Correlates of Quality of Life in Rural Patients With Heart Failure

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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 (QoL). Little is known about the experience of rural patients with HF.

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 with baseline QoL measures only. Patients’ health-related QoL was assessed using the Minnesota Living with Heart Failure scale. The data were analyzed using a general linear model to test the association of various patient characteristics with QoL in rural patients with HF. Patients were 65.8 (+12.9) years of age. The majority were men (58.7%), married (56.4%), and had completed a high-school education (80.9%). Factors associated with reduced QoL among this population include geographic location, younger age, male sex, higher New York Heart Association 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 QoL.

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

Clinical Trial Registration—URL: http://www.clinicaltrials.gov. Unique identifier: NCT00415545.

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Key Words: heart failure ■ quality of life ■ rural population

Heart failure (HF) is a common and significant health problem. It is estimated that 5.8 million Americans are living with HF. Approximately 550,000 new cases are diagnosed every year. The number of new cases is predicted to reach 1.5 million annually by 2040. HF accounts for 15 million office visits and 6.5 million hospital days annually. More than 1 million hospitalized patients have HF listed as their primary diagnosis and 3 million as their secondary diagnosis. Currently, and during the past decade, almost half of the patients discharged with a diagnosis of HF are readmitted within 6 months primarily because of exacerbation of symptoms.6,5 Rural populations have an increased prevalence of cardiovascular disease compared with 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. 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

HF is known to negatively affect health-related quality of life (HRQoL).14 HRQoL, as used in this article, is a subjective multidimensional 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. Spertus15 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 mellitus, 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. Researchers18–25 have identified several variables associated with quality of life (QoL) in patients with HF. Gott et al18 studied 542 British patients >60 years old and identified female sex, evidence of depression, higher New York Heart Association (NYHA) class, >2 comorbidities, and lower socioeconomic status to be associated with reduced QoL. De Jong et al21 identified NYHA class, anxiety, and depression to be predictors of HRQoL. However, in their study, sex, living alone, ejection fraction (EF), or comorbid conditions were not associated with HRQoL. Others19,20,22,23 have also studied the effect of pathogenesis 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 HF knowledge,25 literacy,27 and self-care behaviors25 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, the National Institute of Nursing Research: R01HL83176-5, and the National Center for Advancing Translational Sciences, National Institutes of Health, through grant No. UL1 TR000002. The trial is registered at www.ClinicalTrials.gov NCT00415545. 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 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 neurologi-
cal 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 with 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 QoL outcome was measured by the Minnesota Living With Heart Failure Questionnaire,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 5 broad categories: demographic (age, race, sex, marital status, educational level, income, recruitment site, and number living at home as a measure of social support), biophysiological (body mass index, brain natriuretic peptide levels, left ventricular EF, pathogenesis, and duration of HF), behavioral (smoking, employment, and self-care), psychological (depression, anxiety, and perceived control), and health-related knowledge (health literacy, HF knowledge).

HF disease knowledge was evaluated by a HF knowledge 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 population.28 Content validity of the modified instrument was established through review by 5 physicians and nurses with expertise in HF care. The instrument has acceptable internal consistency of 0.83 established by Cronbach α. 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,29 which classifies comorbid conditions that might change the risk of mortality at 1 year. Self-care behaviors were evaluated using the European Heart Failure Self-Care Behavior Scale,30 which is a 9-item scale that measures HF-related self-care behaviors associated with fluid management. Perceived control was measured using the Control Attitude Scale-revised, 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 Inventory32 and the Patient Health Questionnaire,33 respectively. Health literacy was measured using the Shortened Test of Functional Health Literacy in Adults,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 EF (EF <40% reduced left ventricular function; EF ≥40% preserved left ventricular function). Brain natriuretic peptide levels were measured using the Triage B-Type Natriuretic Peptide test (Biosite Diagnostics, Inc, San Diego, CA).

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 or Spearman correlation as well as variance inflation factors. Any variable with a correlation coefficient >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 >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 white, 89.8%, and on average 65.8±12.9 years old. The majority (58.7%) were men, 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 <$40000 and 52.6% were retired. Thirteen percent were current smokers, almost
three quarters of the participants had a body mass index >25 and the majority of patients reported ≥2 comorbidities in addition to their HF. In addition, 35.2% were classified as being in NYHA class III or IV. A total of 80% of the study population was on β-blockers and ≈75% were on angiotensin-converting enzyme inhibitor or angiotensin receptor blockers.

The graphical exploratory analysis confirmed that the QoL outcome variable was approximately normal. The model residuals seemed to fit the normal model well, with a smooth, symmetrical, mound-shaped histogram, and well-aligned normal probability plot. The mean, median, SD, 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 <0.7), although depression and anxiety were correlated with $R=0.67$ ($P<0.0001$). No variable had a variance inflation factor >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, HF knowledge, and geographic location. However, we did not find any evidence that brain natriuretic peptide, 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 ($P=0.01$).

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 QoL. Being a resident of Nevada was predictive of better QoL compared with 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 QoL 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 women was 7.2 points lower than the average score for men. Subjects with depression had poorer QoL. For every unit increase in the depression (Patient Health Questionnaire-9) score, the average QoL score increased by
2.2 points. Similarly, for each unit increase in the anxiety index (Brief Symptom Inventory) score, the average QoL score increased by 6.14. All P values, parameter estimates, and their 95% confidence intervals are shown in Table 3.

**Discussion**

Improving QoL for rural adults with HF is a key challenge for clinicians involved in their care. Most HF research has underrepresented older people and people living in rural areas. Some common challenges for recruitment of older subjects include presence of comorbidities, physical and cognitive decline, influence of family members, lower health awareness, fear of loss of health-care benefits, higher rates of refusal to participate, and attrition. 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. Hence, more information about these patient groups is needed to improve health outcomes. The current study provides new data about factors predictive of the QoL of people with HF, recruited from rural settings.

Reduced QoL among this population of patients with HF was seen in those who were younger, men, 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 QoL as compared with the other 2 sites included in the study, Northern California and Kentucky. Reduced EF was not associated with a difference in QoL. Moreover, measures of self-care behavior, health literacy, and barriers to seeking care had no influence on health-related QoL. The latter finding challenges a well-established notion that rural populations’ barriers to accessing quality healthcare results in poor outcomes and worse health-related QoL scores. This sets up an interesting scenario that expanding health coverage may not close the gap on health-related QoL 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. 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 QoL, which is also supported by previous research. These past research has not shown a definitive relationship between sex and QoL, some studies have shown lower QoL for women, whereas others have shown the opposite. These past research studies typically included women and older people, a group that has been underrepresented or excluded from most trials. The findings from our study support the conclusion that HF affects the QoL of rural men more than rural women and that this relationship is not influenced by marital status. This sex difference may be attributed to competing demands between family responsibilities and sex 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 QoL may be greater.

Worsening NYHA functional class was associated with reduced QoL. Patients with moderate to severe HF have a statistically

### Table 2. Clinical Characteristics Detail Data

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>Mean</th>
<th>SD</th>
<th>Median</th>
<th>Min</th>
<th>25th</th>
<th>75th</th>
<th>Max</th>
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<td>0</td>
<td>23.0</td>
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<td>411.1</td>
<td>964.1</td>
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<td>72</td>
<td>462</td>
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<td>69.5</td>
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<td>70.0</td>
<td>25.0</td>
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<td>100.0</td>
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<td>19.0</td>
<td>9.0</td>
<td>15.0</td>
<td>25.0</td>
<td>45.0</td>
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<td>Self-care total score</td>
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<td>0.9</td>
<td>0.5</td>
<td>0</td>
<td>1.3</td>
<td>4.0</td>
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<tr>
<td>Anxiety score (BSI)</td>
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<td>1.2</td>
<td>1.2</td>
<td>1.0</td>
<td>0</td>
<td>1.5</td>
<td>10.0</td>
<td>6.0</td>
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<td>Number living at home</td>
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<td>25.5</td>
<td>8.8</td>
<td>28.0</td>
<td>1.0</td>
<td>19.0</td>
<td>34.0</td>
<td>36.0</td>
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<tr>
<td>Health literacy (S-TOFHLA)</td>
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<td>29.4</td>
<td>5.0</td>
<td>30.0</td>
<td>13.0</td>
<td>26.0</td>
<td>32.0</td>
<td>40.0</td>
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<tr>
<td>Perceived control (CAS-R)</td>
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<td>1.8</td>
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<td>1.0</td>
<td>4.0</td>
<td>11.0</td>
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<tr>
<td>Comorbidity index (CCI)</td>
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<td>7.4</td>
<td>6.4</td>
<td>6.0</td>
<td>2.0</td>
<td>11.0</td>
<td>27.0</td>
<td></td>
</tr>
</tbody>
</table>

### Table 3. Correlates of Quality of Life in Rural Patients With Heart Failure

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>Lower Bound, 95% CI</th>
<th>Upper Bound, 95% CI</th>
<th>P Value, F Test</th>
</tr>
</thead>
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<td>Geographic location (California)</td>
<td>Reference</td>
<td>...</td>
<td>...</td>
<td>0.0005</td>
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<tr>
<td>Geographic location (Kentucky)</td>
<td>1.19</td>
<td>-3.37</td>
<td>5.74</td>
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<tr>
<td>Geographic Location (Nevada)</td>
<td>-5.17</td>
<td>-9.67</td>
<td>-0.67</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-0.30</td>
<td>-0.49</td>
<td>-0.10</td>
<td>0.0026</td>
</tr>
<tr>
<td>Women</td>
<td>-7.20</td>
<td>-11.09</td>
<td>-3.31</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Men</td>
<td>Reference</td>
<td>...</td>
<td>...</td>
<td></td>
</tr>
<tr>
<td>NYHA class I</td>
<td>-22.91</td>
<td>-33.05</td>
<td>-12.76</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>NYHA class II</td>
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<td>-29.24</td>
<td>-11.51</td>
<td></td>
</tr>
<tr>
<td>NYHA class III</td>
<td>-12.80</td>
<td>-21.71</td>
<td>-3.90</td>
<td></td>
</tr>
<tr>
<td>NYHA class IV</td>
<td>Reference</td>
<td>...</td>
<td>...</td>
<td></td>
</tr>
<tr>
<td>Heart failure knowledge</td>
<td>0.199</td>
<td>0.061</td>
<td>0.34</td>
<td>0.0048</td>
</tr>
<tr>
<td>Perceived control</td>
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<td>-0.76</td>
<td>-0.027</td>
<td>0.036</td>
</tr>
<tr>
<td>Anxiety score</td>
<td>6.14</td>
<td>3.75</td>
<td>8.58</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Depression score</td>
<td>2.24</td>
<td>1.87</td>
<td>2.61</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

BNP indicates brain natriuretic peptide; BSI, Brief Symptom Inventory; CAS-R, Control Attitude Scale-revised; CCI, Charlton comorbidity index; HF, heart failure; MLWHF, Minnesota Living With Heart Failure Questionnaire; Pct, percentage; PHQ, Patient Health Questionnaire; and S-TOFHLA, Shortened Test of Functional Health Literacy in Adults.
significant impairment of their QoL. This association reflects a direct relationship between increasing HF symptoms and decreased functional capacity with a patient’s self-assessment of their QoL. Maximizing treatments to improve NYHA class would seem to improve perceptions of QoL for patients with HF.

Psychological variables including depression, anxiety, and perceived control were also noted to be associated with poorer QoL in rural populations. Other studies have also noted similar association. Because 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. 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, 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. 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 QoL compared with patients in Northern California and Kentucky. These results were unexpected as demographic and clinical characteristics of patients were evenly distributed and matched across the 3 different sites. To understand this difference, we tested variables that were not included in the original model: type of medications prescribed, insurance type (Medicare versus private), and healthcare provider (primary care physician versus specialist). Further χ² statistical analysis showed that the following medication types prescribed were statistically significant (P=0.02): diuretics, β-blockers, angiotensin-converting enzyme inhibitors, and anticoagulants, and could possibly help explain the QoL difference by site. A lower percentage of Nevada patients were on diuretics and a higher percentage were on anticoagulants. 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 3 sites (P=0.20). We added these variables to our selected model to determine whether 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 >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 QoL 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 patients. Second, the majority of subjects were whites. Because English language requirements exist in the study, some non-English-speaking populations are already excluded. In addition, according to the 2011 US Census Bureau demographic statistics, whites make up 88.9%, 77.7%, and 74.0% of Kentucky, Nevada, and California, respectively. Third, recruitment from 3 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 QoL. Anecdotal reports from the research staff suggested higher rates of pet ownership by Nevada patients than in the other 2 states. As previous studies have confirmed, pet ownership might be an important source of social support that enhances well being among elderly people. Finally, there could be issues related to patient fatigue given the large battery of tests.

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

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Disclosures
None.

References


**CLINICAL PERSPECTIVE**

The analyses in this article seek to identify factors that affect the health-related quality of life (HRQoL) in rural patients with heart failure. Although robust data exist in urban patients, there is a paucity of data in rural patients to suggest they succumb to the same physical, psychological, and social stresses that have been shown to affect HRQoL among their urban peers. This article explores 612 rural patients, as part of the Rural Education to Improve Outcomes in Heart Failure trial, and explores which geographic, social, and medical issues may decrease their HRQoL. Decreased HRQoL was seen in patients who were younger and men and also in those with worse heart failure class and symptoms. Worse heart failure knowledge and poorer perceived control of their heart failure also lead to a worse HRQoL score. The results of this trial corroborate those of previous urban studies suggesting that although rural patients have a perceived inability to readily access health care, their HRQoL scores are affected much in the same way as those patients who do have ready access to care. Practitioners should remain focused on the disease process and education to improve HRQoL measures.
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