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Predictors of Overall Perceived Health in Patients With Heart Failure

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Abstract

Background: Overall perceived health (OPH) is a powerful and independent predictor of negative health outcomes and low health-related quality of life. Overall perceived health is conspicuously low in patients with heart failure (HF).

Objective: The purpose of this study was to determine the key predictors of OPH in persons with HF and explore possible mediating relationships.

Methods: This cross-sectional predictive correlational study was a secondary analysis of an existing data set. Individual characteristics, biophysiological variables, physical symptoms, psychological symptoms, and physical and social functioning were identified from the Wilson and Cleary Model and tested as predictors of OPH in a 5-step hierarchical regression analysis.

Results: The sample (n = 265) was primarily male (64.2%) and white (61.9%), with a mean age of 62 years, and had at least a high school education and a household income enough or more than enough to meet needs. Most (69.1%) had systolic dysfunction, and 78.5% were New York Heart Association class III or IV. The final model containing 15 predictors explained 39.2% of the variance in OPH. Six variables were significant independent predictors of OPH: perceived sufficiency of income, social functioning, comorbid burden, symptom stability, race, and the interaction of gender and social functioning, the last indicating social functioning as a stronger predictor for men than for women. In a multiple mediation analysis, the effects of shortness of breath and fatigue on OPH were mediated by physical and social functioning. Gender moderated the effect of fatigue through social functioning.

Conclusions: These variables explained a significant portion of the variance in OPH and can be used to target individuals at risk for low OPH and to tailor interventions. If OPH is low, a focus on patient symptoms and ability to participate in life activities is appropriate, with particular attention to social functioning in men.

Keywords

heart failure, health-related quality of life, health status, perceived heath, self-rated health

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Predictors of Overall Perceived Health in Patients with Heart Failure

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Abstract

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RESULTS—The sample (n=265) was primarily male (64.2%), white (61.9%), with a mean age of 62 years, at least a high school education, and a household income enough or more than enough to meet needs. Most (69.1%) had systolic dysfunction, and 78.5% were NYHA III or IV. The final model containing 15 predictors explained 39.2% of the variance in OPH. Six variables were significant independent predictors of OPH: perceived sufficiency of income, social functioning, comorbid burden, symptom stability, race, and the interaction of gender and social functioning, the last indicating social functioning as a stronger predictor for males than for females. In a multiple mediation analysis, the effects of shortness of breath and fatigue on OPH were mediated by physical and social functioning. Gender moderated the effect of fatigue through social functioning.

CONCLUSIONS—These variables explained a significant portion of the variance in OPH and can be used to target individuals at risk for low OPH and to tailor interventions. If OPH is low, a focus on patient symptoms and ability to participate in life activities is appropriate, with particular attention to social functioning in men.

Keywords

perceived health; self-rated health; heart failure; health status; health-related quality of life

Heart failure (HF) is a progressive and complex clinical syndrome with no cure. HF affects 5.7 million people in the United States[1] with an age-adjusted 5-year mortality estimate of 48%.[2] For surviving HF patients, the need for rehospitalization is frequent[3] and HRQOL is poor.[4] These negative health outcomes share one common independent predictor, low overall perceived health (OPH).

OPH is a subjective, individualized self-assessment of the current overall state of personal health that is typically measured by a single question asking for a rating of current general health status. OPH is an independent and unique variable that is sensitive to physical, psychological, and social changes.[5–7] Importantly, OPH influences subsequent health behaviors. Persons with poor OPH are less likely to participate in physical activity and to adhere to prescribed medical therapy.[8–9] Yet, no research has been conducted that offers clinically useful information to guide the use of OPH to improve negative health outcomes in persons with HF. Therefore, the purpose of this study was to examine the variables that significantly influence OPH in chronic HF patients and explore possible mediating relationships.

Background and Significance

OPH is notably lower in HF patients than in the general population, healthy age-peers, and patients with other chronic conditions.[10–11] Commonly misconstrued as a proxy for HRQOL, OPH is a distinct construct that directly influences and significantly mediates the influence of other factors on HRQOL.[12–13] OPH has also been verified to be more than solely a personality trait[14] or enduring self-concept.[5]

In patients with HF, OPH has been demonstrated to be a powerful predictor of worsening health,[15] need for hospitalization,[15–17] mortality,[15–16,18–19] and low HRQOL[12] even after controlling for demographic characteristics; [12,15–16,18–19] comorbid conditions;[12,17–19] New York Heart Association (NYHA) class; [12,16,19] exercise tolerance;[15] clinical measures such as ejection fraction (EF),[16,19] estimated glomerular filtration rate,[18] hemoglobin, [18] or B-type natriuretic peptide; [19] and treatment with medication or revascularization.[16] Because of the impressive prognostic value of OPH, experts have suggested the institution of routine monitoring of this variable in the clinical arena.[17,19–20] However, no research has been completed offering direction for how clinicians might effectively respond when low OPH values are detected in patients with HF. Studies are needed to provide clinicians with an understanding of the factors associated with OPH in HF patients.

Variables found in other populations to be associated with OPH include age,[6,21–22] gender,[21,23–25] race/ethnicity,[23,25] education, [21,23,26] income, [21,23–24] comorbid conditions, [5,23–24,26] physical symptoms,[6–7,21] depressive symptoms,[22,24,27] and social[5,13,24,28] and physical functioning.[6,21,23–24,28] An interaction effect between age and both comorbidity and physical functioning has also been found with these factors having a stronger negative association with OPH in younger individuals.[22] Only 3 studies have focused on factors associated with OPH in patients with HF.[29–31] Predictors of OPH included age, health beliefs, exertional dyspnea, fatigue, emotional distress, physical functioning, and the ability to work outside the home. [29–31] In one additional study focused on HRQOL, shortness of breath (SOB) and fatigue predicted OPH.[12] Interestingly in this analysis, physical functioning was not related to OPH and the relationship between physical symptoms and OPH was not mediated through physical functioning.[12] This important finding led us to explore how physical functioning influences the relationship between symptoms and OPH.

In spite of the low levels of OPH and its predictive validity for poor health outcomes in persons with chronic HF, few studies have focused on this construct in this population and the findings from these have limited generalizability. The samples tested have been limited to predominantly males with only systolic dysfunction, only patients with advanced HF with potential for cardiac transplantation or hospitalized for an acute HF exacerbation, or urbanites with low education and limited resources. No study of the key factors known to predict OPH in other populations has been conducted in a typical community-dwelling, general sample of patients living with HF. This study was designed to determine the key variables associated with OPH in persons with chronic HF and to evaluate the amount of variability in OPH attributable to each using a hierarchical regression analysis.

The Wilson and Cleary Model (WCM) of patient outcomes refined by Ferrans et al.[32] was used as a conceptual framework for this analysis. This model postulates five levels of increasing integration and complexity: biophysiological factors, symptoms, functioning, general health perceptions, and overall quality of life, with individual and environmental characteristics postulated to influence each. Because OPH is the core domain of general health perceptions,[33] the major portion of the model offers a framework of factors thought to influence OPH. Therefore, the specific aims of this study were twofold. First we assessed the extent to which OPH in persons with HF is uniquely predicted by individual characteristics (age, gender, race/ethnicity, education, income), biophysiological factors (number of chronic illnesses, comorbid burden, diabetes, atrial fibrillation), physical symptoms (fatigue, shortness of breath, symptom stability), psychological symptoms (depression), and functional status (physical functioning, social functioning). Second, we tested whether functional status mediates the relationship between physical symptoms and OPH.

Methods

Design and Samples

A cross-sectional descriptive and predictive design was used to conduct a secondary analysis of baseline data from patients with HF recruited between 2007 and 2009 for a prospective study examining the influence of excessive daytime sleepiness (EDS) on self-care, HRQOL, and unplanned hospitalization (conducted by BR). For the parent study, subjects were identified from outpatient settings in Philadelphia, PA and Newark, DE. One setting was a university referral center for HF and transplantation. Another was a Veterans Affairs hospital where subjects were enrolled from various cardiology and medical clinics. The third was a community hospital where subjects were enrolled from the practices of any physician treating patients with HF. Inclusion criteria included Stage C chronic HF confirmed by echocardiography and clinical evaluation, ability to speak and read English, adequate literacy, hearing adequate to engage in dialogue, and living in a setting amenable to performing self-care. Patients were excluded if they had major depression, severe dementia or significant cognitive impairment at the time of screening, renal failure requiring dialysis, night shift work, terminal illness, planned relocation, or heavy and regular drug or alcohol abuse within the past year. More detailed information about the sampling and recruitment of subjects in the parent study has been published elsewhere.[34] Medical record reviews were conducted in clinic offices and self-report data were collected during home visits. For this secondary analysis all data were obtained without identifying information and the study was approved by the University of Nebraska Medical Center institutional review board.

A power analysis was performed using GPower 3.010. A sample of 97 subjects was required to explain 40% of the variance in the outcome with 14 predictors. A sample size of 120 was required for a hierarchical regression analysis with an R^2 increase of 5% for the final step with a power of .80 and individual regression coefficient alpha = .05. For the mediation analysis, at least 162 subjects were needed if the path coefficients involved in the mediation effect were both small to medium in size.[35] The available sample exceeded all estimates.

In all, 280 subjects were enrolled in the parent study. The 15 patients who did not have data needed for our study had significantly better NYHA functional class, fewer symptoms, and better physical functioning. Our final sample consisted of 265 patients with symptomatic HF.

Measures

OPH was measured with the commonly used first item in the SF-36 (v2) often referred to as self-rated health. This item states “In general, would you say your health is:” with response choices of *excellent, very good, good, fair, or poor*. The Medical Outcomes Study scoring algorithm was used to recalibrate the response scale and convert scores to a 0–100 scale with 0 indicating “poor” and 100 indicating “excellent” health.[36] The self-rated health item has been used extensively in healthcare research as a subjective assessment of overall health.[6,11–12,25,30,33] Construct and discriminant validity of this measure have been established.[37–38]

Age, gender, race/ethnicity, education, and family income were measured with a sociodemographic questionnaire designed specifically for the parent study. Type, severity and duration of HF were collected from the medical record and used only to describe the sample. Chronic illness was measured with four distinct variables identified in the literature as related to OPH: (a) number of chronic illnesses, (b) comorbidity burden operationalized as an index of number and severity of chronic illnesses, (c) diagnosis of diabetes, and (d) diagnosis of chronic atrial fibrillation. Chronic illness data were collected from medical record review. Comorbid burden was measured with the Charlson Comorbidity Index (CCI) total score. Construct validity of the CCI has been confirmed in the HF population.[39]

Physical symptoms and physical and social functioning were measured with the Kansas City Cardiomyopathy Questionnaire (KCCQ), a HF-specific health status measure.[40] Scores on the KCCQ range from 0 to 100 with higher values indicating better health status. Content and construct validity of the KCCQ as well as internal consistency and test-retest reliabilities for each of the subscales have been established.[40] Internal consistency reliability of the physical and social functioning subscales in this study sample was adequate with Cronbach’s alpha values of .85 and .86 respectively. Individual scores for fatigue and SOB were computed from each set of 2 items measuring frequency and severity of each symptom. The internal consistency reliability of the fatigue and SOB symptom scales in this sample were .88 and .89 respectively.

Depression was measured with the 9-item Patient Health Questionnaire (PHQ-9), which offers a list of depressive symptoms and directions to indicate the frequency of each over the past month. Response values are summed to create a range from 0 to 27. Higher scores indicate greater depression severity. Content and construct validity have been established.[41] Internal consistency reliability of the PHQ-9 has been demonstrated in primary care patients and in women with Cronbach’s alpha coefficients of .89 and .86 respectively.[41] However, in this sample, internal consistency reliability of this measure was only .68, presumably because major depression was an exclusion criterion.

Statistical Analysis

Descriptive statistics were used to describe the sample and predictor and outcome variables. Bivariate correlational analyses of all variables were conducted to verify expected relationships and identify potential multicollinearity. Relationships between categorical predictors and OPH were assessed by statistical testing of differences between groups with independent *t*-tests or ANOVA. To achieve aim 1, a hierarchical multiple regression analysis using five steps was performed with all new variables at each step entered simultaneously as a block. Interaction terms of age with each comorbidity variable and each functioning variable were included in the appropriate blocks. Models were fit with each measure of comorbidity to select the one that explained the most variance. Continuous variables were centered about the mean prior to creating the interaction terms to reduce potential collinearity. All assumptions of linear ordinary least-squares regression were assessed and no violations were found.

To achieve aim 2, a multiple mediator analysis was conducted to assess the indirect effects of physical symptoms on OPH via one or both of the functioning variables. The bias-corrected bootstrapping method for multiple mediator analysis was used to test total and indirect effects in the model.[42] This method reduces potential bias due to omitted variables and offers the advantage of determining the total indirect effect of symptoms on OPH as well as the unique indirect effects of each mediator. Bootstrapping was done by nonparametric resampling with replacement 1,000 times. Based on finding a gender influence on the relationship between social functioning and OPH in the regression analysis, a moderated mediation analysis was done to assess whether the mediation of SOB or fatigue by social functioning differed by gender. Conditional indirect effects were computed in males and females.[43] Significance level for all tests was set at $P = .05$. Data were analyzed using SPSS 17.0 software (SPSS, Inc, Chicago, Illinois).

Results

Patient Characteristics

The sample was predominately older white males (Table 1). Only 25 participants (9.4%) were without comorbid conditions. The vast majority (76.2%) had a total of 3 or more chronic illnesses and over one-third (37.0%) had 5 or more.

More than half (55.1%) of the participants rated their OPH as fair or poor and only 11.3% rated their OPH as very good or excellent (Table 2). Most patients reported being symptomatic with fatigue (61.5%) or SOB (50.9%) at least weekly. Only 11.3% of the sample experienced a worsening in symptoms during the previous month. Most (64.2%) subjects reported no difficulty with life activities because of depressive symptoms. The vast majority of participants reported limitations in physical functioning (88.3%) and social functioning (82.6%) due to HF.

Bivariate Relationships

Correlational relationships between predictor variables and OPH are shown in Table 3. A strong association was evident between physical functioning and OPH while other predictors had weak to moderate correlations with OPH. Age was not correlated with OPH.

Hierarchical Regression Analysis

The results of the hierarchical regression analysis are summarized in Table 4. Age, gender, race/ethnicity, education, and income accounted for 20.5% of the variance in OPH after adjustment for the number of variables ($F(6,258) = 12.38$, $p < .001$). Income, gender, and race/ethnicity were significant predictors of OPH in this model with higher income and female gender predicting better OPH and black compared to white race predicting worse OPH. All variables were retained because of theoretical importance and collective contribution to variance explained.

Several variables were not retained in the sequential models because they offered little or no significant information. These included number of chronic illnesses, atrial fibrillation, diabetes, and all interaction terms involving age, with the exception of age by comorbid burden. When physical and social functioning were added in the last step of the regression analysis, each was significant only when the other was removed. Based on changes in coefficient values for gender and black versus white race when social functioning was added or removed, interaction terms for social functioning with each of these variables were tested. With the gender by social functioning interaction term included, social functioning and the interaction term were both significant independent predictors of OPH in the final model. The interaction term indicated that social functioning differed by gender. Although the coefficient for physical functioning was not significant ($t = 1.68$, $P = .09$) in this final step, the variable was retained because of theoretical importance.

When controlling for individual characteristics, comorbid burden and its interaction with age indicating a stronger negative association in younger patients, uniquely accounted for 6% of the variance in OPH. Adjusting for individual characteristics and comorbid burden, fatigue, SOB, and symptom stability were each significant independent predictors and explained another 10.5% of the variance in OPH. Depressive symptoms, when controlling for previously entered variables, was a significant independent predictor of OPH, but explained only an additional 1% of the variance. Finally, physical functioning, social functioning, and a gender by social functioning interaction term explained an additional 3% of the variance in OPH beyond what was explained by the other variables.

The final model containing 15 variables explained 39.2% of the variance in OPH after adjustment for the number of variables. Six variables were significant independent predictors of OPH: perceived sufficiency of income, social functioning, comorbid burden, symptom stability, black compared to white race, and the interaction of gender and social functioning indicating that social functioning was a stronger predictor for males than for females. Higher OPH was predicted by higher income, symptom stabilization or improvement, and, in males only, higher social functioning. Lower OPH was predicted by higher comorbid burden and black compared to white race. The other variables collectively contributed to the explanation of the variance in OPH, significantly increasing the R^2 value, but none offered significant unique contributions. These included higher age, female gender, more education, lower fatigue burden, lower SOB burden, and higher physical functioning predicting higher OPH and depressive symptoms and other race/ethnicity compared to white predicting lower OPH.

As depicted in Figures 1 and 2, physical and social functioning mediated the effect of SOB ($F(3, 261) = 37.42$, $P < .001$) and fatigue on OPH ($F(3, 261) = 36.33$, $P < .001$). In both cases the total effect of symptoms on OPH was significant, but the direct effect was not. This suggests that the effect of the physical symptom on OPH is entirely transmitted through its effect on the mediating variables. Also in both models, the two indirect effects did not significantly differ from each other indicating that physical functioning and social functioning equally mediate the effect of the symptom on OPH. *Moderated mediation* was identified in one model. Specifically, the effect of fatigue on OPH mediated by social functioning was stronger for males ($B = .30$, $P < .001$, 95% CI [0.20, 0.40]) than for females ($B = .15$, $P = .02$, 95%CI [0.02, 0.28]).

Discussion

This study was the first to determine the key variables associated with OPH in community-dwelling persons with chronic HF and to evaluate the amount of variability in OPH attributable to each. Our finding that the selected variables accounted for 39.2% of the variance in OPH is comparable to the 29% to 38% range reported in large populations studies.[5,27,44] In a study of older patients with a combination of comorbid conditions[24] and one study of HF patients,[31] 44.7% and 46% of the variance in OPH were explained respectively with similar predictors. The variables that predicted OPH in our study are also consistent with those found in population studies.[5,21–22,27] The contribution of symptoms and social functioning to OPH in our study is consistent with other studies of chronically ill patients in which OPH was measured in basically the same manner.[24,44–46] Our results offer validation that the amount of variance and the general factors that account for variance in OPH in patients with HF are similar to those that have been identified in theoretical models, the general population, and others with chronic illness.

Our finding that each group of variables uniquely explained a small, but significant portion of the variance over and above those already added to the model is consistent with theoretical modeling of the integrative nature of this concept,[32] yet highlights the additional and distinct information each offers. This finding is also consistent with results from the sole population study using a similar analysis with similar predictors, but in a sample of older adults.[27] Ours are the first such results in patients with HF.

We found that unmodifiable factors accounted for a sizable portion of the explained variance in OPH, as others have found. [27] of the sociodemographic characteristics we included are known to affect health either biologically or due to influences on lifestyle choices or healthcare use. However, all such personal attributes also form the framework in which self-evaluations of personal health are made, the viewpoint within which other factors are interpreted.[47]

We found a particularly strong positive association between income and OPH in our sample. This predictor remained significant through all steps of the hierarchical regression and had the largest standardized coefficient in the final model. Interestingly, 83.4% of our subjects reported having an income that was enough or more than enough to meet household needs. Chronic illness is expensive, creates disability, and requires life changes. An adequate financial income offers the resources to obtain medical care, drug therapy, and assistance with lifestyle modification or personal obligations in order to maintain health. It also offers protection for OPH from the stress, lack of treatment, and barriers to self-care created by inadequate resources. Our measure of income as a perception of adequacy likely provided a more relevant perspective for OPH than that gained by measures using dollar amounts. This finding illustrates the importance of evaluating perceived manageability in patients with HF from the standpoint of personal financial resources.

Race was an additional unmodifiable factor explaining OPH in our sample. Our finding that black race is predictive of lower OPH is consistent with population studies, but a new finding in patients with HF. Only one other study of OPH in HF patients had sufficient black subjects to analyze race and no association was found.[29] The difference in results may lie in the fact that black respondents in that study were likely to be female, who typically have higher OPH values,[21,23–24] while in our sample most black subjects were male. Health disparities between black and white races are well-known. Cultural differences in OPH related to ethnicity are also well documented and numerous reasons have been postulated, including differences in what constitutes health and the factors considered during selfevaluation of health status.[23,47] Our findings suggest that an assessment of OPH may be particularly important in HF patients of black race.

Comorbidity is another nonmodifiable significant predictor of OPH that has been identified in multiple population studies [21,23,27,44,48] and a study of chronically ill subjects.[24] However, this finding is in contrast to the one study in HF patients that found no relationship between comorbidity and OPH, likely because billing codes were used to measure comorbid burden.[29] Although it was already known that a HF diagnosis alone is associated with lower OPH, our results illustrate that additional chronic illnesses further worsen subjective health perception. Multiple chronic illnesses, through the awareness of medical diagnoses as well as the need to manage multiple medical prescriptive therapies, negatively influence self-assessment of overall health as obvious indicators of the antithesis of health. Sensitivity to the cumulative burden of multiple comorbidities is necessary in care management and patient education to reduce the often overwhelming self-care expectations and deflation of OPH.

The significant modifiable predictors of OPH in our sample were symptom stability, and, in men only, social functioning. Although the physical symptoms included in our model, fatigue and SOB, have been identified as predictors of OPH in two other studies of HF patients,[12,31] only one other study included a measure of symptom stability. In residents of retirement communities, Winter et al.[7] found that changes in symptoms, beyond level of symptoms, contributed independently to OPH on a daily basis. Considering how symptomatic our sample was and most patients with HF typically are, it is not surprising that a change in symptoms is a more powerful predictor of OPH than the symptoms themselves. Living with symptoms becomes commonplace for many HF patients. Our findings add to the empirical support for the importance of symptom change to OPH and highlight the need to immediately assess for such a change when OPH values are found to be low.

In men, social functioning was a significant independent predictor of OPH, stronger than physical functioning. This finding was unexpected and, to our knowledge, only one small study has reported such a relationship.[13] Smith et al.[13] found similar results in a sample of 89 HIV positive men. In all other studies and a meta-analysis of predictors of OPH, physical functioning is a far stronger predictor of OPH.[11,13,24,44] A decrease in the ability to perform life activities is the most apparent indicator of worsening health to patients and those around them. However some restrictions may have more inherent meaning than others. Our results suggest that, in men with HF, a restriction in social functioning is a more compelling indicator of poor health, consistent with Jylha's[47] hypothesis that personal expectations influence health ratings. It should be noted that the measure we used contains items conceptualized by others as both social and role functioning.[49] It may be a more inclusive measure and possibly more sensitive to the influence of ill health. One item, in particular, assessed limitation with intimate relationships and the males in our sample reported being significantly more limited than the females ($P < .01$). Our findings suggest that this may be a critical area for assessment in males with low OPH.

We are the first to find that, in a sample of HF patients, physical and social functioning mediated the effects of SOB and fatigue on OPH and that the direct effect of physical symptoms was not significant when functional status was in the model. Our results are in contrast to that of Heo et al.[7] who found no mediation effect of functional status in the relationship between symptoms and OPH. This difference is likely due to striking differences in the study samples as their subjects were hospitalized for acute decompensated HF. Also, NYHA was used to measure functional status in Heo's study and no measure of social functioning was included. Using both the physical and social functioning KCCQ subscales may provide a more inclusive, and possibly more sensitive, measure of functioning. Our findings are consistent with the WCM model which postulates that symptoms influence OPH through their effect on functioning and help explain the mechanism of the relationship between symptoms and OPH.

Limitations

Because we conducted a secondary analysis, it was not possible to consider other potential variables that may influence OPH in HF patients. Two factors identified in multiple previous studies that were not available for this study were physical activity and a broader construct of mental health encompassing not only depression, but also affect and emotional distress. Selection bias was possible because patients with low levels of OPH may have been more likely to refuse to participate when informed of the longitudinal nature and testing requirements of the parent study. In this sample, internal consistency reliability of the PHQ-9 was low. The low alpha coefficient appeared to be related to the homogeneity of the sample with respect to depression (due to exclusion of patients with major depression) and low variability of responses on items related to fatigue and sleep, common physical symptoms of HF. Finally, the use of cross-sectional data precludes establishment of a causal relationship between variables and may produce misleading estimates of longitudinal meditational processes.

Conclusions and Implications

These results offer useful information for targeting vulnerable populations at risk for adverse outcomes and for guiding further assessment and tailoring interventions when OPH ratings are low. A guided assessment based on our results can be used to facilitate appraisal and identify unrecognized or unreported worsening symptoms or functioning. Specifically, an increase in social functioning limitations in men, particularly, may be associated with worsening or profound fatigue, a symptom that may not be thought noteworthy by a patient but is associated with worsening HF and need for rehospitalization in patients with chronic HF.[50]

Further research is necessary to identify other factors associated with the large amount of unexplained variance in OPH in this population and to further explore gender differences, as well as age, ethnic, and cultural differences. Longitudinal studies are needed to capture changes in OPH and its predictors over time in order to establish the temporal relationships required in casual modeling and mediation analyses. We recommend the use of the CCI rather than a count of the number of chronic illnesses in future research because this measure was a stronger predictor of OPH even as other variables were added to the model.

Numerous efforts have been made to improve outcomes for HF patients. Although progress is being made, the prognosis for those with HF remains dismal and clinicians are continually challenged to find ways to improve the lives of these patients. OPH is a powerful predictor of adverse health outcomes. Armed with an understanding of the factors that are associated with OPH, clinicians can target vulnerable populations for intervention.

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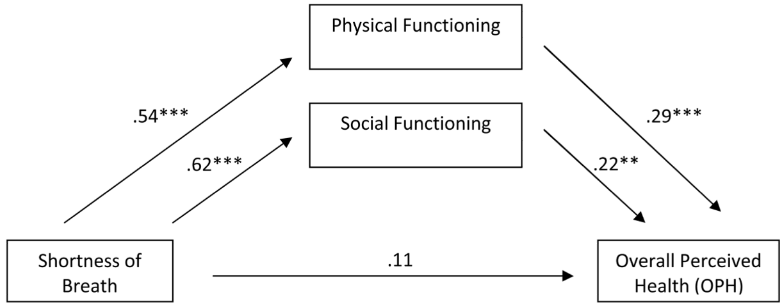

Figure 1.
Multiple mediation model of shortness of breath on OPH through physical and social functioning with coefficients indicated for each path. Total effect = .41 (P = < .001). Indirect effect for physical functioning = .16 (95% CI, .05–.26) and for social functioning = .14 (95% CI, .03–.23). Contrast in indirect effects was 0.03 (95% CI, −.15 to .20). R^2 = .30; Adjusted R^2 = .29 ($F_{3,261}$ = 37.42, P < .001).
** < .01. *** < .001.

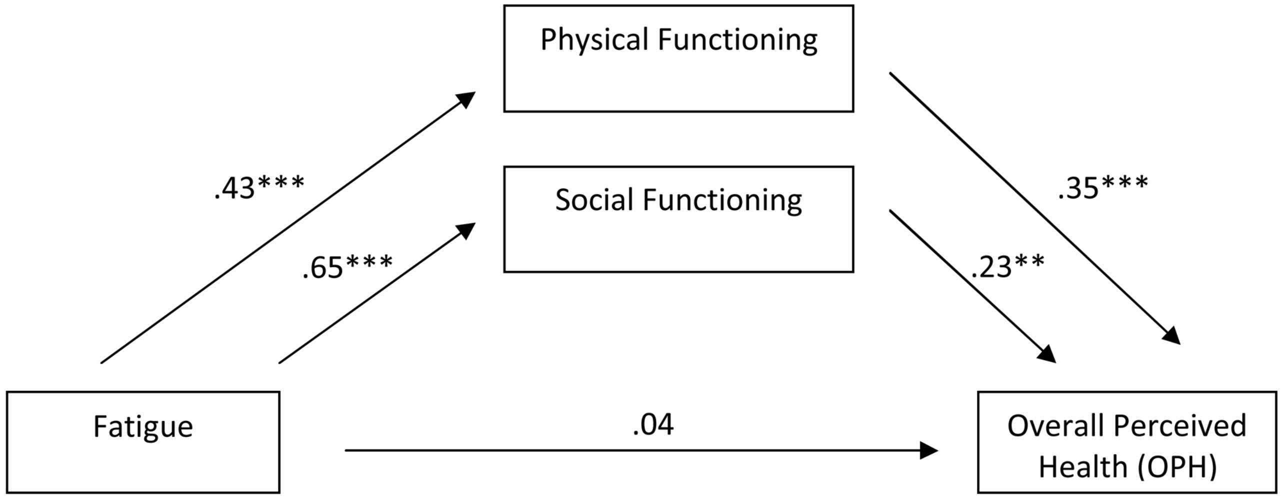

Figure 2.
Multiple mediation model of fatigue on OPH through physical and social functioning with coefficients indicated for each path. Total effect = .34 (P = < .001). Indirect effect for physical functioning = .15 (95% CI, .07–.23) and for social functioning = .15 (95% CI, .04–.25). Contrast in indirect effects was 0.002 (95% CI, −.16 to .17). R^2 = .29; Adjusted R^2 = .29 ($F_{3,261}$ = 36.33, P < .001).
** < .01. *** < .001.

Table 1

Sample Characteristics (N = 265)

Variable	Mean (SD) or Number (%)
Age (range 24 to 89)	61.89 (12.40)
Male	170 (64.2)
Race/ethnicity	
White	164 (61.9)
Black	92 (34.7)
Other	9 (3.4)
Education level	
Less than high school	26 (9.8)
High school	95 (35.8)
Business school, some college, or associate degree	73 (27.5)
Bachelor’s degree	43 (16.2)
Graduate degree	28 (10.5)
Household income	
Not enough	44 (16.6)
Enough	127 (47.9)
More than enough	94 (35.5)
Heart failure type	
Systolic	183 (69.1)
Diastolic	50 (18.9)
Mixed	32 (12.1)
Ejection fraction (n = 264)	35.25 (17.05)
Preserved ejection fraction (50% or greater) (n = 264)	62 (23.5)
Ischemic HF	98 (37.0)
Mean duration of HF in months	74.71 (72.29)
New York Heart Association Class	
I	12 (4.5)
II	45 (17.0)
III	158 (59.6)
IV	50 (18.9)
Comorbid conditions	
Hypertension	169 (63.8)
Diabetes	103 (38.9)
CAD (history of myocardial infarction)	98 (37.0)
Atrial fibrillation	86 (32.5)
Renal disease	70 (26.4)
Chronic obstructive pulmonary disease	58 (21.9)
Pulmonary hypertension	54 (20.4)
Anemia	49 (18.5)
Cerebrovascular disease	39 (14.7)

Variable	Mean (SD) or Number (%)
Peripheral vascular disease	31 (11.7)
Cancer	19 (7.2)
Connective tissue disease	14 (5.3)
Liver disease	3 (1.1)
AIDS	1 (0.4)

Note. Data given as mean (SD) or number (%). CAD = coronary artery disease.

Table 2

Descriptive Statistics for Continuous Variables (N = 265)

Variable	Range	Mean (SD)
Number of chronic illnesses	1–10	4.00 (1.88)
Charlson Comorbidity Index	1–11	2.77 (1.66)
Fatigue symptom Score[a]	0–100	61.89 (29.55)
Shortness of breath symptom score[a]	0–100	67.56 (29.64)
Symptom stability score[a]	0–100	57.26 (22.33)
Depressive symptoms score	0–18	4.48 (3.66)
Physical functioning score[a]	0–100	68.93 (23.55)
Social functioning score[a]	0–100	65.79 (28.16)
Overall perceived health[a]	0–100	40.68 (26.68)

[a]higher score indicates better health.

Table 3

Intercorrelations between Overall Perceived Health and Predictor Variables

	Age	Education	Income	# CI	CCI	Fatigue	SOB	Symptom Stability	Depressive Symptoms	Physical Function	Social Function
OPH	.07	$.25^{***}$	$.39^{***}$	$-.27^{***}$	$-.27^{***}$	$.38^{***}$	$.45^{***}$	$.18^{**}$	$-.32^{***}$	$.51^{***}$	$.49^{***}$
Age	-	−.11	$.18^{**}$	$.34^{***}$	$.25^{***}$	$.22^{***}$	.08	.08	$-.18^{**}$	−.01	.12
Education		-	$.28^{***}$	$-.16^{**}$	−.10	.04	$.18^{**}$	−.00	$-.12^{*}$	$.21^{**}$	$.13^{*}$
Income			-	−.08	−.02	$.28^{***}$	$.33^{***}$	−.04	$-.17^{**}$	$.38^{***}$	$.37^{***}$
# CI				-	$.71^{***}$	−.00	$-.16^{**}$	.03	.01	$-.28^{***}$	$-.16^{**}$
CCI					-	−.05	$-.16^{*}$	.04	.04	$-.22^{***}$	$-.16^{*}$
Fatigue						-	$.60^{***}$	$.15^{*}$	$-.54^{***}$	$.54^{***}$	$.68^{***}$
SOB							-	$.22^{***}$	$-.40^{***}$	$.68^{***}$	$.65^{***}$
Symptom Stability								-	$-.14^{*}$	$.16^{**}$	$.14^{*}$
Depressive Symptoms									-	$-.38^{***}$	$-.42^{***}$
Physical Function										-	$.71^{***}$

Note. Values for education and income are reported as Spearman's rho; all other values reported as Pearson's r correlation coefficient. # CI = number chronic illnesses; CCI = Charlson Comorbidity Index; Fib = fibrillation; OPH = overall perceived health; SOB = shortness of breath.

* $p < .05$.

** $p < .01$.

*** $p < .01$

Table 4

Coefficient values for each predictor from hierarchical regression analysis

	Step									
	1		2		3		4		5	
Predictor	***B***	***β***	***B***	***β***	***B***	***β***	***B***	***β***	***B***	***β***
Age	.06	.03	.21	.10	.10	.04	.07	.03	.12	.05
Gender	7.08	.13*	5.07	.09	5.82	.11*	6.36	.12*	5.70	.10
Black versus white	−11.02	−.20**	−8.30	−.15*	−6.92	−.12*	−7.22	−.13*	−6.39	−.11*
Other race/ethnicity versus white	−10.45	−.07	−9.08	−.06	−5.03	−.03	−5.48	−.04	−4.48	−.03
Education	2.42	.10	2.45	.11	2.17	.09	1.84	.08	1.67	.07
Income	11.52	.30***	11.85	.31***	9.09	.24***	9.28	.24***	7.87	.21***
Comorbid burden			−4.16	−.26***	−3.47	−.22***	−3.44	−.21***	−2.99	−.19**
Age x comorbid burden			.17	.12*	.14	.10*	.15	.11*	.10	.07
Fatigue[a]					.14	.15*	.08	.09	.02	.02
SOB[a]					.15	.17*	.14	.16*	.04	.05
Symptom stability[a]					.17	.14*	.16	.14*	.15	.12*
Depressive symptoms							−9.10	−.12*	−.83	−.11
Physical functioning[a]									.15	.14
Social functioning[a]									.18	.20*
Gender x social functioning									−.20	−.12*
Adjusted R^2		.20***		.26***		.36***		.37***		.39***
ΔR^2				.06***		.10***		.01*		.03**

Note. Gender coding was 0 for males and 1 for females. Continuous variables were centered about the mean to create interaction terms. β = standardized regression coefficient; SOB = shortness of breath; Δ= change.

[a]Higher score indicates better health.

* $p < .05$.

** $p < .01$.

*** $p < .01$