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**Original Research**

# Depressive symptoms and physical functioning: are older females and males different?

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**Abstract**

Objectives. Determine whether depressive symptoms impact males' and females' self-reported physical functioning differently. Methods. Subjects were community dwelling older persons with coronary artery disease and hypertension. Subjects responded to survey items from the Center for Epidemiologic Studies-Depression (CESD) scale and the SF-36 physical functioning domain. Results. 1023 subjects returned both baseline and 1-year surveys. Females reported lower physical functioning, although males reported more baseline medical conditions. Older females, living alone, with less than a high school education, and higher depression symptom scores reported more limitations. Women at high risk of being depressed scored 20.9 points (out of 100) lower on the physical functioning scale; men at high risk scored 32.2 points lower than men not at risk. Conclusion. Although depression occurs more frequently among older females, it has greater impact on older males. Healthcare practitioners should increase their efforts to detect later-life depression and assess its effect on older persons' independence.



## INTRODUCTION

Physical, social, and role functioning are worse among older persons with major depressive disorder or moderate-to-severe depressive symptoms [1], with rates being consistently higher among older women [2,3]. Several phenomena may introduce gender differences in [1] self-reported physical functioning and [2] self reported-health status, even at equal levels of physical health. Gender-based stereotypes are important determinants of perceptions and reactions to current health situations [3,4]. One such stereotype purports that men are more physically oriented and their health assessments are more invested in their abilities to do heavier physical labor or strenuous activities. If physical functioning (e.g., walking long distances, heavy lifting, participating in strenuous sports) is a more integral part of the average male's self-image, then it would not be surprising to observe men underreporting their factual physical limitations to preserve their self-image and reduce gender role conflict [5,6].

Health status differences are the consequence of different bases for females' and males' health-related comparisons. Females typically engage in downward subjective health comparisons to a greater extent than males and males tend to compare themselves against their own previous status, not with other males' status [7]. Downward social comparisons occur when persons preferentially compare themselves with others who are less well when making subjective health

comparisons [7]. Subjective downward health comparisons originate from the need for emotionally protective evaluation to ameliorate psychological distresses caused by one's own health problems. Although not universally accepted [5], subjective health comparisons are one plausible explanation for why women generally report more health problems than males, even with similar health conditions [8,9].

However, depression could conceivably alter these patterns and limit everyday activities [10]. The depression syndrome has two major components, namely the mood and physical aspects. Depression's disabling mood-related consequences are lack of optimism, dysphoria, hopelessness and anhedonia that may suppress an individual's propensity for favorable subjective health comparisons. Given that women are apt to already have lower health comparisons, the mood-related consequences of depression may result in males being relatively less optimistic about their continued ability to participate in vigorous daily activities.

With regard to the physical symptoms, depressed individuals are more fatigued, less able to concentrate, and have less interest in participating in normal daily activities, let alone strenuous or vigorous activities. Consequently, if males' more strenuous physical activities decrease relatively more when moderate-to-severely depressed, it may result in unfavorable subjective health comparisons and reports of more physical limitations. Conversely, moderate-to-severely depressed females might persist in home-related activities and report physical functioning levels similar to previous levels because these tasks are less influenced by the physical symptoms of depression. As a result of both of these phenomena, the gender differences observed in self-reported physical functioning and health status observed among the non-depressed would diminish among the clinically depressed. Closing the gap between females' and males' self-reported physical functioning may be the result of males recalibrating their self-assessments of current functioning based on comparisons with past functioning viewed through depression's "black-colored" lenses [11], while females' assessments remain relatively stable.

Depression occurs at different rates among females and males and clearly impacts physical functioning [1-3,12,13]. However, studies examining gender's moderating influence on the association between depression and functional limitations are cross-sectional and retrospective. While the relationship between higher levels of depressive symptoms and reduced physical impairment is clear [14,15], whether it is similar for females and males is unknown.

Our study investigated our preliminary model regarding whether depressive symptoms influence physical functioning differently among women and men with chronic illnesses (Figure 1). To test our model, our first objective was to examine the relationship between physical functioning and gender after controlling for depressive symptoms. Our hypothesis was that males' and females' physical functioning would be similar when depressed and lower when not at risk of depression. We hypothesized that it would be lower because of females' greater propensity toward reporting more health problems than males, even with similar health conditions. Our second objective was to examine the relationship between subjective health comparisons and gender after controlling for depressive symptoms. Our second hypothesis is similar to the first, namely males' and females' health comparisons should be similar among those that are depressed. However, females' subjective health comparisons should be higher than males' among those not at high risk of being depressed because of their downward comparisons with peers. Our final objective was to determine whether males' and females' self-reported physical functioning differs by examining the interaction of gender with depression. We hypothesized that the interaction term would be statistically significant indicating that males' and females' functioning differed depending whether they were at high risk of being depressed, after adjusting for subjective health comparisons. A rigorous test of the model would require all three hypotheses to be confirmed and in the appropriate direction (e.g., females > males or vice versa).

## METHODS

The Study of Antihypertensive Drugs and Depressive Symptoms (SADD-Sx) [16] was a substudy of the INternational VErapamil/trandolapril STudy (INVEST) [17]. INVEST was conducted September 1997 to February 2003 at 862 sites in 14 countries. INVEST enrolled 22,576 patients. Patients in INVEST were drawn from approximately 1,500 primary care site physicians. Each study physician was tasked to enroll about 15 to 20 patients [17]. After a cardiovascular history and physical exam, INVEST randomized coronary artery disease (CAD) patients who were ≥50 years old to either a verapamil SR- or an atenolol-based multi-drug antihypertensive treatment strategy.

A subset of consecutively randomized US patients were enrolled in SADD-Sx between April 1, and October 31, 1999 (N=2,317). Each patient was mailed a survey within 24 hours of randomization and one year later. A second survey was mailed if the initial survey was not returned within ten working days for each survey administration. No further contacts were made if

patients did not respond to the second survey.

Useable baseline responses were returned by 1,579 patients (70.7%). Reasons for non-response to both surveys included undeliverable or incorrect addresses (n=40), the respondent returned one or both of the surveys incomplete (n=300), the patient died (n=25), or both surveys were not returned for unreported reasons (n=708). In addition, 221 patients returned the second survey incomplete because they discontinued the study drugs and they thought their responses would be invalid. Both baseline and 1-year follow-up surveys were received from 1,023 respondents (47.2%).

Outcome Variable. Respondents' scores on the 1-year physical functioning domain of the Medical Outcomes Study 36-Item Short Form (SF-36) contained in the survey was the primary outcome variable [18]. Physical functioning is scored on a scale of 0 to100, with higher scores indicating fewer self-reported functional limitations. Respondents answered 10-items that asked whether their health interfered with their physical functioning. They responded on to a three-point Likert scale indicating their health poses "no limits", "limits a little", or "limits a lot." Items included questions about vigorous activities (e.g., heavy lifting, strenuous sports), moderate activities (e.g., stooping, pushing a vacuum cleaner, bending), walking a mile, several blocks or a single block, climbing one or several flights of stairs, or dressing and grooming oneself. If the hypothesis of depression impacting health perceptions is to be supported, the males and females should be similar when depressed and significantly different when not depressed. Consequently, each domain was compared versus the composite score. Given the number of comparisons needed to support the hypothesis using this rationale, the Bonferroni adjustment was used to mitigate the likelihood of experiment-wise error.

Predictor Variable: Gender. The INVEST investigator-physician conducted a physical and medical history at baseline and the information was forwarded to the INVEST data center. The physician investigator documented whether the patient was female (0) or male (1).

Predictor Variable: Depressive symptoms. The survey also included the Center for Epidemiologic Studies-Depression (CESD) Scale. The CESD is a self-reported 20-item instrument designed to measure the current level of depressive symptoms with an emphasis on depressed mood [19]. The continuous CESD score (range=0 to 60) represented the level of depressive symptoms in the primary regression model.

As a screening tool, the CES-D has been used to estimate the presence of clinically significant depression. [19, 20] For the purposes of risk classification and graphical display, a score ≥23 was used to classify respondents as closely resembling clinically depressed patients. Patients score ≥23 were classified as at "high risk" of being depressed (1) and <23 classified as not at high risk (0). This conservative cut-point is recommended for subjects with chronic physical diseases, such as CAD, whose symptoms might otherwise be confused with the physical symptoms of depressive disorders [3,21].

Downward health comparisons. Two items from the SF-36 embedded in the 1-year follow-up survey were used to operationalize the concept of "downward health comparisons". In the first item, respondents rated their current health as excellent, very good, good, fair, or poor. In the second item, respondents rated their current health compared to 1-year ago as much better, somewhat better, about the same, somewhat worse, or much worse. In our second hypothesis, the impact of females' higher propensity for emotionally protective, downward health comparisons was hypothesized to be confirmed if (1) we found that females' subjective health comparisons were higher than males' among those not at high risk of being depressed and similar among those that are depressed and (2) if females' perceptions of their health compared to 1-year ago were higher than males' among those not at high risk of being depressed and similar among those that are depressed. The concept will also be considered to be supported if males' and females' responses to the health status questions are similar if males report more medical conditions or females' report better health status if their medical conditions are similar.

Covariates. Certain medical conditions significantly influence older persons physical functioning (e.g., stroke, coronary artery disease). Consequently, their influence on physical functioning may be confounded with the influence of depression. Medical conditions, other than depressive symptoms, were determined by physical exam or history and documented (0=not present; 1=present) by INVEST physicians at both the baseline and 1-year medical visits. Protocol documentation included historical or current abnormal coronary angiogram, angina, myocardial infarction (MI), coronary artery bypass graft (CABG), left ventricular hypertrophy, congestive heart failure (CHF), and cardiac arrhythmias. Histories of diabetes or hypercholesterolemia were defined by a medical history and/or currently taking glucose or cholesterol lowering medications. History of Alzheimer's disease, gastrointestinal bleeding, Parkinson's disease, cancer, stroke, transient ischemic attack, peripheral vascular disease, age, and random assignment to the atenolol-led (0) or verapamil-SR-led (1) hypertension treatment were documented for each respondent. The respondent's age was continuous.

Additional explanatory variables contained in the survey and previously shown to be associated with depression and higher depressive symptoms were the respondents' educational level (0=not high school graduate; 1=high school graduate), living status (0=alone; 1=with someone), and race (0=Caucasian; 1=non-Caucasian). Finally, patients were asked if "…a medical doctor or psychiatrist has ever told you that you were depressed" (0 = no or I don't know; 1 = yes). No further corroboration of the history of treatment for depression was made, nor was any additional information collected regarding onset, duration, severity, or psychological or antidepressant treatment [22,23].

Statistical analysis. Females' and males' baseline demographic characteristics, medical conditions and risk of depression were compared using chi-square analyses for categorical variables and independent t-tests for age. Our first objective examined the association between individual physical functioning items and gender using chi-square analyses, controlling for risk of being depressed, and then using Pearson's correlations [r] and partial correlations [r]. Our second objective examined the association between the subjective health comparisons and gender, controlling for risk of being depressed using chi-square. Third, hierarchical regression models tested the interaction between gender and 1-year CESD score to ascertain if depressive symptoms impacted females' and males' physical functioning differently. Demographic characteristics, baseline medical conditions, antihypertensive treatment strategy, baseline and 1-year follow-up depressive symptoms were entered in the first model and the two subjective health comparison variables were entered in the second model. The gender-risk interaction was entered in the third model. In each case, if the change in explained variance (R2) was significant, then the variables included in the model improved prediction of self-reported physical functioning.

SADD-Sx was conducted according to the principles of the Declaration of Helsinki and was approved by the University of Florida Institutional Review Board. The a priori level of statistical significance was alpha=0.05. When the Bonferroni adjustment for multiple comparisons was indicated for Objective 1 and Objective 2, the a priori level for rejecting the null hypothesis was adjusted to alpha=0.005.

## RESULTS

Comparison of Survey Respondents and Non-respondents. Nearly 54% (n=1,247) of the initial sample were males and the remainder were female (n=1,070). Demographic and clinical data were compared for those who responded to both surveys (N=1,023) and those who did not complete both surveys (n=1,294). Females were somewhat less likely to return both surveys (46.1% versus 41.9%, chi-square = 3.80(1), p=.051). Respondents' who completed both surveys averaged 67.2 ± 9.4 years and were similar to those who did not (67.8 ± 10.6, independent t-test = -0.21 (2,315), p=0.83). Both responders and non-responders were similar at baseline with regard to history of baseline medical conditions and were equally likely to die or have a stroke or MI within 1-year.

Respondents who returned the baseline survey, but not the 1-year survey (n=556), were more likely to report more depressive symptoms (16.1 ± 12.2 versus 13.8 ± 10.9, independent t-test = 3.77 (1577), $p < 0.001$), be at high risk of being depressed (20.3% versus 11.3%, chi-square = 35.45(1), $p < 0.001$), have a history of depression (21.9% versus 17.0%, chi-square = 5.47(1), $p = 0.02$), and less likely to have a high school education (39.1% versus 32.9%, chi-square = 6.11(1), $p = 0.01$). Although these covariates were significantly different, the zero order correlations between baseline depressive symptoms and physical functioning were the same ($r = -0.43$, $P<.001$) for those who returned both surveys (df = 1,010) and those who returned only the baseline survey (df = 535). So, while some of the respondents' demographic characteristics and mental health risk factors were associated with differences in response rate, the relationships between the key predictor and outcome variables were identical for responders and non-responders. They did not differ on the other variables.

Gender Comparison of Baseline Medical Status. In general, males were more likely to have documented baseline medical conditions (Table 1), namely abnormal coronary angiogram, MI, and coronary angioplasty. Histories of left ventricular hypertrophy and classical angina were more prevalent in females, reports of angina symptoms within the past week did not differ. Among the remaining medical conditions, males were somewhat more likely to have them documented, although females and males were statistically similar. After 1-year, the proportions of females and males who had a stroke or an MI were similar.

A higher proportion of females also were at higher risk of being depressed compared to males at baseline, but the proportion at risk was more similar after one-year (Table 1). Females also were more likely to report a history of depression.

Objective #1: Gender Comparisons of Physical Functioning and Risk of Being Depressed. Although males generally reported more baseline medical conditions, females' and males' responses were

**Table 1.** Comparison of female and male physical medical conditions and adverse events (n=1,023).

| Morbidity<br>Baseline History of: | Percent Female<br>(n=450) | Percent Male<br>(n=573) | p-value † |
|---|---|---|---|
| Hypercholesterolemia | 71.1 | 69.5 | .61 |
| Abnormal Coronary Angiogram | 58.7 | 74.3 | <.001 |
| Classical Angina | 52.4 | 38.6 | <.001 |
| Taking Lipid Lowering Agent | 49.3 | 55.1 | .07 |
| Myocardial Infarction | 41.1 | 48.7 | .02 |
| Smoking | 36.9 | 64.0 | <.001 |
| Diabetes | 32.2 | 26.7 | .06 |
| Abnormal Stress Test | 26.4 | 29.0 | .41 |
| Coronary Angioplasty | 25.1 | 31.2 | .04 |
| Left Ventricular Hypertrophy | 22.9 | 15.9 | .006 |
| Angina Symptoms Within the Past Week | 18.2 | 16.1 | .41 |
| Peripheral Vascular Disease | 13.3 | 14.3 | .72 |
| Congestive Heart Failure | 7.8 | 5.1 | .10 |
| Arrhythmias | 7.6 | 8.4 | .72 |
| Stroke | 6.9 | 5.9 | .62 |
| Cancer | 6.2 | 3.7 | .08 |
| Transient Ischemic Attack | 4.9 | 4.9 | 1.00 |
| Gastrointestinal Bleed | 1.6 | 1.9 | .84 |
| Alzheimer's | 0.3 | 0.4 | 1.00 |
| Prior history of depression (n=989) ‡ | 22.0 | 13.0 | < 0.001 |
| High risk of depression at baseline (CESD ≥23) | 25.6 | 16.2 | < 0.001 |
| High risk of depression after 1-year (CESD ≥23, n=1,010) ‡ | 20.6 | 16.7 | .12 |
| New morbidity occurred between baseline and 1-year follow-up. | | | |
| Stroke | 0.4 | 1.4 | .22 |
| Myocardial Infarction | 0.4 | 0.5 | 1.00 |

† p-value based upon Corrected Chi-square, degrees of freedom=1
‡ Discrepancies from overall sample size (n=1,023) due to missing responses to questions in the survey.

generally similar among those at high risk of being depressed (CESD score ≥23) on all of the SF-36 items within the physical functioning domain with two exceptions (Table 2). Alternatively, females expressed more functional limitations for every item at both survey administrations among those at low risk of being depressed. Females reported more limitations performing vigorous and moderate activities; carrying groceries; climbing stairs; bending, kneeling or stooping; bathing and dressing; and walking. In other words, females reported more limitations than males in 16 of 16 comparisons when not depressed (CES-D < 23) and similar levels of limitations in 14 of 16 instances when depressive symptoms scores exceeded the CES-D threshold for classification of at high risk of being depressed. So, the configuration of results hypothesized to demonstrate the modification downward comparisons by depressive symptoms was supported in 30 of 32 comparisons.

Objective #2: Gender Comparisons of Subjective Health Comparisons and Risk of Being Depressed. Similarly, females and males indicated equally low levels on the SF-36 self-rated health items when they were at high risk of being depressed (Table 3). However, when they were at lower risk, females were more likely to rate their health as excellent, very good or good (69.7% versus 76.2%) and less likely to rate their health as only fair or poor (30.3% versus 23.8%). When asked to compare their health to one year ago, females and males again were likely to respond similarly if they were at high risk of being depressed (Table 3). However, females were more likely than males to say that their health is better or much better (40.2% versus 31.4%), whereas males were more likely to report their health as the same (54.0% versus 61.8%) when not at risk of being depressed, indicating more favorable subjective health comparisons for females.

Objective #3: Gender, Depressive Symptoms and Physical Functioning. Females' physical functioning scores were lower than males' scores among those who responded to the 1-year survey (46.1 ± 27.8 versus 60.7 ± 28.6, independent t-test = 8.14(1,001), P<.001; β = 0.25). One-year physical functioning was correlated with baseline depressive symptoms (r(1,001) = -0.42,

**Table 2.** Comparison of female and male physical functioning limitations at baseline and 1-year.

| | Percent Baseline Limits | | | | | | Percent 1-year Limits | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Risk of Depressive Symptoms | At High Risk (≥23) (n=354) (f=198; m=156) | | | Not At High Risk (<23) (n=1,225) (f=503; m=722) | | | At High Risk (≥23) (n=199) (f=96, m=103) | | | Not At High Risk (<23) (n=824) (f=351; m=473) | | |
| Limitations | A lot | A little | No limits | A lot | A little | No limits | A lot | A little | No limits | A lot | A little | No limits |
| Vigorous Activities | | | | | | | | | | | | |
| Female | 76.0 | 15.6 | 8.3 | 68.4 | 24.0 | 7.6 | 73.3 | 23.3 | 3.3 | 59.5 | 32.8 | 7.6 |
| Males | 72.5 | 20.3 | 7.2 | 55.8 | 33.0 | 11.1 | 80.2 | 18.7 | 1.1 | 45.7 | 42.6 | 11.7 |
| Chi-square$_{(df)}$, p-value | $1.32_{(2)}$, P=.52 | | | $19.2_{(2)}$, P<.001 | | | $1.77_{(2)}$, P=0.41 | | | $15.49_{(2)}$, P<.001 | | |
| Moderate Activities | | | | | | | | | | | | |
| Female | 51.1 | 37.9 | 11.1 | 32.5 | 40.0 | 27.6 | 54.9 | 40.7 | 4.4 | 26.4 | 49.9 | 23.8 |
| Male | 41.4 | 43.4 | 15.1 | 14.9 | 38.6 | 46.6 | 44.9 | 47.2 | 7.9 | 13.0 | 37.4 | 49.6 |
| Chi-square$_{(df)}$, p-value | $3.40_{(2)}$, P=.18 | | | $67.8_{(2)}$, P<.001 | | | $2.22_{(2)}$, P=.33 | | | $59.58_{(2)}$, P<.001 | | |
| Lifting/Carrying Groceries | | | | | | | | | | | | |
| Female | 46.8 | 38.9 | 14.2 | 21.1 | 44.3 | 34.6 | 42.9 | 50.5 | 6.6 | 21.1 | 44.2 | 34.8 |
| Male | 23.7 | 53.9 | 22.4 | 7.4 | 31.4 | 61.2 | 32.2 | 52.5 | 15.6 | 6.3 | 27.7 | 65.9 |
| Chi-square$_{(df)}$, p-value | $19.71_{(2)}$, P<.001 | | | $95.7_{(2)}$, P<.001 | | | $4.68_{(2)}$, P=.10 | | | $84.89_{(2)}$, P<.001 | | |
| Climbing Several Flights Stairs | | | | | | | | | | | | |
| Female | 66.5 | 24.6 | 8.9 | 48.0 | 43.2 | 16.2 | 71.1 | 24.4 | 4.4 | 46.6 | 40.7 | 13.7 |
| Male | 60.8 | 28.1 | 11.1 | 28.6 | 40.2 | 28.2 | 76.9 | 19.8 | 3.3 | 32.0 | 40.2 | 27.3 |
| Chi-square$_{(df)}$, p-value | $1.25_{(2)}$, P=.54 | | | $50.80_{(2)}$, P<.001 | | | $0.81_{(2)}$, P=.67 | | | $27.91_{(2)}$, P<.001 | | |
| Climbing One Flight of Stairs | | | | | | | | | | | | |
| Female | 39.8 | 47.6 | 12.6 | 20.3 | 40.4 | 39.3 | 44.4 | 45.6 | 10.0 | 20.7 | 37.6 | 41.7 |
| Male | 28.9 | 50.0 | 21.1 | 10.1 | 29.1 | 60.8 | 27.5 | 57.1 | 15.4 | 5.8 | 32.3 | 61.9 |
| Chi-square$_{(df)}$, p-value | $6.69_{(2)}$, P=.04 | | | $57.37_{(2)}$, P<.001 | | | $5.84_{(2)}$, P=.06 | | | $52.09_{(2)}$, P<.001 | | |
| Bending, Kneeling or Stooping | | | | | | | | | | | | |
| Female | 53.1 | 35.9 | 10.9 | 32.5 | 41.9 | 25.6 | 56.7 | 36.7 | 6.7 | 26.9 | 48.2 | 24.9 |
| Male | 40.5 | 45.1 | 14.4 | 21.1 | 41.6 | 37.3 | 44.0 | 44.0 | 12.1 | 17.1 | 44.5 | 38.4 |
| Chi-square$_{(df)}$, p-value | $5.44_{(2)}$, P=.07 | | | $26.70_{(2)}$, P<.001 | | | $3.47_{(2)}$, P=.18 | | | $20.43_{(2)}$, P<.001 | | |
| Walking More Than a Mile | | | | | | | | | | | | |
| Female | 69.8 | 17.7 | 12.5 | 53.7 | 25.3 | 21.0 | 71.9 | 23.6 | 4.5 | 52.1 | 29.1 | 18.8 |
| Male | 62.5 | 22.4 | 15.1 | 36.3 | 26.6 | 37.1 | 70.3 | 22.0 | 7.7 | 32.8 | 29.6 | 37.6 |
| Chi-square$_{(df)}$, p-value | $2.04_{(2)}$, P=.36 | | | $44.80_{(2)}$, P<.001 | | | $0.82_{(2)}$, P=.66 | | | $40.94_{(2)}$, P<.001 | | |
| Walking Several Blocks | | | | | | | | | | | | |
| Female | 55.4 | 31.1 | 13.5 | 39.2 | 28.8 | 32.0 | 62.9 | 24.7 | 12.4 | 38.9 | 31.0 | 30.1 |
| Male | 47.1 | 35.9 | 17.0 | 23.3 | 27.2 | 49.5 | 53.3 | 36.7 | 10.0 | 20.2 | 28.9 | 50.9 |
| Chi-square$_{(df)}$, p-value | $2.47_{(2)}$, P=.29 | | | $46.66_{(2)}$, P<.001 | | | $3.01_{(2)}$, P=.22 | | | $44.61_{(2)}$, P<.001 | | |
| Walking One Block | | | | | | | | | | | | |
| Female | 31.4 | 40.3 | 28.3 | 20.7 | 28.1 | 51.2 | 34.4 | 42.2 | 23.3 | 17.6 | 33.2 | 49.1 |
| Male | 23.0 | 46.7 | 30.3 | 8.8 | 22.4 | 68.9 | 30.8 | 40.7 | 28.6 | 6.9 | 23.8 | 69.3 |
| Chi-square$_{(df)}$, p-value | $3.07_{(2)}$, P=.22 | | | $47.89_{(2)}$, P<.001 | | | $0.69_{(2)}$, P=.71 | | | $38.97_{(2)}$, P<.001 | | |
| Bathing and Dressing Self | | | | | | | | | | | | |
| Female | 13.5 | 35.8 | 50.8 | 6.1 | 16.8 | 77.1 | 12.4 | 44.9 | 42.7 | 5.2 | 16.6 | 78.2 |
| Male | 7.9 | 37.1 | 55.0 | 4.5 | 10.8 | 84.7 | 9.8 | 45.7 | 44.6 | 2.6 | 8.7 | 88.7 |
| Chi-square$_{(df)}$, p-value | $2.66_{(2)}$, P=.26 | | | $11.30_{(2)}$, P=.004 | | | $0.31_{(2)}$, P=.86 | | | $16.54_{(2)}$, P<.001 | | |

Statistical significance was determined using the a priori alpha error < 0.005 adjusting for experiment-wise error (Bonferroni). However, the important point of this analysis is that all of the statistical tests are significant at this level if the patient is not at high risk of depression (CESD < 23) and most are not significant after adjusting for experiment-wise error if the patient is at high risk of depression (CESD ≥ 23); not the statistical significance of individual items

P<.001) and 1-year depressive symptoms (r(988) = -0.50; P<.001). However, after controlling for 1-year depressive symptoms, the association between 1-year physical functioning and baseline depressive symptoms declined (r(987) = -0.13, P<.001).

On average, patients with more depressive symptoms one-year after enrollment reported lower physical functioning (Table 4). Lower physical functioning also was reported by females, non-high school graduates, those who lived with alone, and those assigned to the atenolol-led blood pressure treatment group. The standardized coefficient between physical functioning and gender declined to 0.16 after adjusting for the demographic and medical and mental health variables. It was interesting to note, while a number of these medical conditions differed among males and females at baseline, only history of angina, stroke, or diabetes were associated with functioning.

In Model 2, female gender (β=0.18), older age, living alone, history of baseline stroke and diabetes, assignment to the atenolol treatment strategy and more 1-year depressive symptoms still predicted lower 1-year physical functioning. Conversely, respondents who rated their health as excellent, very good, or good had better physical functioning than those who rated their health as fair or poor. Likewise, persons reporting

**Table 3.** Female and male self-rated health after 1-year according to risk of being depressed group as measured by the CESD.

| Depression Risk | | At High Risk (≥23) | | | Not At High Risk (<23) | | |
|---|---|---|---|---|---|---|---|
| Gender<br>Self-rated health | n† | Female (Percent) | Male (Percent) | Total (Percent) | Female (Percent) | Male (Percent) | Total (Percent) |
| Excellent | (n=33) | 1.1% | 1.1% | 1.1% | 3.5% | 4.1% | 3.9% |
| Very Good | (n=209) | 4.4% | 2.2% | 3.3% | 20.0% | 29.2% | 25.3% |
| Good | (n=403) | 28.6% | 23.9% | 26.2% | 46.2% | 42.9% | 44.3% |
| Fair | (n=292) | 54.9% | 47.8% | 51.4% | 27.9% | 22.3% | 24.7% |
| Poor | (n=48) | 11.0% | 25.0% | 18.0% | 2.4% | 1.5% | 1.9% |
| Total | (n=985) | 91 | 92 | 183 | 340 | 462 | 802 |
| | | | $X^2=6.50_{(4)}$<br>$p=0.17$ | | | $X^2=10.50_{(4)}$<br>$p=0.03$ | |

Female and male self-rated comparison of health compared to 1-year ago according to high risk of depression as measured by the CESD.

| | | At Risk (≥23) | | | Not At Risk (<23) | | |
|---|---|---|---|---|---|---|---|
| Gender | | Female (Percent) | Male (Percent) | Total (Percent) | Female (Percent) | Male (Percent) | Total (Percent) |
| Much better | (n=106) | 6.6% | 4.4% | 5.5% | 14.2% | 10.4% | 12.0% |
| Better | (n=214) | 18.7% | 13.2% | 15.9% | 26.0% | 21.0% | 23.1% |
| Same | (n=564) | 53.8% | 51.6% | 52.7% | 54.0% | 61.8% | 58.5% |
| Worse | (n=84) | 16.5% | 24.2% | 20.3% | 4.7% | 6.7% | 5.9% |
| Much Worse | (n=14) | 4.4% | 6.6% | 5.5% | 1.2% | 0.0% | 0.5% |
| Total | (n=982) | 91 | 91 | 182 | 339 | 461 | 800 |
| | | | $X^2=3.03_{(4)}$<br>$p=0.55$ | | | $X^2=13.16_{(4)}$<br>$p=0.01$ | |

† Differences in the number of subjects reported in the table and the original analytic sample are due to a small number of incomplete responses by patients to specific questions on the survey and list wise deletion of cases with incomplete responses.

Statistical significance was determined using the a priori alpha error < 0.005 adjusting for experiment-wise error. However, the important point of this analysis is that all of the statistical tests are significant at this level if the patient is not at high risk of depression (CESD < 23) and most are not significant after adjusting for experiment-wise error if the patient is at high risk of depression (CESD ≥ 23); not the statistical significance of individual item.

better and the same health as last year had higher physical functioning compared with those whose health was worse or much worse. After the additional adjustment for subjective health comparisons, the

impact of female gender remained nearly the same as it did in Model 1, but still less than the unadjusted impact.

Finally, the predicted gender x 1-year depressive symptom interaction was significant when added in Model 3, after adjusting for the previous demographic, medical/mental health, and subjective health variables. Additionally, after adjusting for the gender-depression risk interaction term, the standardized regression coefficient representing the association between gender and physical functioning increased by nearly 50 percent, bringing it to nearly the same magnitude as the unadjusted coefficient.

Table 4. Hierarchical ordinary least squares regression model predicting 1-year physical functioning level (n=977) §

| | Model 1 | t-test | Model 2 | t-test | Model 3 | t-test |
|---|---|---|---|---|---|---|
| | §β-coeff | value | β-coeff | value | β-coeff | value |
| Baseline Demographics and Medical Conditions* | | | | | | |
| Age | -0.19‡ | -6.83 | -0.18‡ | -6.94 | -0.18‡ | -7.01 |
| Female Gender | 0.16‡ | 5.70 | 0.18‡ | 6.94 | 0.26‡ | 6.85 |
| Non-Caucasian Race | 0.05 | 1.89 | 0.05 | 1.86 | 0.04 | 1.76 |
| High School Graduate | 0.08† | 2.83 | 0.04 | 1.62 | -0.04 | -1.44 |
| Living With Someone | -0.06¶ | -2.33 | -0.08¶ | -2.99 | -0.08† | -3.03 |
| No History of Angina at Baseline | -0.07¶ | -2.45 | -0.04¶ | -1.70 | -0.04 | -1.70 |
| No History of Stroke at Baseline | -0.06¶ | -2.10 | -0.05¶ | -1.96 | -0.05¶ | -1.96 |
| No History of Diabetes at Baseline | -0.10‡ | -3.71 | -0.07† | -2.78 | -0.06† | -2.66 |
| Assignment to Atenolol-led Strategy | 0.05¶ | 2.05 | 0.05¶ | 2.02 | .05¶ | 2.09 |
| Baseline CESD Score | -0.13‡ | -3.25 | -0.14‡ | -3.86 | -0.15‡ | -3.99 |
| 1-year CESD Score | -0.39‡ | -10.29 | -0.22‡ | 5.95 | -0.14‡ | -3.16 |
| Self-Rated Health: E,VG,G versus FP | --- | --- | 0.32‡ | 11.36 | 0.32‡ | 11.24 |
| Compared to Last Year Health is Better | --- | --- | 0.19‡ | 4.18 | 0.19‡ | 4.08 |
| Compared to Last Year Health is the Same | --- | --- | 0.12 | 2.64 | 0.11† | 2.55 |
| 1-year CESD x Gender Interaction | --- | --- | --- | --- | -0.13† | -2.99 |
| Model Adjusted $R^2$ | 0.358 | | 0.470 | | 0.474 | |
| F-ratio of Model | 49.11‡ | | 60.99‡ | | 58.00 | |
| Degrees of freedom | 11, 940 | | 13, 938 | | 14, 937 | |
| Adjusted $R^2$ Change | 0.358 | | 0.112 | | .005 | |
| F-ratio of $R^2$ Change | 49.11‡ | | 66.71‡ | | 8.94‡ | |
| Change degrees of freedom | 11, 940 | | 2, 938 | | 1, 937 | |

¶ p ≤ .05

† p ≤ .01

‡ p ≤ .001

* Medical conditions not statistically significant are not reported for the purpose of displaying the most parsimonious model

§ Differences in the number of subjects reported in the table and the original analytic sample are due to a small number of incomplete responses by patients to specific questions on the survey and list wise deletion of cases with incomplete responses. B-coefficient = standardized regression coefficient.

E = Excellent, VG = Very Good, G = Good, F = Fair, P = Poor; CESD = Center for Epidemiologic Studies – Depression;

Unadjusted association between gender and SF-36 physical functioning domain = Unstandardized coefficient (SEE) = 14.6 (1.8); β = 0.249, t=8.14, p < .001.

When males and females were compared according to their risk of being depressed, the negative impact of depression on physical functioning was greater for males (Figure 1). First, males not at risk of being depressed reported significantly greater physical functioning compared to females not at risk (66.1 ± 26.6 versus 50.6 ± 27.3, t(807) = 8.08, p < .001). However, when males at high risk of being depressed were compared with high risk females, the physical functioning difference was only 4.2 points (33.9 ± 23.0 versus 29.7 ± 22.5, t(179) = 1.25, p=0.21). Females at high risk scored 20.9 points lower than females at low risk of being depressed on the physical functioning domain. On the other hand, males at high risk of being depressed scored 32.2 points lower than low risk males. None of the other interactions was significant.

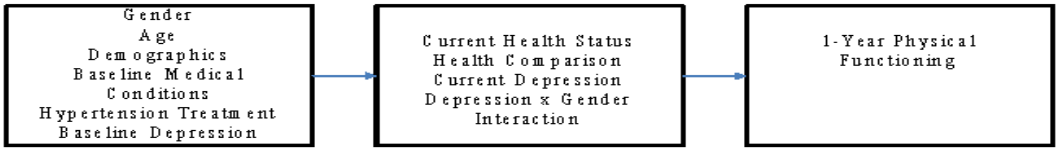


**Fig 1.** Model of the inter-relationship of gender, depression and health-related status and physical functioning

## DISCUSSION

Our first objectives were to compare females' and males' physical functioning and subjective health comparisons among patients at high and low risk of being depressed. According to the precepts of the downward comparison model, females should have (1) lower physical functioning and (2) more favorable impressions of their health than males at similar levels of health. Although all of these SADD-Sx patients had CAD and hypertension, females reported more functional impairments than males at low risk of depression in every instance. Females also were more likely than males to report their health as "excellent or good" or "better when compared to last year" when not at risk of depression, indicating more favorable health comparisons. Moreover, after adjusting for patients' self-ratings of health and current depression, females' physical functioning continued to decline in comparison to males' functioning. These findings are consistent with our notion of downward comparisons as an explanation for females' differing self-assessments. If subjective health comparisons do have a greater influence on women than men, it may be that women "under-report" their functional status at lower levels of depressive symptoms because they are comparing themselves to other females also who report more symptoms and lower functioning. However, females' favorable subjective health comparisons may not translate into subjective evaluations of functional status when at higher risk of being depressed. This "floor" effect indicates that depressed persons of both genders become more similar in their objective assessments and subjective health comparisons [24]. Just as men and women may be forming their perceptions of their self-reported health outcomes in a different way or on a different basis (i.e., downward comparisons [females] versus one's own previous status [males]) [25], they may also be doing the same with physical functioning. Alternatively, men may "over-report" their physical functioning to maintain their perceptions of their masculinity and to protect their egos by reducing gender role conflict and its inherent stresses [26,27]. This would be consistent with others' findings that gender roles operate differently for males and females [28]. Further exploration into the reasons for the apparent gender difference is warranted.

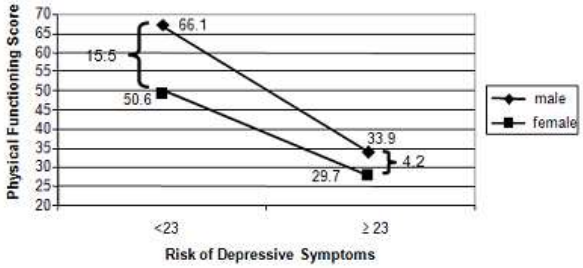


**Fig.2.** Interaction of physical functioning and depressive symptoms among males and females.

Our next objective was to determine whether males' and females' self-reported 1-year physical functioning differs by examining the interaction of gender with current depression; testing whether the "dark colored lenses" of depression impact females and males differently. Females and males at low risk of being depressed had dissimilar levels of physical functioning, but females and males at high risk reported similar levels. If males and females were equally impacted by depression, their scores should have been dissimilar in both instances according to the downward comparison model. Previous longitudinal studies have found that depression reduced physical functioning. However, to our knowledge, our finding of a statistical interaction is the first to test and support the hypothesis that physical functioning differences between those 'at risk' and 'not at risk' of being depressed was greater for men than women in a longitudinal study. At lower levels of depressive symptoms, females reported significantly more functional impairment than did males. At higher levels of depressive symptoms, females and males reported similar physical functioning. Our longitudinal findings differed from one cross-sectional study that did not show a significant interaction of gender and depression with respect to functional impairment [29]. However, our findings are similar to other cross-sectional studies that found more severe post-stroke depression was associated with more physical limitations for men than women [13, 30]. The importance of our findings in comparison is that (1) our study was longitudinal and (2) the depression-gender interaction and self-reported physical functioning analyses are both supportive of the notion of a downward comparison and the consequences that follow regarding how it modifies the impact of females' and males' depression on physical functioning.

Other findings in our study have implications, as well. First, the magnitude of the baseline depressive symptoms' association with 1-year physical functioning was significantly lower after adding 1-year depressive symptoms to the model. Earlier cross-sectional studies demonstrated that baseline depressive symptoms were associated with lower 1-year functional levels [31,32]. Our findings modify this notion somewhat, likely because previous cross-sectional studies report baseline depressive symptoms only and not 1-year depressive symptoms experienced at the same time as 1-year physical functioning. Our finding that the respondents' depressive symptoms from one year earlier were reduced by nearly two-thirds suggests that 1-year self-reported physical limitations were influenced mostly by current depressive symptoms. Consequently, the significant associations obtained from cross-sectional studies are inflated and confounded by 1-year functioning's association with unmeasured 1-year depressive symptoms. So, if depression is prevented or successfully treated, the result may be an improved chance of reducing, preventing, or ameliorating loss of physical functioning [33,34].

Another implication of our study involves the degree of influence that physical disease has on physical functioning, together with comorbid depressive symptoms. The primary assertion of Nagi's disablement process is that respondents are unable to perform their daily activities because of their physical health [35]. However, medical comorbidity is a weak predictor of physical functioning by itself [33, 36, 37]. If physical functioning were determined only by physical disease, then those with the same medical conditions would have the same level of physical functioning. This is clearly not the case. Our findings suggest that physical functioning levels are based on something more than the presence of a serious physical disease. Depression may influence physical functioning because it undermines individual patients' efforts to maintain higher physical functioning levels. In other words, persistent sadness, hopelessness, lack of optimism, anhedonia, and fatigue may affect respondents' capability and willingness to perform routine daily activities or maintain higher levels of functioning. The fact that others [15, 36, 38] also did not find the hypothesized association between physical diseases and functioning to be so simplistic raises the need for performance-based functioning measures in future research.

Finally, relative to the other variables, the contribution of age to the prediction of self-reported physical functioning was fourth largest. Furthermore, it was not significantly reduced after adding the demographic, medical and mental illness, and health status variables to the models. All of the patients in this sample had documented coronary artery disease (e.g., post-myocardial infarction, angina) which limit physical functioning of their own accord, in addition to other significant physical and mental comorbidities. However, these findings show that physical changes associated with normal aging may also impact self-reported physical functioning. These finding did not investigate other age-related physical changes such as reduced muscle mass and bone strength, and balance and gait changes.

## LIMITATIONS

The limitations of the study methods and sample should be considered when interpreting and applying the findings to other populations. First, the CESD score is not a diagnosis of depression, but a self-reported measure of depressive symptoms experienced in the previous two weeks. It is plausible that the mood-related symptoms associated with depression may influence physical functioning less than the somatic symptoms. However, CESD scores are not unduly influenced exclusively through the somatic items in older persons with chronic illness [20,39].

Second, missing data may introduce potential bias. Respondents who completed both baseline and 1-year surveys may differ from non-respondents. However, the magnitude of the depressive symptoms-physical functioning correlations obtained from the baseline measures of both groups was exactly the same. Moreover, the difference in the average correlation was < .02 (95% CI = -0.007 to .03; n=36 correlations, data available upon request) among the eight SF-36 items at baseline and the depressive symptoms measure between those who responded to both surveys and those responding to only the baseline survey.

Third, the relationship between depression and physical functioning is likely reciprocal. The model presented in this study assumes that the causal path goes from depressive symptoms to physical functioning and not vice versa. The recursive nature of this model should be tested using data containing more time points so that the temporal order of changes in depression and physical functioning can be observed.

Next, we are uncertain if women compared their current health to others with worse health or to their own health at a different time in the 1-year comparison. In order to explicitly test the downward comparison theory, it would be important to know if the women were comparing their health downward to others in poorer health. While the subjects' responses fit the hypothesized model, additional explanations must be considered as plausible until explicit tests of downward comparisons are confirmed in future work. Finally, this

study would have been strengthened with the use of performance based measures to validate patients' reported physical functioning.

On the other hand, this study is strengthened because the results reflect a population of community-dwelling persons with CAD and hypertension; highly prevalent conditions among older persons. Depressive symptoms still reduced physical functioning after controlling for CAD and hypertension—a finding important to a large segment of older persons. Also, the longitudinal nature of our data allowed for the elucidation of the impact of depression and gender on physical functioning over time.

## CONCLUSION

These findings suggest a differential nature in the physical functioning consequences of depressive symptoms in men and women. This gender difference is likely modified by depression's impact on males' and females' subjective health comparisons associated with gender roles and the degree of "downward health comparisons" in the development of subjective health ratings.

Our findings have several clinical and public policy implications for depression prevention, screening, and treatment. Women have a higher incidence of depression and, theoretically, should be monitored more frequently than their male counterparts. However, males appear to experience a disproportionate impact to their functional independence when depressed, potentially creating a larger burden on society. Maintaining an individual's ability and willingness to perform activities of daily living may reduce the need for earlier institutionalization and increase independent living time. Although older females generally report higher depressive symptoms, it is still a concern for males as they age and their health declines since their physical functioning is highly affected by their mood. Physical functioning may be improved by depression prevention, early detection, and successful treatment. Healthcare practitioners must remain attuned to their patients' affective mood over time to reduce the functional morbidity associated with later-life depression.

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