re-scheduled randomly according to physician availability. The average number of patients seen was approximately 30 to 40 patients a week. The clinic is managed by two University of Florida cardiologists, nursing and clinical staff, unit secretaries, registration/accounting staff, and a receptionist. A total of 15 personnel staff the heart failure clinic. The heart failure research director is highly involved with the daily operations of the clinic. He is a trained cardiologist specializing in the diagnosis and management of heart failure.

Population and Sample

A total of 108 participants were enrolled in the study. The power analysis was based upon the effect size of 0.5, which was reported in the literature. According to Troughton et al. (2000), the effect of BNP-guided treatment of HF had an effect size of 0.5. Combining this effect size with an alpha of 0.05 and a power of .80, the projected sample size was 128. The target population included patients from the clinic diagnosed with heart failure. Participants were included in the study if the following conditions were met: at least 21 years old; able to read, write, and speak English; able to give voluntary consent; with New York Heart Association (NYHA) classifications of II-IV; and with an ejection fraction (EF) of less than 40%. Participants were excluded from the study if the following conditions were present: co-morbid conditions limiting life expectancy to less than one year as determined by the attending cardiologist and a history of acute or chronic renal failure as evidenced by serum creatinine of over 2.0.

Instruments

The instruments used for the study included the BNP Immunoassay Kit, a medical information form, and the MLWHF questionnaire. The independent variable, BNP level, was measured using BNP Triage Immunoassay Kit (Biosite Co., 2004). Demographic data that included age, gender, ethnic background, education, occupation, marital status, and insurance payers were documented on the demographic information form (Appendix A). Quality of life was assessed by using the

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MLWHF survey (Appendix B). Hospital LOS was documented utilizing the medical information form (Appendix C).

Independent Variable –

BNP Rapid Assay

B-type natriuretic peptide levels are elevated in cardiac disease and are sensitive to increased ventricular stretch (Mark & Felker, 2004). BNP levels are reflective of left ventricular diastolic filling pressure and therefore correlate with pulmonary capillary wedge pressure (Jiang, et al., 2001; Maisel, et al., 2002; Cheng et al., 2001; Ishii et al., 2003; Tabbizar et al., 2002; Anand et al., 2002). Unlike cardiac enzymes that are ordered in series, BNP assays are performed on an as-needed basis in hospitals, emergency rooms, or clinics. According to the American College of Cardiology and American Heart Association Task Force on Heart Failure Guidelines (2005), BNP levels greater than 100 pg per ml predict the diagnosis of symptomatic heart failure.

The BNP test, therefore, measures the presence of b-type natriuretic peptide levels present in the circulating bloodstream. The test is called a rapid assay because it is a simple blood test that can be done at the bedside or clinic and takes 15 minutes to complete. BNP testing in the outpatient clinic is feasible because BNP testing is not affected by food or exercise. It is used when there is a need to have immediate results. BNP levels may help diuretic adjustment after discharge, reflect CHF exacerbation, or may reflect successful treatment or titration (Maisel, 2002).

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The two most commonly used criteria for diagnosing heart failure are those of the National Health and Nutrition Examination Survey (NHANES) and the Framingham criteria (AHA, 2005). When compared to the NHANES and the Framingham criteria for diagnosing heart failure, the BNP screening test is more accurate at 83%; the National Health and Nutrition Examination Survey (NHANES) showed an accuracy of 67%, and the Framingham criterion showed an accuracy of 73% in confirming the diagnosis of heart failure (Maisel, 2002).

The Triage BNP Test (Biosite, San Diego, CA) uses a fluorescence immunoassay that measures B-type natriuretic peptide (BNP) in whole blood and plasma specimens using trisodium ethylenediaminetetraacetate trihydrate (EDTA) as the anticoagulant (Biosite, 2004). In order to satisfy Clinical Laboratory Improvement Amendments (CLIA) and Joint Commission on Accreditation of Healthcare Organizations (JCAHO) standards, three levels of assayed liquid controls were used to verify the calibration of the Triage BNP Test throughout the reportable range every six months. There is no time to first-result since the BNP immunoassay is not an analyzer and not run in batch modes. Calibration of the test was done by using the provided assayed controls supplied by Biosite. There were five assay controls, and CLIA required doing at least three out of the five controls. The lowest and highest controls were used to perform the calibration. Controls used should result in numbers not less than 5 pg per ml or higher than 5000 pg per ml.

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The BNP Triage Immunoassay Kit has a reportable range of 5 pg per ml to 5000 pg per ml (Biosite, 2001). BNP results less than 100 pg per ml are representative of normal values in patients without CHF. BNP results higher than 100 pg per ml are considered abnormal and suggestive of CHF. According to Maisel (2001), the mean BNP values for NYHA Class I are 152 ±16 pg/ml; for NYHA Class II, 332 ± 25 pg per ml; NYHA Class III, 590 ± 31 pg per ml; and 960 ± 34 pg per ml for NYHA Class IV. BNP results higher than 5000 pg per ml are considered very high values and exceed the upper limits of the BNP test. Higher BNP concentrations measured in the first 72 hours after an acute coronary syndrome are associated with an increased risk of death, myocardial infarction, and CHF (Biosite, 2004).

The BNP Immunoassay Kit uses a sample type of either whole blood or plasma drawn in plastic tubes. Sample collection and storage for whole blood and plasma is up to 24 hours at room temperature or 2-8 centigrade degrees in a refrigerator. Reagent stability is good until expiration date on the box or up to 14 days at room temperature. The BNP analysis is based on the amount of fluorescence the meter detects within a measurement zone on the device. A greater amount of fluorescence detected by the meter indicates a higher BNP value (Biosite, 2004).

A daily quality control (QC) procedure was performed on the BNP machine to maintain consistently accurate readings. This was done on on heart failure clinic days (Mondays and Fridays) before any participants'

blood was drawn for the BNP test. To run the daily QC, a stimulator chip code was inserted into the meter and prompts on the screen were followed. A test was run, and a pass or fail result was displayed/printed when testing was completed. Biosite provided QC materials containing plasma to run the daily QC procedure (Biosite, 2004).

Performance Characteristics of the Triage BNP Test

Linearity of the BNP Triage Immunoassay Kit

Plasma specimens anticoagulated with EDTA were spiked with purified BNP to a final concentration of 5000 pg per ml. Each spiked plasma specimen was diluted gravimetrically with unspiked plasma to obtain BNP values throughout the range of the Triage BNP Test. Linear regression analysis of the data indicated that the assay is linear throughout the measurable range of the test (Biosite, 2004).

Interfering substances

Hemoglobin up to 10,000 mg per dL, cholesterol up to 1,000 mg per dL, triglycerides up to 1,000 mg per dL and bilirubin up to 20 mg per dl added to plasma concentrations containing BNP did not interfere with the recovery of BNP. Hematocrit varied between 27% and 51% with no significant effect on the recovery of BNP (Biosite, 2004).

Analytical Sensitivity

Analytical sensitivity differs from clinical sensitivity; analytical sensitivity refers to the test and not to the patient population. Analytical sensitivity refers to the lowest value that the test can read that distinguishes

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from zero (Biosite, 2004). The average 95% confidence limit of the analytical sensitivity of the Triage BNP Test was less than 5 pg/mL (95% confidence interval 0.2 pg/L to 4.8 pg/ L). Thus, the test cannot be exactly zero. Analytical sensitivity or the lowest detectable concentration that is distinguishable from zero for the BNP test was determined by testing a zero calibrator 20 times each using three lots of reagents and five meters on 5 days (Biosite, 2004).

Analytical specificity

Analytical specificity refers to the accuracy with which the test is able to detect the correct molecule, BNP (Biosite, 2004). Precision of the BNP machine, the use of various pharmaceuticals and the use of blood and plasma for drawing BNP levels are discussed as they relate to the analytical specificity of the BNP assay.

Precision

The average within-day and total precision of the BNP assay was determined using the ANOVA model by testing control materials that had BNP added at concentrations near the decision points of the assay and throughout the range of the standard curve. This study was done over 12 days, testing each control ten times a day. Each device was read on five Triage meters (Biosite, 2004). It is noted that the use of different Triage meters does not significantly affect the test precision. Coefficient of variation (CV) is equal to the standard deviation multiplied by 100 divided by the mean (Hulley & Cummings, 1988). This means that the higher the

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CV, the less precise the test. As a point-of-care test and the use of an immunoassay, the BNP test is considered precise at 10% within the National Laboratory Guidelines (Biosite, 2004). Table 2 illustrates the coefficient of variation (CV) measures of the BNP test as stated by the Biosite instruction manual.

Table 2

Coefficient of Variation Measures for BNP Test (Total CV %)

Mean (pg per ml)	SD (pg per ml)	CV (%)
71.3	7.0	9.9%
629.9	75.5	12.0%
4087.9	500.1	12.2%

Biosite Inc., 2004

Test-retest reliability

A test-retest reliability of the Triage BNP rapid assay was performed for this study. The purpose of performing the test-retest reliability was to make sure that the BNP machine produced the same BNP results when a participant took the same test twice. BNP-levels results from the first and second tests should fall within the coefficient of variation percent (CV%) in order to be precise. A test-retest method of the Triage BNP Immunoassay Kit was done on 10% (n = 14) of the participants. The CV% for this study was 9.3%. Using systematic sampling, every 10th subject had

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blood tested for the second BNP levels. Only one cubic centimeter (cc) of whole blood was drawn; this was sufficient for both the initial BNP test and for the test-retest reliability procedure. A detailed description of the procedure for performing BNP test is described under baseline data collection.

Pharmaceuticals

Fifty-four drugs, ranging from common acetaminophen to angiotensin-converting enzyme inhibitors, diuretics, beta blockers, statin drugs, and antibiotics, were evaluated for potential cross-reactivity and interference of the Triage BNP Test. Results showed none of the drugs interfered with the recovery of BNP; neither did they produce a significant response when tested in a specimen not containing BNP. There was no significant interference with the BNP measurement and no assay cross-reactivity (Biosite, 2004).

Use of whole or plasma correlation

A study comparison performed on EDTA whole blood versus plasma showed the correlation data as r^2 = .9878, y = 0.925 x +13.439 (Biosite, 2004). Plasma is indicated by *y* and whole blood by *x* (Biosite, 2004). This means that there is a slight difference in using plasma and whole blood, but the correlation is high enough that it does not make any difference when the test is run by either whole blood or plasma. For the study, whole blood was used to test for BNP levels.

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Clinical sensitivity

Clinical sensitivity, or sensitivity, refers to the proportion of subjects with the disease who have a positive test; it also indicates how well a test identifies the disease (Hennekens, 1987). In a study conducted by Maisel et al. (2002), using the BNP Triage Immunoassay Kit, the BNP cutoff value of 100 pg per mL had a sensitivity of 90%, meaning that approximately 90 heart failure patients will test positive for heart failure, and 10 patients will test false negative.

Clinical specificity

Clinical specificity, or specificity, refers to the proportion of subjects without the disease who have a negative test; it indicates how well a test identifies the non-diseased subjects (Hulley & Cummings, 1988). In the Breathing Not Properly (BNP) study conducted by Maisel (2002), using the BNP triage Immunoassay Kit, the specificity was 76% with a predictive negative value of 90% (cut-off value of 100 pg / mL).

Relative risk

Relative risk compares the incidence of disease among exposed people with the incidence of disease among non-exposed people by means of a ratio (Hennekens, 1987). A BNP level of 230 pg per ml is correlated with a relative risk of 7.0 (Maisel, 2002). A relative risk of 7.0 means that the incidence of heart failure is seven times as high in patients with heart failure as in those without heart failure. Table 3 illustrates comparison

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decision statistics using the BNP Triage Immunoassay Kit as reported from several studies.

Table 3

Summary of Studies Utilizing the BNP Triage Immunoassay Kit

Study	BNP cut-off (pg per ml)	Sensitivity (%)	Specificity (%)	PPV[a] (%)	NPV[b] (%)	Diagnostic Accuracy (%)
Maisel et al.(2002) n = 1,586	100 50	90 -	76 -		96	83
Wiezorek et al. (2002) n = 1050	100	82	97			93
Dao et (2001) n = 250	100	94	94	92	96	94
Morrison et al. (2002) n = 321	94	86	98	98	83	91

Note. [a]PPV = positive predictive value   [b] NPV = negative predictive value

Demographic Data Form

The demographic form (Appendix A) created for this study was a ten-item survey used to collect information that could be related to the outcome variables. These variables included the following: age, gender, marital status, ethnic background, education, occupation, and insurance payers. These factors were documented to determine the relationship

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between these variables and BNP levels, CHF hospital LOS, and quality of life.

<div align="center">

Dependent Variables

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The Minnesota Living with Heart Failure Questionnaire (Appendix B) was utilized to measure the dependent variable of quality of life. The medical information form was used to abstract patients' hospital length of stay.

Description of the Minnesota Living With Heart Failure Questionnaire

The dependent variable quality of life (QOL) was measured by the Minnesota Living With Heart Failure (MLWHF) questionnaire (Rector, Kubo, & Cohn, 1987). This was a 21-item, self-administered questionnaire with subscales covering physical, socioeconomic, and psychological impairments among CHF patients. The instrument was developed to systematically and thoroughly evaluate patients' perceptions of the effects on daily life of heart failure and its treatment. Patients ranked specific impairments, on a scale from 0 (best) to 5 (worst), according to how CHF prevents them living as they would like, in other words, ranking each impairment's significance or difficulty. The MLWHF questionnaire was scored by adding all the numbers circled by the participant. The higher the patient's score, the greater the limitations, with the worst possible score being 105 (Rector, Kubo, & Cohn, 1987).

The questionnaire contained total, physical, and emotional subscales. These subscales included groups of questions that contained

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similar information. Responses to questions 2 (rest during the day), 3 (walking and climbing stairs), 4 (working around the house), 5 (going away from home), 6 (sleeping), 7 (doing things with others), 12 (dyspnea), and 13 (fatigue) were highly correlated to the physical dimension. Questions 17 (feeling burdensome), 18 (feeling a loss of self control), 19 (worry), 20 (difficulty concentrating and remembering), and 21 (feeling depressed) were highly correlated to the emotional factor (Rector et al., 1992). The physical subscale had 8 items, the emotional subscale had 5 items, and a total of 21 items were used in the study.

Reliability and Validity of the MLWHF

A study conducted by Riegel (2002) reported that total QOL scores among discharged HF patients improved after receiving intensive interventions. After 1 month, 3 months, and 6 months of intensive treatment, the study showed significant differences in quality of life scores among treatment dose groups ($F = 3.43$, $df = 9,579$, $p<.001$; $F = 7.45$, $df = 9,579$, $p <0.001$; $F = 4.86$, $df = 9,768$, $p<.001$, respectively). The trial concluded that the MLWHF questionnaire was sensitive to major differences in symptom severity but not to subtle signs and symptoms of heart failure. A recommendation of the study was to caution researchers that the instrument was best used with a control or comparison group (Riegel, 2002). The alpha coefficients for total QOL scores at each time period ranged from 0.92 at baseline to 0.96 at one month. The alpha coefficient for the physical subscale was .92 at baseline and .95 at one

month; the alpha coefficient for the emotional subscale was .87 at baseline to .92 at one month (n = 1,136).

In another study by Rector et al. (1987), 83 patients with left ventricular dysfunction completed the MLWHF. Baseline variability was assessed by a second administration after 21 days. Statistical analysis on the differences and weighted kappas provided evidence for reliability, and internal consistency of the MLWHF questionnaire was examined using Spearman rank order. Validity was assessed by correlating the MLWHF scores with the response to, "Overall, how much did your heart failure prevent you from living as you wanted the past month?" The correlation between the NYHA classification and the patients' rating on the MLWHF questionnaire was statistically significant (r = 0.80, p <0.01). This association suggests that the questionnaire is a suitable representation of functional impairment. For this study, the MLWHF score reliably measured QOL among CHF patients with a weighted kappa of 0.84 between the individual items and the total score. Thus, the MLWHF questionnaire showed potential to increase knowledge of CHF symptoms and effects of medical interventions.

In 1992, Rector and Cohn evaluated the quality of life of 198 ambulatory patients using the MLWHF questionnaire. The inter-item correlations of the questionnaire identified categories of questions for both physical and emotional scores. Test–retest reliability was high for the total

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score: $r = 0.93$, physical: $r = 0.89$; and emotional: $r = 88$. Cronbach's alpha was 0.94 (total), 0.94 (physical), and 0.90 (emotional).

In a study conducted by Gorkin et al. (1993), psychometric properties of the baseline measures used in the Studies of Left Ventricular Dysfunction (SOLVD) trial were analyzed. The measures included the 6-minute walk test, dyspnea scale, MLWHF, physical limitations, psychological distress, and health perceptions. Researchers concluded that the internal consistencies of the self-report instruments were high, with the exception of the health perceptions of NYHA Class II or III patients. The MLWHF questionnaire revealed a Cronbach alpha of 0.95 for 135 NYHA Class I patients and an alpha of 0.94 for 123 NYHA class II and III patients. Table 4 illustrates the reliability of the MLWHF questionnaire as presented from several studies.

Table 4

Reliabilities of the MLWHF Questionnaire

Study	Sample Size	NYHA Class	Reliability
Rector et al. (1992)	198	III	$\alpha = 0.94$
Rector et al. (1987)	83	I-III	Weighted kappa 0.84
Gorkin et al. (1993)	135	I	$\alpha = 0.95$
	123	II-III	$\alpha = 0.94$
Reigel et al. (2002)	1136	--	$\alpha = 0.92$

Note. NYHA = New York Heart Association

Hospital Length of Stay

Hospital length of stay (LOS) was tallied for each admission after the baseline clinic visit. The medical records of all participants who reported a hospitalization were immediately reviewed by the primary investigator (PI) to see whether the primary discharge diagnosis was reported as CHF. The PI reviewed hospital charts to examine whether patients were admitted because of CHF diagnostic symptoms and/or other causes. Only the CHF admissions were of interest to this study. The frequency of hospital admissions were monitored and documented in the medical information form for up to 3 months and were reviewed for the number of days patients stayed in the hospital. Portions of the day were considered as one day of hospital stay.

Medical Information Form

The medical information form (Appendix C)developed by the (PI), is a three-item survey used to document NYHA classifications, hospital admissions and dates (if any), diagnoses, and number of days participants stayed in the hospital.

Summary of Reliabilities of Instruments

Table 5

Summary of Reliabilities of Instruments Used in the Study

Variables	Number of items	Instruments	Reliabilities	Range of scores
BNP[a]	1	Triage BNP	Sensitivity = 95% Specificity = 98% PV- = 96% Standard Error = 4%	5 to 5000 pg / ml
QOL[b]	21	MLWHF[c]	α = 0.95 α = 0.94	0-105
Hospital LOS[d]	10	Demographic Form	NA	
	3	Medical Information Form	NA	

Note. [a]BNP = B-type natriuretic peptide [b]QOL = quality of life

[c]MLWHF = Minnesota Living With Heart Failure   [d]LOS = Length of stay;

Procedures

Approvals

Permission to use the Minnesota Living With Heart Failure Questionnaire was obtained from the University of Minnesota, which provided a waiver for research purposes for one year Approval to conduct the study and recruit participants was obtained from both the Institutional Review Boards (IRBs) of the University of South Florida and the University of Florida, Shands Jacksonville A letter of support from Shands Heart

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Failure Clinic Medical Director was also provided (Appendix D). The informed consent form (ICF) and any changes made thereafter had to be approved by both IRB institutions. A continuing review report was filed and had to be approved by both IRB institutions prior to the expiration date of the study.

Recruitment

Upon approval of the IRBs and Health Insurance Patient Portability Act (HIPPA) compliance Board, a research assistant employed by Shands Jacksonville reviewed the CHF clinic schedule and patient charts and then screened eligible participants for the study. During the clinic visit, eligible participants were referred to the Principal Investigator (PI). Prior to being seen by the physician, the participant was approached by the PI in the waiting room and taken to a consultation room for privacy. The purpose of the study was explained thoroughly and ample time given for any questions regarding the study to be answered. Potential risks and benefits were explained to the patient. If the patient agreed to participate, the participant signed the informed consent form that incorporated the HIPPA authorization form (Appendix E).

The average number of heart failure patients scheduled on Mondays and Fridays varied from 16 to 20 patients. The PI saw participants on both days. Data collection for each participant took no less than 30 to 45 minutes. The participant signed two copies of the informed consent, which included a contact number for the PI. A leaflet of frequently

asked questions (FAQs) regarding the study was given to each patient (Appendix F). One copy of the informed consent was given to the participant, and the other copy remained in the participant's clinic chart. The PI explained to the participants the importance of completing the study. Participants were informed that once the study was completed, the results were available to them if they so desired. Additionally, participants were assured that participation in the study would not increase their medical costs.

The participant, or the participant's family member, was asked to contact the PI in the event of any hospitalization within 90 days from time of clinic visit. Once the PI had information on participants' hospitalization via telephone or mail, the PI reviewed the hospital chart to verify if the hospitalization was due to CHF. Subjects were informed that participation was voluntary, that they could withdraw from the study at any time, and that all data collected were kept confidential.

Random Assignment

Participants were randomly assigned to either the experimental (BNP) or control group after agreeing to take part in the study. It is important that the PI and physician not know in advance whether a patient is assigned to the BNP or the control group. Participants were randomized by the PI using randomization with concealment using the following process: To prevent bias, patient treatment allocation was done by the Statistical Analysis System (SAS) (SAS Institute Incorporated, 2001) based

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on a computer generated table of random numbers, using a syntax to allow random allocation. Numbers were printed, cut apart, and placed inside identical opaque envelopes and then sealed. The envelopes were numbered from 1 to 140 and stacked in numerical order. The original table of random numbers was destroyed. The PI was not able to anticipate into which group the next subject would be assigned. This randomization with concealment provided initial blinding of group assignments to the researcher. After eligibility was assessed and consent was obtained, each participant took an envelope from the top of the stack. Following assignment to treatment condition, all the envelopes had subjects' names written on the outside and were kept in a locked cabinet.

Baseline Data Collection

The PI used a consultation room near the waiting room as a private area to talk to the participant regarding the study, have the informed consent signed, and the survey completed by the patient. The PI assisted with the completion of the QOL survey if the patient verbalized the need for help. The consultation room was equipped with a table and chair so that participants had space to complete the questionnaire. Blood for BNP levels was drawn by the PI and analyzed at point-of-care prior to the patient being seen by the physician. Syringes, tubes, pipettes and the BNP machine were available on site for drawing BNP levels.

Procedure for Completing MLWHF Questionnaire

The participant self-administered the MLWHF questionnaire, unless assistance was requested. The PI explained to the participant the importance of completing the MLWHF questionnaire again in 90 days. The participants read and responded to all 21 questions and was asked to rank, on a Likert-type scale (0-5), each specific impairment according to how heart failure had affected their lives during the past month. If a participant was not sure an item applied or if an item was not related to heart failure, then the participant was directed to circle 0 (No). If an item did apply, then the patient was directed to circle a number from 1 (very little) to 5 (very much). The total scores indicated the difficulty or importance of the impairment. Participants completed the questionnaire prior to any assessment or physician interaction.

Procedure for Performing BNP Test

Prior to enrolling participants in the study, the PI was certified in obtaining BNP levels utilizing the Triage BNP Immunoassay Kit. Using sterile technique, the PI drew one cc of whole blood by venipuncture collected into a 1-cc tube containing potassium EDTA and measured with a fluorescence immunoassay (BNP Triage Immunoassay Kit). The blood was mixed gently by inverting the tube several times before transferring the blood to the test device. The specimen was added to the sample port of

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the test device with a transfer pipette designed to deliver 250 ul to the test device.

After the specimen was added, the device was inserted into the Triage meter. The meter was programmed to automatically perform the BNP analysis after the sample had reacted with the reagents within the BNP device. The PI was responsible for collection and disposal of all data and blood drawn. Used needles, tubes, and syringes were disposed of in a sharps container located inside the laboratory. Blood levels for BNP were drawn following completion of the survey. BNP blood levels were drawn only once. The physician involved in the study was not given the BNP results of participants in the control group. For those in the BNP group, the physician was informed of BNP levels by the PI handing him the BNP results generated from the Triage BNP Immunoassay Kit when the experimental participant entered the examining room. Results were documented on the demographic data information form and destroyed. Results of BNP levels were not documented in the patient records. On any given clinic day, only the PI and one physician exposed to the experimental subject had access to the results of the BNP levels. The PI documented the BNP level results on the medical information form. Participants were not informed of their BNP levels.

The PI did not inform the physician of BNP levels if he was seeing a patient in the control group even if an extremely high level was obtained. Treatment and management of CHF patients was guided at this facility

using HF guidelines. Currently, BNP testing is not part of routine heart failure guidelines (HFSA, 2006). Therefore, the withholding of extremely high BNP levels was ethical.

Follow-Up

Following the clinic visit and examination of the participant, the clinic staff scheduled the next study visit appointment in approximately 90 days. If the physician requested to see the patient prior to 90 days, this was considered a clinic visit—not a part of the study. Every effort was made to ensure that the participant came back in 90 days to complete the MLWHF survey. The PI contacted the participants via telephone once a month, for 3 months to ensure that every CHF hospital admission and hospital LOS was known. Three monthly letters were sent inquiring if there had been any hospitalizations within the past month, and if so, the place of admission, date of admission, and number of days the patient stayed in the hospital. Once the PI had information on participants' hospitalization via telephone or mail, the PI reviewed the hospital chart to verify whether the hospitalization was due to CHF.

Ninety days after enrollment in the study, the participants again completed the MLWHF questionnaire at the clinic, and the PI completed the medical information form to verify whether participants had any previous hospital admissions. If unable to reach the participants, the PI contacted the alternative contact numbers. In the event that the PI was not able to contact anyone, a telephone message was left for the participant to

call the PI regarding the survey. Within 90 days plus minus 7 days after the baseline clinic visit, if attempts to contact the participant and to do the 90-day follow-up interview were unsuccessful, then the patients were considered lost to follow-up.

Data Management

Demographic and medical information used computer generated random codes to protect personal identifiers. A master file with names was kept and locked in a secure location in the physician's office. Only the PI and supervisors had access to this information. To ensure patient confidentiality, the PI entered all completed surveys, the demographic and medical information form, and BNP results into an Excel program. After data collection was completed all identifiers were deleted and destroyed. Per IRB protocol, the quality of life questionnaire, demographic, and medical information forms are to be kept for 5 years, and study findings will be available to participants upon request.

Data Analysis

Data were analyzed using Statistical Analysis System (SAS). A confidential, password-secured database was used for data entry, management, and data analysis. Frequency distributions of the data were used to check for missing values, outliers, inconsistencies. Descriptive statistics of the data were provided. An independent t-test was used to compare means of QOL scores between the experimental group and control group at baseline as well as at 90 days. Bivariate correlations were

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done among the independent and dependent variables. BNP data were log transformed as necessary. Results of the study were reported as aggregate numbers, and participants were not identified.

Hypothesis 1: It was hypothesized that clinicians' knowledge or lack of knowledge of BNP levels at the time of the baseline clinic visit would make a difference in the quality of life scores between the experimental and the control group at 90 days. An independent t-test was used to examine the relationship between experimental and control groups and quality of life scores at 90 days.

Hypothesis 2: It was hypothesized that clinicians' knowledge or lack of knowledge of BNP levels at time of CHF clinic visit would affect hospital LOS on all hospital admissions of CHF patients within 90 days. An independent t-test was used to examine the difference in the mean LOS between the experimental and control groups.

Chapter Four

Results

This chapter presents the results of this study on the effects of clinic physician knowledge of BNP levels on participants' quality of life at the 90-day follow-up. Preliminary analyses are discussed. These included bivariate correlations, checking normality distributions, checking for errors in data entry, missing data or outliers. This is followed by the discussion of the demographic characteristics and clinical profile of the participants. Next, the statistical analyses are discussed in depth, and outcomes for each hypothesis are presented.

Procedure

Participants were recruited by the PI from a heart failure clinic in Northeast Florida, where 112 subjects were assessed for eligibility. Two potential participants were excluded because of high serum creatinine levels, and two refused to participate. Enrollment spanned from October 2005 to August 2006, and the 90-day follow-up period was completed inn November 2006. The intended number of participants to be enrolled was 62 per group for a total of 124 for both groups. Because of staffing and clinic scheduling issues, such as decrease in the frequency of clinic days, fewer patients were enrolled in the study than intended. After enrolling patients with due process, questionnaires were distributed by the PI. Completion of the questionnaire took an average of 15 minutes. The survey consisted of 10 demographic questions and 21 QOL survey questions.

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The next step in the procedure was for the PI to draw blood. The blood was processed according to the procedure described in Chapter 3 (Procedure for Performing the BNP Test). After blood was drawn, a physician examined each participant. To minimize error, only one physician performed all the patient assessments.

The participants were then allocated to either the control group or the experimental group. Randomization was done by a random number generator. The participants and the physician were blinded to the randomization status. After randomization, the BNP level results for those in the experimental group were given to the physician. The physician did not receive the BNP results for the control group.

Sample

A total of 108 participants completed the Minnesota Living with Heart Failure questionnaire and had their BNP levels blood drawn at baseline. Of the 108, 57 (53%) participants were assigned to the experimental group and 51 (47%) participants to the control group at time one (baseline). At time two (follow-up), 16 participants did not complete the study. Of these, 10 (15%) left the study and 6 (5%) died. Of the 10 who left the study, 6 were from the experimental group and 4 were from the control group. This left 50 participants in the experimental group and 42 participants in the control group, a total of 92 participants who completed the study at 90 days.

Due to the concerns about the effects of attrition, data were examined for those who did not complete the study. T-test analyses between completers and

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non-completers showed that there were no significant differences in age, BNP, ejection fraction, QOL or the physical and emotional subscales at baseline. Therefore, it appears that the loss of these patients did not affect the overall outcome. Figure 3 illustrates the trial sample flow diagram.

Figure 3. The flow of participants through the trial.


```
            ┌─────────────────────────┐
            │  Screened for eligibility│
            │      (n = 112)           │
            └─────────────────────────┘
                        │
                        ▼                          ┌──────────────────────┐
            ┌─────────────────────────┐            │ Excluded             │
            │                         │            │ (n = 4)              │
            │  Enrollment (n = 108)   │──────────▶ │ Not meeting          │
            │                         │            │ inclusion criteria   │
            └─────────────────────────┘            │ (n = 2)              │
                        │                          │ Refused to           │
                        │                          │ participate          │
                        │                          │ (n = 2)              │
                        │                          │ Total allocated      │
                        │                          │ (n = 108)            │
                        │                          └──────────────────────┘
```

| Allocated to Experimental (n = 57) | **Allocation** | Allocated to Control (n = 51) |

| Lost to follow-up (n = 6) Reasons = unable to reach at 90 days. Discontinued intervention (n = 1) Reasons = Death | **Follow-Up** | Lost to follow-up (n = 4) Reasons = unable to reach at 90 days. Discontinued intervention (n = 5) Reasons = Death |

| Total Analyzed Experimental (n = 50) | **Analysis** | Total Analyzed Control (n = 42) |

Description of Baseline Demographic Characteristics

The results for the demographic data are discussed next for the total

sample (N = 92). Demographic data were collected to include the following

characteristics: [a] age, [b] ethnicity, [c] gender, [d] education level, [e] insurance

payers, [f] marital status, and [g] occupation. All participants completed their demographic forms at baseline. Data analysis was conducted, and frequency distribution of values of each variable was performed. Utilizing the frequency distributions was helpful in examining missing data or revealing the number of missing values for each variable that may be due to problems in data collection. Patient demographics and clinical profile at baseline were compared for equivalence between the two groups by an independent t-test and X^2 as appropriate (SAS Institute, Version 8.2, Gary, North Carolina, 2001). A X^2 was used to analyze the categorical/nominal variables of gender, ethnicity, marital status, occupation, education, insurance payers and NYHA classification.

The independent t-test was used to analyze the continuous variables of age, ejection fraction, BNP levels and QOL scores. The four assumptions of the t-test which include independence, scale of measurement used, normality, and homogeneity were used to validate whether the data met the criteria for using the independent t-test. The BNP values were highly skewed. They ranged from 9 pg per ml to 5000 pg per ml at baseline. The mean was 458 pg per ml (SD = 759). However, the mode was 101 pg per ml; this showed the effects of the outliers of the mean. Of the total sample, 31% had BNP values of less than or equal to 101 pg per ml, and 59% had values ranging from greater than 101 pg per ml to 1000 pg per ml. The remaining 10% (n = 10) had BNP values ranging from 1110 pg per ml to 5000 pg per ml. These last ten data drastically affected the mean; therefore, the mode has been reported. Because of the skewness, it was

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deemed necessary to do a log transformation of the BNP value before using it in statistical analyses.

The demographic and clinical characteristics of the experimental group (n = 50) and the control group (n = 42) at baseline are summarized in Table 6. There were no significant differences by group in gender, ethnicity, marital status, education, occupation, or insurance payers. Additionally, there were no significant differences on the clinical profile between groups with regard to age, ejection fraction, and BNP levels. Therefore, random assignment of study participants appeared to successfully minimize differences between the groups at baseline.

Table 6

Baseline Demographic and Clinical Characteristics of Patients by Group

Variables	Experimental Group n = 50	Control Group n = 42	P value
Age			
Mean ± SD*	63.3±11.5	65.4±13.4	.410
Gender (%)			
Female	24 (48%)	18 (43%)	
Male	26 (52%)	24 (57%)	.621
Ethnicity (%)			
African American	26 (52%)	23 (55%)	
Caucasian	23 (46%)	19 (45%)	.645
Asian	1 (2%)	0 (0%)	
Marital Status (%)			
Single	3 (6%)	7 (17%)	
Married	19 (38%)	16 (38%)	.364
Divorced	14 (28%)	8 (19%)	
Widow/Widower	14 (28%)	11 (26%)	
Occupation (%)			
Retired	36 (72%)	27 (64%)	.354
Disabled	12 (24%)	10 (24%)	
Working	2 (4%)	5 (12%)	
Education (%)			
<High school	13 (26%)	10 (24%)	
High school	19 (38%)	17 (41%)	
Some college	12 (24%)	7 (17%)	.816
4 Year Degree	5 (10%)	6 (14%)	
Masters Degree	1 (2%)	1 (2%)	
Doctoral Degree	0 (0%)	1 (2%)	
Insurance Payers (%)			
Private Insurance	4 (8%)	7 (17%)	
Medicare/Medicaid	43 (86%)	32 (77%)	.189
Tricare Military	0 (0%)	2 (4%)	
Shands Card	3 (6%)	1 (2%)	

Note. *SD = Standard Deviation

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Table 6 (continued)

Variables	Experimental Group n = 50	Control Group n = 42	P value
NYHA Classification [a]			
NYHA II	18 (36%)	12 (29%)	
NYHA III	32 (64%)	29 (71%)	.496
Ejection Fraction (%)			
Mean ± SD*	27.5 ± 7.3	25.9 ± 9.4	.385
Serum Creatinine (mg/dl) [b]			
Mean ± SD	1.2 ± 0.37	1.0± 0.40	
			.054
BNP levels(pg/ml) [c]	407 ± 713	452± 598	.744
LogBNP levels (pg/ml)	4.9 ± 1.44	5.4 ± 1.30	.131
Mean ± SD*			

Note. *SD = Standard Deviation   [a] NYHA = New York Heart Association Classification   [b]mg/dl = milligrams per deciliter   [c] BNP = b-type natriuretic peptide; measured in picograms per milliliter (pg/ml)

The mean age for the total sample was 64.5 years (range 24-94 years,

SD = 12.4, N = 92). By racial identity, 49% were African American, 42% were

Caucasian, and 1% was Asian. There were more married participants in both the

experimental and control groups (n = 35, 38%) than single (n = 10, 11%),

divorced (n = 22, 24%), or widowed/widower (n = 25, 27%).

More of the total sample completed high school (39%) than did not (25%).

Additionally, 36% had some college. Of the total study sample, 68% were retired,

24% were disabled, and 8% were employed. The majority of the study

participants from both groups had Medicare and Medicaid insurance coverage (n

= 75, 82%), private insurance (n = 11, 12%), military insurance (n = 2, 2%) and

Shands Clinic card (n = 4, 4%).

Description of Baseline Clinical Profile of the Participants (N = 92)

For both study groups, the majority (67%) were classified as NYHA III and, 33% were classified as NYHA II. The median and the mode for the total distribution were both 3.0. The NYHA IIIB were coded as NYHA III for statistical purposes. Of particular interest, the NYHA classification was only weakly correlated with BNP levels ($r = .25$, $p = .009$) and the log BNP levels ($r = .22$, $p = 0.03$).

Data on both the ejection fraction and serum creatinine levels were obtained within one year from office visit. The overall mean ejection fraction for this sample of HF patients was 26.7% (SD = 8.3, median = 28.0, mode = 30). The overall mean serum creatinine levels for the total sample was 1.1 milligrams per deciliter (mg/dl) (SD = .39, median = 1.0, mode = 0.8). Again, the mean BNP was 458 pg per ml, and the mode was 101 pg per ml. In summary, participants had a poor ejection fraction and normal serum creatinine levels as required by the inclusion criteria. However, they also had BNP levels that barely crossed the threshold for heart failure.

Description of Dependent Variables at Baseline

Quality of life was measured using the Minnesota Living With Heart Failure questionnaire. The questionnaire had a total of 21 questions and two subscale scores. The physical subscale dimension score consisted of items 2-7, 12, and 13. The emotional subscale dimension score consisted of items 17-21. The total QOL score ranged from 0-105; the total physical subscale score ranged from 0 to 40; and the total emotional subscale score ranged from 0 to 25 (Rector et al.,

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2002). The remaining 8 questions (range of 0-40) consisted of general questions. An independent t-test of the QOL variables demonstrated equivalence at baseline. The mean scores for QOL (overall, physical, and emotional) are summarized in table 7.

Table 7 *Baseline Descriptives and Reliabilities of QOL Scores by Group*

Variables	MLHFQ[a], Overall	MLHFQ, Physical	MLHFQ, Emotional
Experimental Group (n = 50)			
mean ± SD	45.9 ± 29.8	19.7 ± 13.0	9.76 ± 7.91
median	48.0	20.5	9.5
mode	13.0	0.0	0.0
min-max [b]	3.0-101	0.0 - 40	0.0 -25
Control Group (n = 42)			
mean ± SD	48.6 ± 29.3	21.1 ± 14.2	11.2 ± 8.37
median	53.0	23.5	10.5
mode	6.0	0.0	0.0
min-max	11.0-93	0.0 - 40	0.0 -24
Cronbach's alpha			
	0.94	0.95	0.89
t value	0.60	0.49	0.90
P value	0.54	0.62	0.37

Note. [a]MLHFQ = Minnesota Living With Heart Failure Questionnaire

[b]min-max = Minimum and maximum scores

Bivariate correlation was examined next. As expected, the data revealed an inverse relationship between ejection fraction and BNP levels (r = -0.28, p = .006). However, the magnitude was not as strong as expected. That is, participants with the lower ejection fractions demonstrated higher BNP levels. There was a direct relationship between NYHA classification and QOL. As NYHA increased, the QOL score increased; this demonstrated a corresponding deterioration in the quality of life. There was a weak but significant correlation between NYHA and BNP levels (r = .23, p = 0.02). Based upon literature findings

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from larger sample sizes, it was anticipated that the correlation would be stronger.

Table 8 summarizes the bivariate correlations among the variables.

Table 8

Bivariate Correlational Analysis of Baseline Variables

Bivariate Variables (N = 92)	QOL Baseline	BNPL	Age	Ejection Fraction	Serum Creatinine	NYHA
QOL Baseline	1.00					
BNPL	0.25**	1.00				
Age	-0.09	0.21*	1.00			
Ejection Fraction	-0.14	-0.28***	0.23*	1.00		
Serum Creatinine	0.10	0.22*	0.16	-0.07	1.00	
NYHA	0.50***	0.23*	0.00	-0.12	0.16	1.00

Note. P value = *0.05, **<0.01, ***<0.0001

Discussion of Results by Hypotheses at the 90-Day Follow-Up

Research Hypotheses:

Hypothesis 1: It was hypothesized that clinicians' knowledge or lack of knowledge of BNP levels at time of clinic visit would make a difference in the quality of life scores between the experimental group and the control group at 90 days. An independent t-test between experimental and control groups was used to compare mean QOL scores at 90 days. Based on the results of the t-test,

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there was no significant difference in the QOL scores at 90 days (t = -0.79, df = 90, p = 0.43). Table 9 summarizes the results of the two groups at 90 days.

Table 9

Comparison of QOL Score Means by Group at 90 Days

Variables	Cronbach's alpha	Experimental Group 90 days n = 52 (mean ± SD)	Control Group 90 days n = 40 (mean ± SD)	t Value	p Value
MLHFQ, overall	0.94	37.5 ± 29.8	32.7 ± 27.9	-0.79	0.43

Note. MLHFQ = Minnesota Living With Heart Failure Questionnaire

Therefore, physician knowledge of BNP levels at time of clinic visit did not make a difference in QOL scores at 90 days for either group. It was noted that QOL scores went down for each group; this indicated an improvement of their overall QOL at 90 days. However, this improvement was equal for both groups. The pre and post paired t-test for the experimental group was significant

(t = .5.07, df = 90, p = .001). For the control group the pre and post t-test was significant as well (t = 4.62, df = 41, p = 0.00). These findings will be discussed in depth in the next chapter. Hypothesis one was not supported.

Hypothesis 2: It was hypothesized that clinicians' knowledge or lack of knowledge of BNP levels at the time of CHF clinic visit would affect hospital length of stay (LOS) on all hospital admissions of CHF patients within 90 days. Portions of the day were considered as one hospital day. The experimental group had a total of 9 participants who were admitted for heart failure for a total

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of 31 hospitalization days within the 90-day follow-up period. The control group had a total of 2 participants who were admitted for heart failure for a total of 6 hospitalization days within the 90-day follow-up period. An independent t-test showed that there was no significant difference in the mean LOS (t = 1.10, df = 90, p = ns). Table 10 displays the number of hospital days per group assignment.

Table 10

Hospital Length of Stay by Group Assignment

Group	Number of Patients Admitted (n = 11)	Admission Rate Percent (%)	Total Days In Hospital	Mean Hospital LOS
Experimental Group (n=50)	9	18	31	3.4
Control Group (n=42)	2	5	6	3.0

Note. LOS = length of stay

Ancillary Findings

Mortality

There were a total of six deaths between enrollment and the 90-day follow-up. By the 90-day follow-up, 12% (n = 5) in the control group had died, and 2% (n = 1) from the experimental group had died. There was a significant difference in the mortality rate with the control group having more deaths than the experimental group (t = 1.99, df = 90, p = .04). These deaths were attributed to complications of heart failure. Table 11 displays the number of deaths by group assignment.

Table 11

Total Number and Percent of Deaths per Group Assignment

Sample	Deaths Number/ Percent by group	
Experimental Group (n = 50)	1	(2%)
Control Group (n = 42)	5	(10%)
Total (N = 92)	6	(5%)

To summarize, hypotheses one and two were not supported, but an ancillary finding showed a significant difference in the mortality rate. Additionally, BNP levels and QOL scores were significantly correlated but with a weak magnitude for both groups at baseline. A more in-depth discussion of findings, limitations, implications for nursing, and recommendations for future study will be described in chapter five.

Chapter 5

Discussion, Conclusions, and Recommendations

Introduction

This chapter presents a broad discussion of the findings, conclusions, implications, limitations, and recommendations for future research. In the discussion section, hypotheses one and two are discussed in detail. Several plausible explanations are offered for the findings of each hypothesis. The factors that limit the generalizability of the study are discussed. Finally recommendations for future research are included.

Discussion

Hypothesis 1

Previous research on QOL and its relation to BNP levels in HF has been widely studied. However, little has been known about whether a physician's knowledge or lack of knowledge of BNP levels affects QOL scores and hospital LOS at 90 days. It was hypothesized that if physicians were aware of BNP levels, then appropriate treatment would circumvent the development and progression of HF. Additionally, timely treatment would help alleviate and ease the symptoms of HF and might improve the patient's quality of life. In the current study, the physician's knowledge of BNP levels at the time of the clinic visit did not have any significant effect on the QOL scores for either the experimental or the control group at 90 days. Despite the fact that no significant association was observed between the experimental and control group at 90 days, the data indicated a decrease in the mean QOL scores at 90 days (37.46 ± 28.67) as compared to

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the mean QOL scores at baseline (46.87 ± 29.63) for both groups. Because the QOL scale is reversed, this indicated that there was a positive change in QOL scores during the 90-day interval.

There are several plausible explanations for this outcome. First, the data showed a QOL mean of 45.9 ± 29.8 and 48.6 ± 29.3 for the experimental and control groups, respectively. Although, these mean QOL scores at baseline demonstrated an impaired QOL (based on the range of 0-105), they may have had little room for improvement. The patients' QOL might already have been quite positive. It is possible that these HF patients may have adapted to their chronic disease and adjusted their perception of their QOL. This lack of room for improvement reflects a ceiling effect.

Second, another possible explanation for failing to detect a significant difference between the experimental and control groups on QOL scores at 90 days could have been that the same physician was treating both groups. The patients were already well managed, as evidenced by the BNP level of 101 pg per ml as mode. The clinician continued to provide optimum care to each group, and knowing current BNP values at the clinic visit may not have altered the clinician's overall treatment plan for either group.

Third, it is possible that if the participants were newly diagnosed HF patients at baseline, the finding might have been different since new patients might not have adapted to their functional limitations and QOL. Perhaps at this point, quality of life is a not a stable construct in newly diagnosed HF patients.

Fourth, sample size may not have been large enough to detect a significant difference in QOL scores between the two groups.

Although hypothesis one was not supported, the lack of association between physician knowledge of BNP levels is an unusual finding, since previous studies suggested that clinicians' knowledge of BNP-guided treatment provided alleviation of symptoms and improvement of QOL (Troughton, 2000).

Hypothesis 2

The data revealed no significant difference on the hospital LOS when comparing groups. In this study, the experimental group had a higher frequency of admission when compared to the control group; however, this was not statistically significant. Perhaps the physician's awareness of the BNP levels for those participants in the experimental group prompted closer monitoring; this could have accounted for the increased number of hospitalizations. However, it does not explain the non-significant difference in the length of stay across the two groups. Three possible reasons are proposed; an obvious one is that the sample size of those admitted was quite limited. A second possible explanation is that the event rate of hospitalization was too low, and the study was not powered for this outcome. Expanding the interval beyond 90 days might have allowed for more events to occur. Another possible explanation could be that the admitted HF patients were treated by different attending physicians with differing modalities of treatment.

The results of the second hypothesis was an unexpected finding since it has been suggested by Cheng et al. (2001) and Mueller et al. (2004) that

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physician knowledge of BNP levels predicts shorter hospital LOS. Additionally, findings from a previous study concluded that patients who did not receive BNP-guided treatment experienced more cardiovascular event hospitalizations and deaths (78%) than those receiving BNP-guided treatment (22%) (Troughton et al., 2000). BNP levels should not be interpreted in isolation, but as part of the whole clinical assessment of the patient.

Ancillary Finding

Additionally, the study revealed an ancillary finding, demonstrating that there was a statistically significant association between BNP at baseline and the physical subscale scores at baseline (r = .24, p = 0.01). This corroborated the idea that increased BNP levels indicated more severe HF symptoms as reflected in the QOL scores. Regardless of whether patients were randomized to the experimental or control groups, the data reflected that as BNP level increased, patients experienced more impaired quality of life and physical health. These findings were consistent with previous research concerning elevated BNP level and its association with bad prognosis and poor quality of life (Morrison et al. 2002; Ninuma et al., 1998; Wieczorek et al., 2002; Lubarsky & Mandell, 2004; Hirata et al., 2001; Teboul et al., 2004; Sagnella, 1998; Vanderheyden et al., 2004; Heidenreich et al., 2004; Mair et al., 1999; Valle et al., 2005). Findings of this study are similar to those of Mueller et al. (2004), Steg et al. (2005), and Maisel et al. (2002), who concluded that clinician's knowledge of BNP levels as an additive diagnostic tool along with other clinical information is useful in assessing QOL. According to Heidenrich et al. (2004), Maisel et al. (2001), and

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MacMahon et al. (2002), timely detection of BNP levels may lead to early diagnosis and treatment of CHF, thereby decreasing readmissions and improving patients' quality of life. The results of this study extend these same findings to this clinic sample: increased BNP level directly correlated with QOL scores; an increased QOL score indicated more functional impairment.

Another incidental finding was that the mean of NYHA II HF patients for this sample was higher (460 pg per ml) than reported by Maisel et al. (2001) (332 pg per ml). These results provided evidence that the participants in the NYHA II classification were sicker than those in the same NYHA II classification reported by Maisel et al. (2001). The mean for the NYHA III patients of this study was 569 pg/ml, similar to the mean of 590 pg per ml for NYHA III as reported by Maisel et al. (2001). Although the NYHA classification was made within 6 months of assessments, the discrepancy between the mean BNP of this sample when compared to the mean of BNP sample reported by Maisel et al. (2001) highlights the subjective validity of the classification. So even though the t-test showed no statistical difference at baseline between the two groups in the current study, there may have been a subjective difference in the clinical picture that affected the treatment by the physician, and therefore, the results.

Additionally, data from this study showed a higher number of deaths in the control group as compared to the experimental group at 90 days ($t = 1.99$, $df = 90$, $p = .04$). A possible explanation is the physician's lack of awareness of BNP values; this may have distorted the assessment of the HF patient. Troughton et al. (2000) concluded that death rates and hospital admissions were

fewer in the BNP-guided group than in the clinical group (19 vs. 54, p = .02). Ishii et al. (2003) concluded that BNP levels were strong predictors of cardiac events and were associated with mortality rates. Therefore, further study is warranted to determine whether physicians' lack of knowledge of BNP levels is related to increased heart failure mortality. Consequently, the use of BNP rapid assay and its modest cost ($26/ test), is crucial in comparison to heart failure's enormous economic healthcare burden to society. Mueller et al. (2006) concluded that the cost effectiveness of BNP-guided testing in heart failure patients showed that total treatment cost of $7,930 for the BNP-guided group was significantly reduced from the $10,503 incurred by the control group (p<0.004).

Limitations

Several limitations of this study warrant caution in interpreting the results. One major limitation is that the PI did not collect data on medications used for this cohort or track any change in medications from baseline to 90 days. A retrospective preliminary pilot study conducted at the same HF clinic indicated that these patients were receiving the optimum pharmacological treatment for HF. It was the researchers' assumption that knowledge of BNP levels would somehow prompt the physician to improve their care. Perhaps the assumption that physician knowledge of BNP levels would have affected the physicians' decision on the treatment rendered to the patient was incorrect. In retrospect, there were several variables that should have been controlled and analyzed. One such variable was the presence of cardiac devices like the biventricular pacemakers. As noted earlier, medication history was not obtained for all patients

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at baseline or 90 days. These patients were likely receiving optimum medications for heart failure; however, changes in the medications were not tracked at the 90-day interval. Such changes could have influenced any hospital admissions, LOS, and QOL. Another variable that could have been monitored was presence of comorbidities in these HF patients. These comorbidities, such as arthritis or emphysema, could have significantly impacted QOL.

Another limitation to the study was its setting. The study sample was recruited from one clinic in the Southeastern United States, limiting generalization of findings to other clinics and geographical areas. This was a unique clinic population consisting largely of elderly, African-American men who were relatively unwell. This limited heterogeneity amongst subjects. This sample may be similar to those who live in the northeastern region of Florida yet different from those who live in the southeastern region of Florida. Additionally, the study might have benefited from a larger sample size in order to better address attrition and be powered for a low base rate of hospitalizations. Given the low base rate for hospitalizations, a larger sample size might have permitted detection of a statistically significant difference between groups in the number of hospital admissions and LOS. Furthermore, there is a likelihood that participants of the study may have been enrolled in other heart failure studies in the past and may have been exposed to the same MLWHF questionnaire. Also, there is a possibility of excessive systematic error in the MLWHF questionnaire and a possibility of random error occurring in the BNP rapid assay machine. Lastly,

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there exists the possibility of investigator bias since the PI was not blinded to group assignment.

Implications for Nursing

The implications drawn from this experimental study are presented in this section. As evidenced by the results, increased BNP levels are negatively associated with QOL in patients with heart failure. Based on this information, clinical nurses need to understand that BNP levels may be directly related to volume overload. Increased volume overload begets increased symptoms and increased functional limitations. Understanding the relationship of BNP levels in relation to these symptoms may help delay the progression of the disease, alleviate deterioration of functional status, and improve QOL. Thus, nurses need to keenly observe signs and symptoms of heart failure exacerbation; they need to know that BNP values are an additive diagnostic tool to be used in the context of all other available clinical information.

Furthermore, knowledge of BNP levels empowers patients to make informed consumer decisions regarding their health conditions, such as importance of daily weights, compliance with medications, exercise, and proper diet. Physical indicators of heart failure are not as obvious as indicators of other disorders. For example, although HF patients can do daily weights, no objective at-home blood tests are currently available to assess volume status, but patients with diabetes have immediate access to point-of-care tests for blood glucose. Awareness of BNP level and its relationship to the pathophysiology of the

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disease process would allow the patient to have better control and management of this chronic and debilitating condition.

Recommendations for Future Study

Based upon the results of this study as well as the review of literature, the following recommendations are made for future research. It is recommended that [a] this study be replicated using a larger sample size in order to detect any effect of knowledge of BNP levels to QOL and to detect low event rate such as hospitalizations; [b] the follow-up period be extended for more than 90 days to allow for the occurrence of more cardiovascular events; [c] correlations be retested between BNP and current NYHA classification to validate the use of BNP as a clinical marker, [d] other physiologic variables that heart failure patients experience (such as sleep disorders, implantation of cardiac devices, and effects of life-sustaining medications on patients' QOL) be examined, [e] adding a psychological component such as a depression questionnaire may provide a more holistic view of how heart failure patients experience their quality of life; and [f] conducting a structural equation modeling procedure would provide a more comprehensive statistical analysis when attempting to evaluate the physical, psychological, and emotional dimensions when assessing the quality of life of heart failure patients.

Summary

Managing congestive heart failure continues to present a challenge for nurses and other clinicians. The impact of heart failure on patients as well as its economic burden to society is undeniable. Despite a high level of public awareness of this disease, a majority of the population is unaware of their risks of developing heart failure. Nurses can educate heart failure patients, so they may empower themselves in circumventing the development of this clinical syndrome.

Even though the hypotheses of this study were not supported, incidental findings warrant further research. The limitations, as previously discussed, should be addressed so that future studies in the same area have more power. The inclusion of additional variables would further enhance the study. Quality of life remains a key area of heart failure research and a focal point in the treatment and management of heart failure.

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Appendices

Appendix A

Demographic Information Form

1. Data Collection Date_____
2. Subject code_____
3. Date of clinic visit _____
4. Age (circle one):
    [1] age 21 to 40
    [2] age 41 to 60
    [3]age 61 to 80
    [4] age 90 and older
5. Ethnic Background (circle one):
    [1] Asian
    [2] African-American
    [3] Caucasian
    [4] Hispanic
    [5] Native American
    [6] other _____
6. Education (highest level achieved):
    [1] Less than high School
    [2] High school Diploma
    [3] Some college
    [4] 4 year Degree
    [5] Masters Degree
    [6] Doctoral Degree
7. Occupation (circle one):
    [1] Management
    [2] Business, Finance and Administration
    [3] Natural and Applied Sciences and related occupations
    [4] Health Occupations
    [5] Social Science Education, Government Service & Religion
    [6] Art, Culture, Recreation and Sport
    [7] Sales and Service
    [8] Occupations unique to Primary Industry
    [9] Occupations unique to Processing, Manufacturing and Utilities
8. Marital Status:
    [1] Single
    [2] Married
    [3] Divorced
    [4] Widow/ Widower

9. Insurance:
- [1] Yes
- [2] No

10. Insurance Payers:
- [1] Private Insurance
- [2] Medicare
- [3] Medicaid
- [4] Tricare Military

Appendix B

Subject Code_____

Date_____

LIVING WITH HEART FAILURE® QUESTIONNAIRE

These questions concern how your heart failure (heart condition) has prevented you from living as you wanted during the last month. The items listed below describe different ways some people are affected. If you are not sure an item does not apply to you or is not related to your heart failure then circle 0 (No) and go on to the next item. If an item does apply to you, then circle the number rating how much it prevented you from living as you wanted.

Did your heart failure prevent you from living as you wanted during the last month by:	No	Very Little			Very Much	
1. causing swelling in your ankles, legs, etc?	0	1	2	3	4	5
2. making you sit or lie down to rest during the day?	0	1	2	3	4	5
3. making your walking about or climbing stairs difficult?	0	1	2	3	4	5
4. making your working around the house or yard difficult?	0	1	2	3	4	5
5. making your going places away from home difficult?	0	1	2	3	4	5
6. making your sleeping well at night difficult?	0	1	2	3	4	5
7. making your relating to or doing things with your friends or family difficult?	0	1	2	3	4	5
8. making your working to earn a living difficult?	0	1	2	3	4	5
9. making your recreational pastimes, sports or hobbies difficult?	0	1	2	3	4	5
10. making your sexual activities difficult?	0	1	2	3	4	5
11. making you eat less of the foods you like?	0	1	2	3	4	5
12. making you short of breath?	0	1	2	3	4	5
13. making you tired, fatigued, or low on energy?	0	1	2	3	4	5
14. making you stay in a hospital?	0	1	2	3	4	5
15. costing you money for medical care?	0	1	2	3	4	5
16. giving you side effects from medication?	0	1	2	3	4	5
17. making you feel you are a burden to your family or friends?	0	1	2	3	4	5
18. making you feel a loss of self-control in your life?	0	1	2	3	4	5
19. making you worry?	0	1	2	3	4	5
20. making it difficult for you to concentrate or remember things?	0	1	2	3	4	5
21. making you feel depressed?	0	1	2	3	4	5

Appendix B/LwHFO

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Appendix C

Medical Information Form

Data Collection Date_____   Subject
code_____

    1. Hospital Admission
      [A] Yes
      [B] No
    2. If admitted:
      [A] Date of admission_____
      [B] Hospital_____
      [C] Diagnosis_____
      [C] Date of discharge_____
    3. NYHA Classification
      [A] NYHA I
      [B] NYHA II
      [C] NYHA III
      [D] NYHA IV

Appendix D
Letter of Support from Medical Director

UNIVERSITY OF FLORIDA

HEALTH SCIENCE CENTER / JACKSONVILLE
Department of Medicine
Division of Cardiology

655 West 8th Street
Jacksonville, Florida 32209
Telephone: (904) 244-4198
Fax: (904) 244-3102

November 23, 2004

To whom it may concern,

This letter is to certify that Irma Ancheta is allowed access to our patient records, the use of our cardiovascular center facility, and to inform you that we give her our total support (including study design) so she may complete her research plan.

Sincerely,

Alan B. Miller
Professor of Medicine

St. Mary's Specialty Center
94 Andrews Way, St. Mary's, Georgia 31558
Telephone: (912) 729-4821
Fax: (912) 729-7594

An Equal Opportunity Institution

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Informed Consent Form

IRB# <u>UFJ-2005-50/ USF 103600</u>

Informed Consent to Participate in Research

The University of Florida
Health Science Center
Jacksonville, Florida 32209

You are being asked to participate in a research study. This form provides you with information about the study. The Principal Investigator (Irma B. Ancheta) will describe this study to you and answer all of your questions. Before you decide whether or not to take part, read the information below and ask questions about anything you do not understand.

1. Name of the Participant

2. Title of Research Study

"The relationship between of b-type natriuretic peptide (BNP) levels and hospital length of stay and quality of life in congestive heart failure patients"

3. Principal Investigator(s), Address and Telephone Number(s)

Irma B. Ancheta RN, MSN
4120 Shoal Creek Lane East
Jacksonville, Fl. 32225
(904) 645-3862
(904) 629-7923

4. Source of Funding or Other Material Support

None

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5. What is the purpose of this research study?

The purpose of the study is to find out if physician's knowledge of your blood levels of the result of a particular blood test will affect the management of your illness, hospital length of stay and quality of life. This blood test measures the level of BNP, or B-type natriuretic peptide present in your blood. BNP is a substance secreted from lower chambers of the heart, in response to changes in pressure that occur when heart failure develops or worsens.

You are being asked if you are interested in taking part of this study because you have been diagnosed with congestive heart failure. Your doctors and researchers involved with heart failure patients around the country would like to learn more about this condition. Approximately 160 patients will participate at our site for this study.

6. What will be done if you take part in this research study?

• You will be asked to respond to two questionnaires that would take about 15 minutes of your time. The questionnaire will ask you how living with congestive heart failure has affected your life. You will be asked to respond to the same questionnaire in 90 days in the privacy of this clinic office.

• Approximately one cc (about ½ teaspoon) of your blood will be drawn from a vein to test for BNP levels in the clinic.

• You will be randomly (like a flip of a coin) put in a group who will have the BNP blood test disclosed to the physician or in the group whose BNP levels will not be disclosed to the physician.

• You will allow us to follow up and record any heart failure hospitalization in the next 90 days.

• Information from your clinic visit and medical record will be collected such as age, gender, ethnicity, education, marital status, insurance payers, the severity of your congestive heart failure, the date of any potential hospital admission, what the diagnosis was and the date of hospital discharge.

• You will be contacted by phone or during your normal clinic visits at monthly intervals for the next three months to find out how you are doing. During these follow-ups we will be inquiring about whether or not you have been in the hospital.

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7. What are the possible discomforts and risks?

Blood Sampling

The risks may include discomfort at the puncture site; possible bruising and swelling   around the site; and uncommonly, faintness; and rarely, an infection.

Potential risks may involve violation of confidentiality, embarrassment or discomfort that might arise if the data regarding your diagnosis, hospital length of stay and quality of life survey is unnecessary exposed. Your answers are confidential and we will take all necessary precautions to ensure your confidentiality.

8a. What are the possible benefits to you?

There are no direct benefits to you for taking part in this study, but the information gained from your participation may help other patients.

8b. What are the possible benefits to others?

As an outcome of this study, the possible benefits to others might include improving quality of life and reducing hospital length of stay for future congestive heart failure patients.

9. If you choose to take part in this research study, will it cost you anything?

The study will not cost you anything.

10. Will you receive compensation for taking part in this research study?

You will not receive compensation for taking part in this study.

11. What if you are injured because of the study?

If you experience an injury that is directly caused by this study, only professional care that you receive at the University of Florida Health Science Center will be provided without charge. You may call the Shands Cardiovascular Center at (904) 244-4198 or your principal investigator (Irma B. Ancheta) at (904) 645-3862. However, hospital expenses will have to be paid by you or your insurance provider. No other compensation is offered.

If you are harmed while taking part in the study: The state of Florida enjoys what is called "sovereign immunity." This means that you usually cannot sue the state of Florida. However, the state has waived sovereign immunity (agreed to be sued) in certain situations. One of those situations is if a state employee, such as your study doctor or other USF employee is negligent in doing his or her job in a way that harms you during the study. The money that you might recover from the state of Florida is limited in amount.
You can also call the University of South Florida Self Insurance Programs (SIP) at 1-813-974-8008 if you think:

- You were harmed because you took part in this study.

- Someone from the study did something wrong that caused you harm, or didn't do something they should have done.

- Ask the SIP to look into what happened.

12. What other options or treatments are available if you do not want to be in this study?

If you do not want to take part in this study, tell the principal Investigator (Irma B. Ancheta) you do not want to participate in the study.

13a. Can you withdraw from this research study?

You are free to withdraw your consent and to stop participating in this research study at any time. If you do withdraw your consent, there will be no penalty and you will not lose any benefits you are entitled to.

If you decide to withdraw your consent to participate in this research study for any reason, you should contact: Irma Ancheta at
(904) 645-3862. If you have any questions regarding your rights as a research subject, you may phone the University of Florida Institutional Review Board (IRB) office at (904) 244-3136 and the University of South Florida Institutional Review Board (IRB) office at (813) 974-5638.

13b. If you withdraw, can information about you still be used and/or collected?

If you withdraw, we would like to retain the surveys and questionnaires that you have responded during the initial interview. We would like your permission to continue to collect information from your physician or your medical records. Please initial:

Yes_____ If I choose to withdraw from the study you may continue to use my personal data that has been collected.

No_____If I choose to withdraw from the study, you may not continue to use my personal data that has been collected.

13c. Can the Principal Investigator withdraw you from this research study?

You may be withdrawn from the study for the following reasons:

[A] If knowledge of any unexpected or unexplained side effects that affect your safety becomes known;

[B] If on receiving new information about the treatment, your PI (Irma B. Ancheta) might consider it to be in your best interests to withdraw you from the study without your consent if they judge that it would be better for your health. An example of this is when the study shows that an increased number of congestive heart failure patients die as a result of failure to report BNP levels.

14. How will your privacy and the confidentiality of your research records be protected?

Authorized persons from the University of Florida and the University of South Florida, have the legal right to review your research records and will protect the confidentiality of those records to the extent permitted by law. Otherwise, your research records will not be released without your consent unless required by law or a court order. If the results of this research are published or presented at scientific meetings, your identity will not be disclosed.

15. If you agree to participate in this research study, what protected health information about you may be collected, used and disclosed to others?

Your diagnosis, number of days in hospital and results of your BNP levels may be collected, used and disclosed to others.

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16. For what study-related purposes will your protected health information be collected, used and disclosed to others?

Your protected health information may be collected, used and disclosed to others to determine eligibility for the study. Other protected health information collected, used and disclosed to others would include study information such as your diagnosis and number of days in hospital.

17. Who will be authorized to collect, use and disclose to others your protected health information?

Your protected health information may be collected, used, and disclosed to others by
the study principal investigator (Irma B. Ancheta, RN) and other employees at the University of South Florida
-        other professionals at the University of Florida or Shands Hospital that provide study-related treatment or procedures
-        the University of Florida and University of South Florida Institutional Review Boards.

18. Once collected or used, who may your protected health information be disclosed to?

Your protected health information may be given to:
The study investigator, co-investigators, supervisors and the University of Florida and University of South Florida Institutional Review Boards (IRB).

19. If you agree to participate in this research, how long will your protected health information be collected, used and disclosed?

Your information will be maintained in a password protected database for 5 years.

20. Why are you being asked to authorize the collection, use and disclosure to others of your protected health information?

Under a new Federal Law, researchers cannot collect, use or disclose any of your protected health information for research unless you allow them to by signing this consent and authorization form.

IRB# UFJ-2005-50/ USF 103600

21. Are you required to sign this consent and authorization and allow the researchers to collect, use and disclose (give) to others of your protected health information?

No, and your refusal to sign will not affect your treatment, enrollment, or eligibility for any benefits outside this research study. However, you cannot participate in this research unless you allow the collection, use and disclosure of your protected health information by signing this consent/authorization.

22. Can you review or copy your protected health information collected, used or disclosed under this authorization?

You have the right to review and copy your protected health information. However, you will not be allowed to do so until after the study is finished.

23. Is there a risk that your protected health information could be given to others beyond your authorization?

Yes. There is a risk that information received by authorized persons could be given to others beyond your authorization and not covered by the law. To ensure confidentiality all data will be recorded in a secure, password-protected data file, the PI (Irma B. Ancheta) and the Institutional Review Boards (IRB) of the University of Florida and University of South Florida will have access to the database.

24. Can you revoke (cancel) your authorization for collection, use and disclosure of your protected health information?

Yes. You can revoke your authorization at any time before, during or after your participation in the research. If you revoke, no new information will be collected about you. However, information that was already collected may be still be used and disclosed to others if the researchers have relied on it to complete and protect the validity of the research. You can revoke this authorization by giving a written request with your signature on it to the Principal Investigator.

25. How will the researcher(s) benefit from your being in this study?

The PI (Irma B. Ancheta) will learn more about how to care for congestive heart failure patients and further the science.

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26. Signatures

As a representative of this study, I, Irma B. Ancheta, have explained to the participant the purpose, the procedures, the possible benefits, and the risks of this research study; the alternatives to being in the study; and how privacy will be protected:

_____   _____
Signature of Person Obtaining Consent   Date

You have been informed about this study's purpose, procedures, possible benefits, and risks; the alternatives to being in the study; and how your privacy will be protected. You will receive a copy of this form. You have been given the opportunity to ask questions before you sign, and you have been told that you can ask other questions at any time.

You voluntarily agree to participate in this study. By signing this form, you are not waiving any of your legal rights.

_____   _____
Signature of Person Consenting   Date

Appendix F

Frequently Asks Questions

1. What is the purpose of the study?
The purpose of the study is to find out if this blood test can help improve your care and keep your heart failure symptoms under control.

2. What does the study involve?
The study will involve having to have a small amount of blood drawn, about 1 ml, from a vein to test your blood levels for heart failure. This will only be done once during your clinic visit. You will also be asked to answer a survey of 21 questions pertaining to the physical, psychological and emotional aspects of having to live with congestive heart failure. This survey will be done once during the clinic visit and again in 90 days in the clinic or via telephone. You will also be asked to report to the Principal Investigator (PI) any hospital admissions within the next 90 days.

3. What happens if I do not want to participate in this study?
The study is entirely voluntary. Non-participation will not in any way hinder your standard of care.

4. Can I refrain from the study anytime?
You may elect to refrain from the study at any time. You may withdraw from the study at any time by telephoning or writing the Principal Investigator.

5. Will it cost me to participate in the study?
You will not have any additional costs because of your involvement in this study.

6. How long is the study?
The study will run for 90 days from time of clinic visit.

7. Will I have the chance to know the results of the study?
Once study is completed the results of the study will be available to you if you so desire.

About the Author

Irma B. Ancheta, Ph.D., R.N., an assistant professor of nursing at the University of North Florida. She received her Bachelor's Degree in Nursing from Cebu Velez College of Nursing in Cebu City, Philippines. She went on to complete a Masters Degree in Nursing at the University of Phoenix at Jacksonville Florida. Her research interest focuses on finding clinical strategies that may help improve quality of life among congestive heart failure patients. Dr. Ancheta resides in Jacksonville, Florida where she is actively involved in her community.