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Correlates of Quality of Life in Rural Heart Failure Patients

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Abstract

Background—There is abundant research indicating poor physical, psychological and social functioning of patients with chronic heart failure (HF), a reality that can lead to poor health related quality of life (HRQoL). Little is known about the experience of rural HF patients.

Methods and Results—This study was part of a randomized clinical trial titled Rural Education to Improve Outcomes in Heart Failure (REMOTE-HF) designed to test an education and counseling intervention to improve self-care in patients with HF. We evaluated 612 rural patients. Multiple validated questionnaires were administered to assess patient perceptions of health and health literacy. Baseline factors were collected and compared to baseline QoL measures only. Patients' HRQoL was assessed using the Minnesota Living with Heart Failure (MLWHF) scale. The data were analyzed using a general linear model to test the association of various patient characteristics with quality of life in rural patients with HF. Patients were 65.8 (+12.9) years of age. The majority were male (58.7%), married (56.4%) and had completed a high school education (80.9%). Factors associated with reduced quality of life amongst this population include: geographic location, younger age, male gender, higher NYHA class, worse HF knowledge, poorer perceived control and symptoms of depression or anxiety. The data provided no evidence of an association between left ventricular ejection fraction and quality of life.

Conclusions—This study of rural HF patients confirms previously identified factors associated with perceptions of quality of life. However, further study is warranted with an urban control group.

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Disclosures
None

Keywords

heart failure; quality of life; rural

Heart failure (HF), is a common and significant health problem. It is estimated that 5.8 million Americans are living with HF. Roughly 550,000 new cases are diagnosed every year.[1] The number of new cases is predicted to reach 1.5 million annually by 2040.[2] HF accounts for 15 million office visits and 6.5 million hospital days annually[1]. Over 1 million hospitalized patients have HF listed as their primary diagnosis and 3 million as their secondary diagnosis.[3] Currently, and over the last decade, almost half of the patients discharged with a diagnosis of HF are readmitted within six months primarily due to exacerbation of symptoms.[4,5]

Rural populations have an increased prevalence of cardiovascular disease compared to urban, and rural patients are more likely to be readmitted with HF exacerbations.[6,7] Rural patients are also more likely to be uninsured, poor, and chronically ill.[8,9] Disparities in morbidity and mortality between metropolitan and rural cardiovascular patients have increased in recent years.[9] One proposed explanation is that rural populations have certain behaviors, attitudes, and access challenges that may contribute to their heightened risk of coronary heart disease, myocardial infarction and HF. These include poor adoption of lifestyle habits associated with decreasing heart disease, such as, smoking cessation, low-fat diets, exercise, and increased perception of heart disease risk, especially among older rural women.[6,10] Additional factors include limited access to screening services and preventative care, reduced availability of technology and specialists to diagnose and treat heart disease, long travel distances to urban medical centers and limited access to cardiac rehabilitation services.[11–13]

Heart failure is known to negatively affect health-related quality of life (HRQoL).[14] HRQoL, as used in this paper is a subjective multi-dimensional concept that includes domains related to biological, physical, mental, emotional and social functioning.[14] In contrast to physician assessment of symptoms and function, HRQoL is based on the patient's own assessment. Spertus[15] has used Health Status to describe a similar concept. In fact, HRQoL is more severely impaired in HF than in several other common chronic conditions (ie, hypertension, diabetes, arthritis, chronic lung disease and angina).[16,17] Because HRQoL is recognized as a significant predictor of HF outcomes, more research is needed to evaluate its role in this clinical setting.

Researchers[18–25] have identified several variables associated with quality of life in patients with HF. Gott et al[18], studied 542 British patients older than 60 years old and identified female sex, evidence of depression, higher NYHA class, more than two co-morbidities and lower socio-economic status to be associated with reduced quality of life. De Jong et al[21] identified NYHA class, anxiety and depression to be predictors of HRQoL. However, in their study, gender, living alone, ejection fraction (EF) or comorbid conditions were not associated with HRQoL. Others[19,20,22–25] have also studied the effect of etiology of HF[20,22,24], duration of HF[20,23], education[22,23], smoking status[22], race[19,23], income[23], anemia[20],health literacy[25], heart failure knowledge[25], literacy[25], and self-care behaviors[25] on HRQoL in HF populations. The purpose of this study was to determine the factors associated with worse HRQoL in rural patients with HF.

Methods

Study Design and Sample

This study was part of a randomized clinical trial titled Rural Education to Improve Outcomes in Heart Failure (REMOTE-HF) that was designed to test an education and counseling intervention to improve self-care in patients with HF. The trial was funded by the National Heart, Lung and Blood Institute (NHLBI), the National Institute of Nursing Research (NINR):5R01HL83176-5 and the National Center for Advancing Translational Sciences (NCATS), National Institutes of Health (NIH), through grant #UL1 TR000002. The trial is registered at www.ClincalTrials.gov-NCT 00415545. Institutional Review Board approval was obtained and each of the patients gave informed written consent to participate. A total of 612 rural patients with HF were recruited from northern California, Kentucky, and Nevada. Patients were selected from either a hospital setting or primary care physician's office. Criteria for recruitment included: age ≥18 years old with stable HF, hospitalized for HF within the past 6 months, English fluency, and living independently with primary decision-making. Patients were excluded if they had a complicating serious comorbidity (disease or illness predicted to cause death within the next 12 months), a psychiatric illness or untreated malignancy, a neurologic disorder that impaired cognition, or concurrent participation in a HF disease management program. Patients who met the inclusion criteria were screened using the Mini-Cog, which is a global measure of mental status.[26] Patients with a word recall score of zero or a word recall score of < 2 with an abnormal clock drawing were excluded. Baseline factors were collected and compared to baseline QoL measures only.

Procedures

The research nurses at each site completed appropriate training related to the study protocol. Data from each site were obtained through self-administered forms either in the patient's home or during a clinic visit. Medical histories were collected by chart review.

The quality of life outcome was measured by the Minnesota Living With Heart Failure Questionnaire (MLWHF)[27] which is a widely used self-assessment questionnaire that focuses on physical and emotional impairments that patients attribute to HF and are amenable to therapy. The framework of our predictor variables included five broad categories: demographic (age, race, sex, marital status, educational level, income, recruitment site and number living at home as a measure of social support), bio-physiological (body mass index, brain nateuretic peptide (BNP) levels, left ventricular ejection fraction, etiology and duration of heart failure), behavioral (smoking, employment, self-care), psychological (depression, anxiety and perceived control) and health related knowledge (health literacy, HF knowledge).

Heart failure disease knowledge was evaluated by a heart failure knowledge (HFK) questionnaire developed by the investigators and tested during 2 pilot studies. The questionnaire contains 20 multiple choice and yes/no or true/false questions. The questions on HF disease knowledge were adapted for the HF population from the Rapid Early Action for Coronary Treatment (REACT) study in the acute myocardial infarction (AMI) population.[28] Content validity of the modified instrument was established through review by five physicians and nurses with expertise in HF care. The instrument has acceptable internal consistency of 0.83 established by Cronbach's alpha. Higher scores imply better knowledge, with a maximum score of 20 or 100%. Patients without overt HF had significantly lower scores (less impairment) than patients with overt HF.

Comorbidities were assessed using the Charlson Comorbidity Index (CCI)[29] which classifies comorbid conditions that might change the risk of mortality at one year. Self-care behaviors were evaluated using the European Heart Failure Self-Care Behavior Scale (EHFScBS)[30] which is a nine-item scale that measures HF-related self-care behaviors associated with fluid management. Perceived control was measured using the Control Attitude Scale-revised (CAS-R) which is an 8-item instrument to measure the level of perception of control felt by individuals with cardiac disease.[31] Anxiety and depression were measured using the Brief Symptom Inventory (BSI)[32] and the Patient Health Questionnaire (PHQ-9)[33], respectively. Health literacy was measured using the Shortened Test of Functional Health Literacy in Adults (S-TOFHLA)[34] which is a 36 item, 7 minute test of reading comprehension. It measures the ability to read and understand actual health-related passages.

Data on left ventricular function were obtained from echocardiograms in the patient's medical chart or by performing an echocardiogram to evaluate ejection fraction. (EF < 40% reduced LV function; EF >= 40% preserved LV function). BNP levels were measured using the Triage™ B-Type Natriuretic Peptide test (Biosite Diagnostics Inc., San Diego, CA, USA).

Statistical Methods

All statistical analyses were performed using SAS software version 9.3. A multiple linear regression was fit using the SAS® software procedure GLM version 9.3 (SAS Institute, Cary, NC). Descriptive statistics were used to characterize the sample. Multicollinearity of the continuous covariates was assessed using Pearson's or Spearman's correlation as well as variance inflation factors. Any variable with a correlation coefficient larger than 0.7 was considered problematic and the variable with the lowest correlation with the dependent variable was removed from model selection. A variable with a variance inflation factor greater than 10 was considered problematic and was removed from model selection. Model assumptions were verified using graphical methods.

Results

Table 1 summarizes participant characteristics, which were used as independent variables. The majority of study participants were Caucasian, 89.8%, and on average 65.8 ± 12.9 years old. The majority (58.7%) were male, 80.9% had completed a high school education or beyond, 56.4% were married, and 23.1% reported living alone. Approximately 73.8%, of participants reported an annual household income of less than $40,000 and 52.6% were retired. Thirteen percent were current smokers, almost three-quarters of the participants had a body mass index (BMI) greater than 25 and the majority of patients reported two or more co-morbidities in addition to their HF. Additionally, 35.2% were classified as being in NYHA class III or IV. 80% of the study population was on Beta-blockers and about 75% were on ACE Inhibitor or Angiotensin Receptor Blockers.

The graphical exploratory analysis confirmed that the quality of life outcome variable was approximately normal. The model residuals appeared to fit the normal model well, with a smooth, symmetrical, mound shaped histogram and well-aligned normal probability plot. The mean, median, standard deviation, lower quartile, upper quartile, minimum and maximum of the quantitative variables are shown in Table 2. There was no evidence of multicollinearity among the continuous independent variables (all correlations less than 0.7), though depression and anxiety were correlated with R = 0.67 ($p<0.0001$). No variable had a variance inflation factor greater than 10. The largest variance inflation factor was 1.97 for anxiety.

Our data provided strong evidence that HRQoL is associated with age, sex, NYHA class, depression, anxiety, perceived control, heart failure knowledge and geographic location. On the other hand, we did not find any evidence that BNP, reduced EF, income, number of comorbid conditions, anemia, marital status, education, employment, the number of individuals in the household, smoking and race/ethnicity were associated with HRQoL. There was weak evidence of an association with self-care (p-value =0.01).

The effect (estimate) of each variable as noted in Table 3 is the observed effect after controlling for all other variables in the model. In our model, lower QOL scores correlate with a better quality of life. Being a resident of Nevada was predictive of better QOL compared to California or Kentucky. Nevada had the lowest average QOL score (indicating higher QOL) with a score 5.17 points lower than California. Kentucky had an average score 1.2 points higher than California. Older subjects had better average quality of life scores, with the average QOL score decreasing by 0.3 points for every year increase in the age of the subject. The average QOL score for females was 7.2 points lower than the average score for males. Subjects with depression had poorer quality of life. For every unit increase in the Depression (PHQ-9) score, the average QOL score increased by 2.2 points. Similarly, for each unit increase in the anxiety index (BSI) score, the average quality of life score increased by 6.14. All p-values, parameter estimates, and their 95% confidence intervals are shown in Table 3.

Discussion

Improving quality of life for rural adults with HF is a key challenge for clinicians involved in their care. Most HF research has under represented older people and people living in rural areas. Some common challenges for recruitment of older subjects include presence of co-morbidities, physical and cognitive decline, influence of family members, lower health awareness, fear of loss of health coverage benefits, higher rates of refusal to participate and attrition[35]. In addition, a significant barrier to rural representation includes lack of resources and infrastructure to conduct research. Moreover, barriers to representation of minority populations residing in rural areas include mistrust of researchers and their perception of a lack of relevance to the research[36]. Hence, more information about these patient groups is needed to improve health outcomes. The current study provides new data about factors predictive of the quality of life of people with HF, recruited from rural settings.

Reduced quality of life amongst this population of HF patients was seen in those who were: younger, male, had a high NYHA class, poorer knowledge about HF, lower perceived control or symptoms of depression or anxiety. Interestingly, patients residing in Nevada indicated a better quality of life as compared with the other two sites included in the study, northern California and Kentucky. Reduced ejection fraction was not associated with a difference in quality of life. Moreover, measures of self-care behavior, health literacy, and barriers to seeking care had no influence on health-related quality of life. The latter finding challenges a well established notion that rural populations' barriers to accessing quality healthcare results in poor outcomes and worse health related quality of life scores[37]. This sets up an interesting scenario that expanding health coverage, may not close the gap on health-related quality of life between rural and urban populations as the goals of such expansion would serve to bring about increased education, health literacy and improve self care behavior[38]. These programs should also serve to help break down barriers to access of quality healthcare but may not improve HRQoL. Future studies will need to be done in that regard.

Our study points to older age being associated with a better quality of life, which is also supported by previous research[18,19,22,]. This finding supports the conclusion that age related quality of life changes, including general deterioration of health, likely compound a younger patient's experience of quality of life resulting from HF and other co-morbid conditions. We selected a disease specific measure of QOL and did not use a general measure of QOL instrument to avoid instrument burden, therefore we do not know if patients' responses on a general quality of life questionnaire would have been different than those we documented.

Being male was also associated with lower quality of life. Although past research has not shown a definitive relationship between gender and quality of life; some studies have shown lower quality of life for women[18,19], whereas others have shown the opposite[23]. These past research studies typically included women and older people, a group that has been under represented or excluded from most trials. The findings from our study support the conclusion that HF impacts the quality of life of rural men more than rural women and that this relationship is not influenced by marital status. This gender difference may be attributed to competing demands between family responsibilities and gender roles and taking care of one's health. This finding may relate to limitations posed by HF on typical activities, both related to the occupations and leisure of rural men and its impact on their perception of quality of life may be greater.

Worsening NYHA functional class was associated with reduced quality of life. Patients with moderate-severe HF have a statistically significant impairment of their quality of life.[18,20,21,22] This association reflects a direct relationship between increasing HF symptoms and decreased functional capacity with a patient's self-assessment of their quality of life. Maximizing treatments to improve NYHA class would appear to improve perceptions of quality of life for patients with HF.

Psychological variables including depression, anxiety and perceived control were also noted to be associated with poorer quality of life in rural populations. Other studies have also noted similar association.[21,23,24] Since perceived control is the patient's perception about the extent to which HF symptoms can be managed, patients with a higher sense of perceived control may be more engaged in managing their symptoms[24]. Therefore interventions designed to improve these psychological variables may result in improved HRQoL.

The relationship between literacy, HF knowledge and HRQoL has also been studied[25] and low literacy was also associated with poorer HF knowledge and HRQoL. It has been suggested that low literacy may limit information retention and thus poorer HF knowledge[39]. Our study, however, did not find a relationship between educational level and HRQoL but did note an association between HF knowledge and HRQoL. It is plausible that interventions to improve HF knowledge and hence HRQoL in patients with lower literacy levels would be beneficial. However, given the complex interaction between literacy, HF knowledge and self-care behaviors, further studies are warranted.

Location of residence was also noted to effect HRQoL. As noted above, patients residing in Nevada reported an overall better quality of life compared to patients in northern California and Kentucky. These results were unexpected as demographic and clinical characteristics of patients were evenly distributed and matched across the three different sites. To understand this difference we tested variables that were not included in the original model: type of medications prescribed, insurance type (Medicare vs. private) and health care provider (primary care physician vs. specialist). Further Chi-square statistical analysis showed that the following medication types prescribed were statistically significant (p=0.02): diuretics, beta blockers, angiotensin converting enzyme (ACE) inhibitors, and anti-coagulants, and could possibly help explain the quality of life difference by site. A lower percentage of Nevada patients were on diuretics and a higher percentage were on anti-coagulants. Perhaps the lower penetration of diuretics, and the constant concern about the physical results of taking diuretics, led to a perceived improvement in HRQoL. Provider type was not significant (25% of patients were under the care of a primary care physician and 75% were cared for by a cardiologist). Type of insurance (Veterans Affairs (VA) Medicare, Medicare supplement, Medicaid, private insurance, Health Maintenance Organization (HMO), or other insurance) was not statistically significant among the three sites (p=.20). We added these variables to our selected model to determine if “site” was serving as a mediator for other variables not included in our analysis. With site excluded from our model, diuretic use and Medicare were significant. When site was added back into the model, diuretic use dropped out with a p-value just over 0.1, implying some relationship between diuretic use and site. We conclude that it is not clear which “mediating variable” may be causing the importance of “site,” as “site” remains highly significant even with the inclusion of significant possible mediators.

Our study provides new information about quality of life for rural patients with HF, and certain study limitations must be acknowledged. First, there was no urban control group and the study only targeted a rural population. Therefore it is not possible to conclude that the variables identified in our study only apply to rural patents. Second, the majority of subjects were Caucasian. Since English language requirements exist in the study, some non English speaking populations are already excluded. Additionally, according the 2011 U.S. Census Bureau demographic statistics, Caucasians make up 88.9%, 77.7%, and 74.0% of Kentucky, Nevada, and California respectively[40]. Third, recruitment from three rural sites may not be reflective of all rural populations in the United States. Further research needs to be done to determine why patients in Nevada reported a better quality of life. Anecdotal reports from the research staff suggested higher rates of pet ownership by Nevada patients than in the other two states. As previous studies have confirmed, pet ownership might be an important source of social support that enhances well-being among elderly people[41]. Finally, there could be issues related to patient fatigue given the large battery of tests.

Further studies, linking correlates of quality of life as determined by this study with outcome measures such as emergency department visits, hospitalization and death could help clinicians identify HF patients who might benefit from more intensive follow-up.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Demographic and Clinical Characteristics of Study Participants, N= 612

Variable	**N**	**Mean ± SD or N (%)**
Geographic Location California Kentucky Nevada	187 225 200	30.6% 36.7% 32.7%
Age, years	612	65.8 ± 12.9
Gender Female Male	612	41.3% 58.7%
Race White Black Other	605	89.8% 5.5% 4.8%
Education Level < High School Completed High School > High School	538	19.1% 47.9% 33.0%
Annual Household Income < $20,000 $20,000 – $40,000 $40,000 – $75,000 > $75,000	538	40.3% 33.5% 17.7% 8.6%
Employment Status Employed for pay Disabled Retired Other	612	14.7% 26.6% 52.6% 6.1%
Married	612	56.4%
Current Smoker	612	13.2%
BMI > 25	609	74.6%
Cause of Heart Failure Ischemic Hypertension Cardiomyopathic Idiopathic Viral Other	610	47.5% 24.3% 18.2% 4.1% 0.5% 5.4%
Ejection Fraction < 40% (REF) > 40% (PEF)	602	50.5% 49.5%
NYHA Class I II III IV	611	10.5% 54.3% 31.1% 4.1%
BNP	581	411.1
Diuretic use	611	84.3%
Beta Blocker use	611	80.0%
ACE Inhibitor use	608	56.1%
Angiotensin Receptor Blocker use	611	19.0%
Heart Failure Knowledge Total Score	612	13.9 ± 2.6
PHQ – 9 Depression Score	612	7.4 ± 6.406

Variable	**N**	**Mean ± SD or N (%)**
Self-care Total Score	612	20.1 ± 7.0
Anxiety Score	612	0.8 ± 0.9
Perceived Control	612	29.4 ± 5.0
Quality of Life Score Total Physical	612	46.7 ± 27.8 3.4 ± 1.8

Table 2

Clinical Characteristics Detail data

Variable	N	Mean	Std Dev	Median	Min	Lower Quartile	Upper Quartile	Max
MLWHF Total Score	610	46.7	27.8	48.0	0	23.0	70.0	104.0
BNP	610	411.1	964.1	185	1.0	72	462	14598
HF Knowledge Pct Score	612	69.5	13.0	70.0	25.0	60.0	80.0	100.0
Self Care Total Score	612	20.1	7.0	19.0	9.0	15.0	25.0	45.0
Anxiety Score (BSI)	612	0.8	0.9	0.5	0	0	1.3	4.0
Number Living at Home	612	1.2	1.2	1.0	0	1.0	1.5	10.0
Health Literacy (S-TOFHLA)	612	25.5	8.8	28.0	1.0	19.0	34.0	36.0
Perceived Control (CAS-R)	585	29.4	5.0	30.0	13.0	26.0	32.0	40.0
Comorbidity Index (CCI)	612	3.4	1.8	3.0	1.0	2.0	4.0	11.0
Depression Score (PHQ-9)	612	7.4	6.4	6.0	0	2.0	11.0	27.0

Table 3

Correlates of Quality of Life in Rural Patients with Heart Failure:

Parameter	**Estimate**	**Lower bound 95% CI**	**Upper bound 95% CI**	**p-value F test**
Geographic Location (California)	Reference			0.0005
Geographic Location (Kentucky)	1.19	−3.37	5.74	
Geographic Location (Nevada)	−5.17	−9.67	−0.67	
Age	−0.30	−0.49	−0.10	0.0026
Female	−7.20	−11.09	−3.31	<0.0001
Male	Reference			
NYHA Class I	−22.91	−33.05	−12.76	<0.0001
NYHA Class II	−20.38	−29.24	−11.51	
NYHA Class III	−12.80	−21.71	−3.90	
NYHA Class IV	Reference			
Heart Failure Knowledge	0.199	0.061	0.34	0.0048
Perceived Control	−0.39	−0.76	−0.027	0.036
Anxiety Score	6.14	3.75	8.58	<.0001
Depression Score	2.24	1.87	2.61	<.0001