ORIGINAL ARTICLE

Relationship between functional capacity and socioeconomic status in a cohort of Turkish heart failure patients

Türk kalp yetersizliği hasta kohortunda fonksiyonel kapasite ile sosyoekonomik durum arasındaki ilişki

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ABSTRACT

Objective: New York Heart Association (NYHA) classification predicts prognosis for heart failure (HF) patients. Socioeconomic status (SES) has the potential to affect treatment strategy and disease course. The present objective was to investigate whether SES of Turkish HF patients affected NYHA classification.

Methods: Turkish research team-HF (TREAT-HF) is a questionnaire study with 52 questions, the purpose of which is to aid in the assessment of various qualities of HF patients. The 2013 TREAT-HF cohort included 503 patients from 11 centers in Turkey. Patients were divided into 2 groups according to NYHA functional classification: I-II, a better functional classification, or III-IV, a poorer functional classification. In addition, patients were analyzed according to gender.

Results: Evaluated were NYHA functional classifications of 459 (326 males and 133 females) patients with a mean age of 59.7±14.07 years and a mean ejection fraction (EF) of 31.7±9.22%. Total monthly family income level of ≥1000 TL, younger age, higher EF, and male gender were independently associated with better NYHA functional classification. In addition to EF, regular weight control was found to be independently associated with better NYHA classification for females, while younger age and income of ≥1000 TL were independently associated with better NYHA classification for males.

Conclusion: The present results demonstrated that SES was associated with NYHA functional classification in a cohort of Turkish HF patients.

ÖZET

Amaç: New York Kalp Cemiyeti (NYHA) sınıflaması kalp yetersizliği (KY) bulunan hastalarda prognozu öngörür. Sosyoekonomik durumun hastalığın seyri ve tedavi stratejilerini etkileme olasılığı mevcuttur. Biz bu çalışmada Türk KY'li hastaların sosyoekonomik durumlarının NYHA sınıflarını etkileyip etkilemediğini incelemeyi amaçladık.

Yöntemler: Türk Araştırma Takımı-KY (TREAT-HF) KY'li hastaların çeşitli yönlerini araştırmayı amaçlayan 52 soruluk bir anket çalışmasıdır. Türk Araştırma Takımı-KY 2013 kohortuna Türkiye'deki 11 farklı merkezden KY'li 503 hasta alındı. Hastalar fonksiyonel sınıflarına göre daha iyi NYHA fonsiyonel sınıfı (I-II) olanlar (Grup I) ve daha kötü NYHA fonksiyonel sınıfı (III-IV) olanlar (Grup II) olarak iki gruba ayrıldı. Ayrıca hastalar cinsiyetlerine göre değerlendirildi.

Bulgular: Ortalama yaşları 59.7±14.07, ortalama ejeksiyon fraksiyonları (EF) %31.7±9.22, 326'sı erkek, 133'ü kadın olan 459 hastanın NYHA fonksiyonel sınıfı değerlendirildi. Yapılan çok değişkenli analizde gelir düzeyinin ≥1000 TL olması, erkek cinsiyet, daha genç yaş ve daha yüksek EF; tüm hasta popülasyonu için diğer değişkenlerden bağımsız olarak daha iyi fonksiyonel sınıf ile ilişkili bulundu. Ejeksiyon fraksiyonuna ek olarak kadınlar için düzenli kilo kontrolü yapmak daha iyi fonksiyonel sınıf ile bağımsız olarak ilişkili bulunurken, erkekler için daha genç yaş ve gelir düzeyinin ≥1000 TL olması daha iyi fonksiyonel sınıf ile bağımsız olarak ilişkiliydi.

Sonuç: Çalışmamız KY'li Türk hastalardan oluşan bir kohortta sosyoekonomik durumun NYHA fonksiyonel kapasite sınıflandırması ile ilişkili olduğunu göstermiştir.

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Chronic heart failure (HF) is a progressive syndrome that results in poor quality of life and places an economic burden on the healthcare system. In spite of advances in control of cardiovascular diseases, incidence is still high, and hospitalizations for HF and rates of readmission continue to rise.[1] Functional capacity is an important prognostic element, and New York Heart Association (NYHA) classification predicts prognosis. NYHA classification is the system most commonly used to predict the impact of HF on daily activity. Higher classification indicates greater severity of symptoms, with worse outcome.[2] The classification is a marker of disease progression, hospitalization, and mortality.

Socioeconomic status (SES), including income, has the potential to impact quality of life, and affects treatment strategies and disease course.[3] In Western European countries and the US, association between lower SES and poorer health has been shown.[4,5] Individuals who are less educated, have jobs of lower status, and earn low or no income are at greater risk of poor health than their counterparts with higher SES. In patients with higher NYHA classification, all aspects of quality of life are affected, reflecting the severe impact of HF status on daily life,[6] and raising the question of whether SES affects functional capacity in HF patients.

The present aim was to investigate whether SES of Turkish HF patients affected functional capacity, thus corresponding to NYHA classification.

METHODS

Patients

Turkish research team-HF (TREAT-HF) is a questionnaire study with 52 questions, the purpose of which is to aid in the assessment of various qualities of HF patients. The 2013 cohort included 503 patients with HF. The questionnaire was administered at 11 centers in Turkey (7 university hospitals, 4 training research hospitals), each located in the respective city center.

The questionnaire was administered to willing participants attending HF outpatient clinics. NYHA functional classification was determined by an independent investigator. HF patients received 1 of 4 classifications, with higher classification indicating more severe symptoms, greater limitation of physical activity, and worse health.

Excluded were pregnant women, patients with acute myocardial ischemia diagnosed within the past 30 days, acute myocarditis, <1-month history of acute HF requiring hospitalization, cancer, and life expectancy of <1 year.

Abbreviations:

EF	*Ejection fraction*
HF	*Heart failure*
NYHA	*New York Heart Association*
SES	*Socioeconomic status*
TREAT-HF	*Turkish research team-HF*

Considering the hunger limit in Turkey in 2013, which was approximately 1000 TL, patients were divided into 2 groups: those with total monthly family income of greater than or less than 1000 TL. Patients were also classified according to level of education, and answered questions regarding occupation, whether or not they provided income, whether they attended regular doctor visits, whether they regularly controlled their weight, whether they exercised regularly, whether they complied with the dietary advice of their doctors, and whether they used medication regularly. Patients who sought medical advice when symptoms worsened and saw a cardiologist 2 or 3 times a year were considered to attend doctor visits regularly. Patients who weighed themselves daily were considered to control their weight. Regular exercise was considered an aerobic session lasting 20–30 minutes at least 5 times a week. Hypertension was defined as in-office blood pressure measuring >140/90 mmHg on more than 2 occasions or taking antihypertensive treatment. Diabetes mellitus was defined as fasting blood sugar ≥126 mg/dL or taking antidiabetic treatment.

Clinical, socioeconomic, and medico-social properties of patients were recorded. Patients in Group 1 had better NYHA functional classification (I-II), while those in Group 2 had poorer classification (III-IV). All properties were compared. In addition, patients were classified according to gender, and properties of males and females were compared according to NYHA group. Institutional ethics committee approval was obtained, as was written, informed consent prior to enrollment.

Echocardiographic measurements

Transthoracic echocardiography was performed in the left lateral position using a commercially available machine with a 3.5–8 MHz phased-array transducer by experienced cardiologists blinded to study groups. All patients underwent standard 2-dimensional and Doppler echocardiographic examinations with de-

tailed HF evaluation. Imaging planes were standardized, and included parasternal long-axis, short-axis, and apical 4- and 2-chamber views. Ejection fraction (EF) was measured using standard methods.[7]

Statistical analysis

Age and EF, analyzed using single-sample Kolmogorov-Smirnov test, were normally distributed and expressed as mean±SD, while categorical variables were expressed as percentages. Categorical data were evaluated using chi-square, continuity-corrected chi-square, or Fisher's exact test, where appropriate. A p value of 0.05 was considered statistically significant. Univariate logistic regression analysis was used to quantify association of variables with better NYHA functional classification. Variables that were statistically significant ($p<0.25$) in univariate analysis were entered into multivariate logistic regression analysis using the backward logistic regression method, in order to determine independent prognostic factors of better NYHA functional classification. Separate analyses were performed for males, females, and for the total population. All statistical procedures were performed using SPSS software (version 14.0; SPSS Inc., Chicago, IL, USA).

RESULTS

NYHA functional classification was evaluated for 459 patients (326 males, 133 females) with a mean age of 59.7±14.07 years. Mean EF was 31.7±9.22% and 88.7% of patients suffered from HF with reduced EF (≤40%). A total of 283 patients were classified as NYHA I-II (Group 1) and 176 as NYHA III-IV (Group 2). Mean age was lower, and mean EF was higher in patients with better NYHA functional classification (I-II) than in patients with poorer classification (III-IV). Rate of patients with monthly household income of ≥1000 TL, rate of patients who provided income, rate of patients who attended regular doctor visits, rate of patients who regularly controlled their weight, and rate of patients who regularly used medication were higher in Group 1. Other clinical, socioeconomic, and medico-social characteristics were similar between the groups, as presented in Table 1. All these results were independent from gender.

When patients were analyzed according to gender, the rates of males who provided income and exercised regularly were higher in Group 1. In addition, mean EF was higher in Group 1. Such a correlation was not detected in female patients for these

Table 1. Characteristics of males, females, and all patients, according to NYHA classification

Characteristics	All Patients (n=459)			Male (n=326)			Female (n=133)		
	NYHA I-II (n=283)	NYHA III-IV (n=176)	*p*	NYHA I-II (n=207)	NYHA III-IV (n=119)	*p*	NYHA I-II (n=76)	NYHA III-IV (n=57)	*p*
Age (years)	57.7±14.00	63.0±13.58	<0.001	57.5±13.77	62.5±13.40	0.004	58.2±14.70	65.2±13.84	0.006
Female (%)	76/283 (26.9%)	57/176 (32.4%)	0.204	–	–	–	–	–	–
Hypertension (%)	77/282 (27.3%)	56/176 (31.8%)	0.301	50/206 (24.3%)	36/119 (30.3%)	0.239	27/76 (35.5%)	20/57 (35.1%)	1.000
Diabetes mellitus (%)	47/282 (16.7%)	36/176 (20.5%)	0.306	24/206 (11.7%)	22/119 (18.5%)	0.124	23/76 (30.3%)	14/57 (24.6%)	0.596
Ejection fraction (%)	33.1±8.15	29.4±10.34	<0.001	32.9±8.21	28.9±10.12	<0.001	33.7±8.00	30.6±10.77	0.072
Graduation from high school or university (%)	48/247 (19.4%)	32/156 (20.5%)	0.791	39/177 (22.0%)	27/103 (26.2%)	0.517	9/70 (12.9%)	5/53 (9.4%)	0.760
Occupations									
Self-employment	94/266 (35.3%)	68/169 (40.2%)	0.303	87/197 (44.2%)	62/114 (54.4%)	0.082	7/69 (10.1%)	6/55 (10.9%)	1.000
Farmer	22/266 (8.3%)	10/169 (5.9%)	0.467	20/197 (10.2%)	9/114 (7.9%)	0.647	2/69 (2.9%)	1/55 (1.8%)	1.000
Worker	16/266 (6.0%)	5/169 (3.0%)	0.222	14/197 (7.1%)	5/114 (4.4%)	0.472	2/69 (2.9%)	0/55 (0%)	0.502
Official	10/266 (3.8%)	4/169 (2.4%)	0.601	9/197 (4.6%)	4/114 (3.5%)	0.774	1/69 (1.4%)	0/55 (0%)	1.000
Retired	76/266 (28.6%)	45/169 (26.6%)	0.659	67/197 (34.0%)	34/144 (29.8%)	0.448	9/69 (13.0%)	11/55 (20.0%)	0.423
Housewife	48/266 (18.0%)	37/169 (21.9%)	0.324	–	–	–	48/69 (69.6%)	37/55 (67.3%)	0.937
Having income level ≥1000TL (%)	183/278 (65.8%)	74/173 (42.8%)	<0.001	135/203 (66.5%)	51/116 (44.0%)	<0.001	48/75 (64.0%)	23/57 (40.4%)	0.007
Providing income himself/herself (%)	165/281 (58.7%)	82/173 (47.4%)	0.019	148/206 (71.8%)	66/116 (56.9%)	0.006	17/75 (22.7%)	16/57 (28.1%)	0.612
Having regular doctor visits (%)	213/280 (76.1%)	101/174 (58.0%)	<0.001	152/206 (73.8%)	69/117 (59.0%)	0.006	61/74 (82.4%)	32/57 (56.1%)	0.002
Controlling weight regularly (%)	146/280 (52.1%)	69/176 (39.2%)	0.007	102/204 (50.0%)	50/119 (42.0%)	0.166	44/76 (57.9%)	19/57 (33.3%)	0.005
Exercising regularly (%)	71/274 (25.9%)	33/163 (20.2%)	0.179	59/198 (29.8%)	21/108 (19.4%)	0.049	12/76 (15.8%)	12/55 (21.8%)	0.515
Complying with doctors' dietary advices (%)	145/281 (51.6%)	78/175 (44.6%)	0.144	100/205 (48.8%)	57/119 (47.9%)	0.878	45/76 (59.2%)	21/56 (37.5%)	0.014
Using medications regularly (%)	245/281 (87.2%)	135/176 (76.7%)	0.004	177/205 (86.3%)	93/119 (78.2%)	0.080	68/76 (89.5%)	42/57 (73.7%)	0.031

NYHA: New York Heart Association.

Table 2. Univariate logistic regression analyses for predicting better NYHA classification for males, females, and for all patients

Variables	*p*	OR	95% CI
All patients			
Age	<0.001	0.972	0.958–0.986
Female gender	0.205	0.767	0.508–1.156
Ejection fraction	<0.001	1.046	1.024–1.069
Being worker	0.156	2.099	0.754–5.841
Having income level ≥1000 TL	<0.001	2.577	1.745–3.807
Providing income himself/herself	0.019	1.579	1.078–2.311
Having regular doctor visits	<0.001	2.298	1.529–3.454
Controlling weight regularly	0.007	1.690	1.152–2.478
Using medications regularly	0.004	2.067	1.261–3.389
Exercising regularly	0.179	1.378	0.863–2.200
Complying with doctors' dietary advices	0.145	1.326	0.908–1.937
Male patients			
Age	0.005	0.976	0.959–0.993
Hypertension	0.240	0.739	0.446–1.224
Diabetes Mellitus	0.091	0.581	0.310–1.090
Ejection fraction	<0.001	1.052	1.025–1.080
Being self-employed	0.083	0.663	0.417–1.055
Having income level ≥1000 TL	<0.001	2.530	1.584–4.042
Providing income himself	0.007	1.933	1.200–3.114
Having regular doctor visits	0.006	1.958	1.210–3.170
Controlling weight regularly	0.166	1.380	0.875–2.177
Exercising regularly	0.050	1.758	0.999–3.096
Using medications regularly	0.058	1.767	0.980–3.188
Female patients			
Age	0.008	0.966	0.941–0.991
Ejection fraction	0.062	1.037	0.998–1.077
Having income level ≥1000 TL	0.008	2.628	1.294–5.339
Having regular doctor visits	0.001	3.666	1.655–8.119
Controlling weight regularly	0.006	2.750	1.346–5.619
Complying with doctors' dietary advices	0.015	2.419	1.191–4.914
Using medications regularly	0.021	3.036	1.185–7.774

All variables in Table 1 were examined and only those significant at a p<0.25 level are shown in univariate analysis. CI: Confidence interval; OR: Odds ratio.

parameters. However, rate of patients who regularly controlled their weight, who complied with dietary advice, and who used medications regularly were higher in Group 1 than in Group 2, only in female patients. In the analysis of both genders, patients with better functional classification were younger. In addition, ratio of patients with income ≥1000 TL and that of patients who attended regular doctor visits were higher in Group 1.

In univariate analysis, income level ≥1000 TL, providing family income, younger age, higher EF, male gender, being an employee, attending regular doctor visits, regularly controlling weight, using medications regularly, exercising regularly, and

Table 3. Multivariate logistic regression analyses for predicting better NYHA classification for males, females, and for all patients

First step				Final step			
Variables	*p*	OR	95%CI	Variables	*p*	OR	95%CI
All patients							
Age (years)	0.008	0.975	0.957–0.994	Age (years)	<0.001	0.969	0.953–0.986
Female gender	0.231	0.716	0.415–1.236	Ejection fraction (%)	<0.001	1.097	1.064–1.130
Ejection fraction (%)	<0.001	1.096	1.065–1.130	Having income level ≥1000 TL	<0.001	2.968	1.872–4.708
Being worker	0.163	2.296	0.714–7.385	Female gender	0.050	0.606	0.367–0.999
Having income level ≥1000 TL	<0.001	2.969	1.827–4.824				
Providing income himself/herself	0.302	1.319	0.779–2.234				
Having regular doctor visits	0.388	1.297	0.718–2.343				
Controlling weight regularly	0.460	1.225	0.715–2.099				
Exercising regularly	0.589	1.177	0.651–2.129				
Complying with doctors' dietary advices	0.553	1.173	0.692–1.987				
Using medications regularly	0.710	1.145	0.560–2.339				
Male patients							
Age	0.004	0.966	0.943–0.989	Age	0.002	0.970	0.952–.989
Presence of HT	0.984	0.993	0.491–2.006	Ejection fraction (%)	<0.001	1.063	1.032–1.094
Presence of DM	0.390	0.665	0.263–1.683	Having income level ≥1000 TL	0.004	2.128	1.270–3.565
Ejection fraction (%)	<0.001	1.115	1.072–1.159				
Being self-employed	0.123	0.625	0.344–1.135				
Having income level ≥1000 TL	<0.001	2.831	1.561–5.136				
Providing income himself	0.164	1.569	0.832–2.957				
Having regular doctor visits	0.513	1.256	0.635–2.483				
Controlling weight regularly	0.651	1.169	0.594–2.301				
Exercising regularly	0.269	1.512	0.727–3.145				
Using medications regularly	0.599	1.254	0.540–2.908				
Female patients							
Age (years)	0.207	0.979	0.948–1.012	Ejection fraction (%)	0.034	1.044	1.003–1.087
Ejection fraction (%)	0.107	1.037	0.992–1.084	Controlling weight regularly	0.003	3.026	1.446–6.333
Having income level ≥1000 TL	0.043	2.316	1.027–5.224				
Having regular doctor visits	0.769	1.190	0.372–3.807				
Controlling weight regularly	0.121	2.064	0.826–5.161				
Using medications regularly	0.309	1.853	0.565–6.081				
Complying with doctors' dietary advices	0.911	1.052	0.429–2.577				

All variables in Table 2 were entered into multivariate logistic regression analysis with backward LR method. CI: Confidence interval; DM: Diabetes mellitus; HT: Hypertension; OR: Odds ratio.

complying with dietary advice were found to be associated with better functional classification for the entire population (p<0.25; Table 2). When univariate analyses were performed separately by gender, providing family income and exercising regularly were associated with better functional classification, while presence of hypertension, diabetes mellitus, and being self-employed were associated with poorer functional classification for males. Complying with dietary advice was associated with better functional classification only for females, while income level ≥1000 TL, younger age, higher EF, attending regular doctor visits, regularly controlling weight, and regularly taking medication were associated with better functional classification for both genders.

Presented in Table 3 are factors associated with better NYHA functional classification, determined by multivariate logistic regression analysis for the total population, for males, and for females. For the total population, income level of ≥1000 TL, younger age, higher EF, and male gender were associated with better NYHA functional classification, independent from other variables. When multivariate analyses were performed separately for male and female patients, higher EF was found to be associated with better NYHA functional classification, independent from other vari-

ables, for both genders. While younger age and income level ≥1000 TL were found to be associated with better NYHA functional classification only for males, regular weight control was found to be associated with better NYHA functional classification only for females.

DISCUSSION

Chronic HF is a progressive syndrome that results in poor quality of life. The aim of HF treatment is to relieve symptoms, improve functional capacity, and achieve the highest quality of life. In order to ensure successful outcome, the importance of dietary discretion, adherence to medical treatment, and daily weight measurement should be understood by the patient. Meta-analyses suggest a 35% reduction in mortality in patients treated with optimal doses of beta-blockers, in addition to the benefit provided by angiotensin-converting-enzyme inhibitors.[8]

SES is a multidimensional construct that represents an individual's position, relative to others in the community. Income, education, employment, and family structure all affect SES.[9] It has been suggested that SES is correlated with higher adherence to medical treatment in patients suffering from chronic disease.[10,11]

NYHA classification, while subjective and variable over time, is a clinical measure of overall symptom burden in cases of HF. The classification was proposed in 1928 and has been revised several times, most recently in 1994.[12] It is an indicator of disease progression, hospitalization, and mortality. Higher NYHA classification is associated with increased rate of hospitalization, worse quality of life, and decreased rate of survival.[2]

Associations between SES and rates of mortality and hospitalization in HF patients have been reported. In a study by Zubin et al., level of income was found to be related to mortality in 30-day follow-up following hospitalization due to HF, and level of education was found to be associated with re-hospitalization.[13] Furthermore, effect of level of income on re-hospitalization rates in patients with HF has been studied, and it has been reported that level of education had no effect on re-hospitalization rates.[14–19]

While many studies have demonstrated the association of HF patient SES and prognosis, the association of SES and functional capacity had never been evaluated. In the present study, level of income, one of the most important indicators of SES, was demonstrated to be associated with functional capacity, independent from other variables. The number of patients with income greater than the hunger limit was higher in the group with better functional capacity. The ability of these patients to afford their medication is an important factor in adherence and functional capacity. Neither was it a surprise that younger age and higher EF were related to better functional capacity, independent from other variables, in accordance with the results of others. Relatively higher distribution of poor NYHA functional classification among women may be due to exaggerated description of symptoms by women, compared to men.

Individuals with better (lower) functional classification regularly attended doctor visits, regularly controlled their weight, and regularly used medication. We attribute this to patient awareness of the disease, affecting adherence to therapy and increasing functional capacity. Interestingly, no significant differences were found in the level of education and occupation between functional capacity groups.

For the first time, factors associated with functional capacity were separately evaluated, and found to be different in females, compared to males and to the general population. Higher EF was found to be associated with better functional capacity in both genders, independent from other variables. However, monthly family income of 1000 TL or higher and younger age were associated with better functional capacity, independent from other variables, for male patients, but not for females. This may be attributed to the psychosocial condition of males, as the self-confidence of these males may affect behavioral characteristics and hierarchy in the decision-making process, increasing treatment adherence. In female patients, regularly controlling weight was the single factor found to be independently associated with better functional capacity, other than EF. We attribute this to women being more attentive to health status and weight, though the low number of female patients included and the high number (64%) of housewives represented may have affected this result.

In addition, several limitations may have affected the present study. NYHA classification involves subjective judgement of symptoms and clinical data, and wide inter-observer and intra-observer variability

have been reported. Functional status can be affected by a variety of psychological and environmental factors, and cognitive factors and patient attitude may also affect adherence to therapy.

In the present study, the factor associated with better functional capacity in females was found to be different from that of the general population. However, this result may have been influenced by the low number of females included and the high number of housewives among them. This finding should be supported with more extensive studies. In addition, medico-social parameters such as regular control of weight, regular doctor visits, and regular use of medication were recorded according to patient statement, and were not confirmed by medical records. Lastly, the present results reflect only a cohort of Turkish HF patients.

In conclusion, higher EF was presently shown to be associated with better functional capacity, independent from other variables, in each gender. In addition to younger age, income ≥1000 TL, a socio-psychological parameter, was found to be associated with better functional capacity in males. Regularly controlling weight, a medico-social parameter, was found to be associated with better functional capacity in females. The present study was the first to demonstrate an association between functional capacity and SES in a cohort of Turkish HF patients.

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