Published in final edited form as:

Psychosom Med. 2008 May ; 70(4): 417–421. doi:10.1097/PSY.0b013e31816f858d.

Patients With Worse Mental Health Report More Physical Limitations After Adjustment for Physical Performance

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Abstract

Objective—To determine whether mental health scores are associated with self-reported physical limitations after adjustment for physical performance. Patient-reported physical limitations are widely used to assess health status or the impact of disease. However, patients' mental health may influence their reports of their physical limitations.

Methods—Mental health and physical limitations were measured using the SF-36v2 mental health and physical functioning subscales in a cross-sectional study of 1024 participants. Physical performance was measured using tests of strength, endurance, dexterity, and flexibility. Multivariable linear regression was performed to examine the relationship between self-reported mental health and physical limitations adjusting for age, gender, race/ethnicity, education, body mass index, and measured physical performance.

Results—The score distributions for mental health and physical functioning were similar to that of the United States population in this age range. In unadjusted analyses, every 10-point decline in mental health scores was associated with a 4.8-point decline in physical functioning scores (95% Confidence Interval (CI) = -4.2 to -5.3; $p < .001$). After adjusting for covariables including measured physical performance, every 10-point decline in mental health scores was associated with a 3.0-point decline in physical functioning scores (95% CI = -2.5 to -3.6; $p < .001$).

Conclusions—People with poor mental health scores seem to report more physical limitations than would be expected based on physical performance. When comparing self-reported physical limitations between groups, it is important to consider differences in mental health.

Keywords

mental health; physical functioning; physical limitation; health status; self-assessment

INTRODUCTION

The evaluation of health status often involves an assessment of physical limitations using self-reported questionnaires. However, self-reported physical limitations correlate only moderately well with measures of physical performance (1-6). Many researchers have described performance-based measures and self-reported measures as complementary to each other in providing useful information about functional status (3,7,8). Performance-based measures and self-reported measures of physical limitations have been found to be independently predictive of mortality (9).

Self-reported physical limitations may be influenced by sociodemographic variables, personality, or cognitive or affective functioning (7). Depression may play a key role in this discrepancy between self-reported physical limitations and measures of physical performance (7,8,10). However, the studies that find depression or worse mental health associated with over-reporting of physical limitations after adjusting for measured physical performance have been few and limited to very select populations, e.g., individuals with either back pain or heart failure (8,10,11). Although one can envision how depression can lead to changes in attitudes, behavior, and perception and/or overestimation of disability, it remains unclear to what extent mental health influences self-assessment of physical limitations after adjusting for measured physical performance in more general populations not necessarily suffering from debilitating or traumatic conditions.

The objective of this study was to determine whether mental health scores are independently associated with self-reported physical limitations after adjustment for measured physical performance among a diverse population of middle-aged adults.

METHODS

Research Design and Study Population

We performed a cross-sectional study of participants recruited from two academic general internal medicine practices and two community clinics in Chicago, Illinois and Cleveland, Ohio. Patients were eligible if they were aged 45 to 64 years. This age group was chosen to capture a wider range of health status, physical functioning, and comorbid illnesses as compared with that of young adults. Patients were excluded if they were nonambulatory, had a body mass index (BMI) of $>35 \text{ kg/m}^2$, or did not speak English or Spanish. For safety, patients were also excluded if their resting heart rate was <56 or >90 beats/minute, resting respiratory rate was >17 breaths/minute, or resting blood pressure was $>160/100$ mm Hg. Next, potential participants were asked a series of questions from the Physical Activity Readiness Questionnaire (12) to determine ability to exercise safely. Patients who answered "yes" to any of the seven screening questions were asked to get written approval from their physician before enrolling in the study.

Recruitment and Study Protocol

All eligible study patients aged 45 to 65 years were recruited in person or contacted via letter and/or telephone. In addition, study fliers were posted in the clinics where the study was conducted. We recruited a convenience sample from September 2005 to October 2007.

A research assistant approached potential participants to inform them of the study, determine their eligibility, and ask if they would be willing to participate. After obtaining informed consent, each participant completed a set of questionnaires and the performance-based measures. The study protocol was approved by both universities' Institutional Review Boards.

Mental Health

Mental health was measured using the SF-36v2 mental health subscale, which consists of five questions assessing primarily symptoms of depression and anxiety (13). Responses to the items are summed and the raw scale scores are transformed to 0 to 100 scale scores, with lower scores representing worse mental health.

Self-Reported Physical Limitations

We measured self-reported physical limitations using the SF-36v2 physical functioning subscale (13). The physical functioning subscale consists of 10 questions asking about limitations in activities ranging in content from bathing and dressing to participation in strenuous sports. The responses from the items are summed and the raw scale scores are transformed to 0 to 100 scale scores, with lower scores representing worse physical functioning.

Performance-Based Measures

Six performance-based measures were chosen to measure physical function in specific domains including strength, endurance, flexibility, and dexterity. In addition, the first two domains were measured in both the upper and lower extremities. In choosing these tests, we tried to balance acceptability to subjects, ease of performance, evidence of test reliability, low rates of subject inability to complete the item, time required to perform the test, and the ability of the test to provide a substantial variance in the nondisabled population.

Upper Extremity Strength

Shoulder strength was measured using a push-pull dynamometer, which consists of a gripping bar attached to a chain that is anchored to a level platform (14). The bar height is set at the level of the relaxed elbow. With palms facing rear, the subject grabs the bar and lifts. The lifting force is generated by the shoulder with the elbows pointed outward. The peak force (in kilograms) of two attempts is recorded and used to calculate the score. The distribution of scores is normal for this test after adjustment for body mass (14). The score is calculated from the peak force divided by the participant's body mass.

Lower Extremity Strength

Lower extremity strength was assessed using a modification of the test described by Sherrington and Lord (15), which uses a spring balance to measure isometric quadriceps strength. The test modification positions the subject in a chair with a 17-inch seat height. A cuff with a D-ring is applied to the ankle and the ring is hooked to a dynamometer that is attached to the cross-bar of the chair leg. Subjects are essentially in a fixed position (90° hip flexion and 90° knee flexion), when they are asked to extend their knee. The peak of two attempts is recorded and used to calculate the score. The score is calculated by dividing the peak force by the participant's body mass.

Upper Extremity Endurance

Upper extremity endurance was evaluated by repeatedly lifting a weight with the preferred arm (16). For men, an 8-pound weight is used. For women, a 4-pound weight is used. The subject sits in a chair with a straight back. The nondominant arm hangs at his/her side and is not used to brace or support the trunk. The subject is instructed to repeatedly lift the weight through the full range of motion of the biceps as many times as possible in 30 seconds.

Lower Extremity Endurance

The chair stand test is an adaptation of the “get up and go test” (17). The use of this adaptation in the aged has been described by Guralnik et al. (3) and was recently used in middle-aged

adults by Malmberg and associates (18). The version of the test used here measures the number of repetitions in a fixed time (19). This is felt to be a better measure of the ability of the muscles to sustain activity. The subject is asked to rise from a 17-inch chair without using his/her arms, sit back down, and repeat this task as many times as possible in 30 seconds.

Upper Arm Flexibility

Upper arm flexibility was measured using the back scratch test (16). In this test, the subject places the preferred hand, palm down over the same shoulder with the fingers extended. Simultaneously, the opposite hand is placed up the middle of the back, palm outward, reaching upwards toward the opposite fingers. The overlap of the extended middle fingers is measured. If there is no overlap, the distance between the fingertips is recorded as a negative value.

Dexterity

The modified Jebsen hand function test (20) was used to assess dexterity. This test includes three subsets of the original Jebsen hand function test and simulates everyday activities. The subject is seated at a table and is asked to sequentially flip over five playing cards, stack four cones, and spoon five kidney beans into a bowl. The time (up to 150 seconds) to complete the task is recorded.

Other Covariables

Demographics—Participants self-reported their age, sex, race/ethnicity (non-Hispanic White, African-American, or Hispanic), and number of years of education.

Body Mass Index

BMI was calculated from measured height and weight and categorized as normal ($<25 \text{ kg/m}^2$), overweight (≥ 25 but $<30 \text{ kg/m}^2$), and obese ($\geq 30 \text{ kg/m}^2$).

Comorbidities

Each study participant was asked whether or not he/she had ever been told that he/she has any of the following: hypertension, diabetes, heart disease, cancer, arthritis, and stroke. Each comorbidity was entered as a separate dichotomous variable in the multivariable models.

Statistical Methods

The analyses were performed on participants with complete data for the following variables: age, sex, race/ethnicity, education, BMI, comorbidities, mental health, physical functioning, and the six performance-based measures.

We used staged multivariable linear regression to examine the relationship between mental health and self-reported physical limitations. In the first model, we examined the unadjusted association between mental health and self-reported physical functioning. In the second model, we adjusted for age, sex, race/ethnicity, years of education, and BMI. In the third model, we added the performance-based measures to the second model. Performance-based measures were each entered into the multivariable model as continuous variables. In the fourth model, we added comorbidities to the third model.

We report p values for t tests and β coefficients with 95% Confidence Intervals (CI) for the variables in the multivariable linear regression. All statistical tests were two-tailed.

RESULTS

Descriptive Characteristics

We recruited a total of 1111 participants. Of the 1024 participants with complete data, the mean $\pm$ standard deviation (SD) age was 53 ± 6 years and 56% were female. They were 33% non-Hispanic white, 31% African-American, and 32% Hispanic. The median level of education was 13 years (range = 1-23 years). The average BMI was 27 ± 4 kg/m². Comorbidities were common with 38% reporting a history of hypertension and 16% reporting a history of diabetes (Table 1).

On the performance-based measures, men scored better on measures of strength and endurance than women ($p < .001$) (Table 2). Women scored better than men on measures of flexibility and dexterity ($p < .001$) (Table 2).

The mean transformed scale scores for the mental health (73 ± 21) and self-reported physical functioning (81 ± 22) were similar to that of the United States population-based norms (21).

Associations Between Mental Health and Self-Reported Physical Limitations

In unadjusted analyses, participants with lower mental health scores reported significantly more physical limitations. On average, a 10-point decrease in mental health scores was associated with a 4.8-point decline in physical functioning scores. With adjustment for age, gender, race/ethnicity, education, and BMI, participants with lower mental health scores reported significantly lower physical functioning scores (Table 3). On average, every 10-point decrease in mental health score was associated with a 4.5-point lower physical functioning score (95% CI = -4.0 to -5.1; $p < .001$). This pattern persisted after additional adjustment for the six performance-based measures. Specifically, participants with worse mental health scores continued to report significantly more physical limitations than those with higher mental health scores (Table 3). These findings changed minimally with the addition of comorbidities to the multivariable model (-2.7; 95% CI = -2.2 to -3.2; $p < .001$).

DISCUSSION

Our findings demonstrate that people with worse mental health scores on the mental health subscale of the SF-36v2 reported more physical limitations than would be expected based on their ability to perform a set of six tests of physical functioning that measured strength, endurance, flexibility, and manual dexterity. The magnitude of the difference (-3.0 for every 10-point decline in mental health scores) in self-reported physical limitations after adjusting for performance-based measures was quite large. As a clinical reference point, the effect size of a 40-point decline in mental health score and recent acute myocardial infarction have approximately the same magnitude of the impact on physical functioning (21).

Few studies of the association between depression and functional status have included performance-based measures of physical functioning (5,11,22-24). For example, one systematic literature review of risk factors for functional status decline in the elderly found that only 4 of 89 studies included observed functional performance (25). Thus, the prior large studies were unable to examine whether self-reported physical limitations were an accurate assessment of physical functioning among patients with depressive symptoms.

Our findings are consistent with prior studies in the elderly (10) and in individuals with back pain (8) or heart failure (11) that concluded that those with depression tended to report worse physical functioning despite similar performance on objective assessment. In our study, we found a similar pattern: those with worse mental health scores tended to report worse physical

functioning after adjustment for measured physical performance. Our findings expand on prior findings by evaluating a diverse middle-aged outpatient population.

There are two main explanations for the association between worse mental health scores and more self-reported physical limitations after adjustment for measured physical performance. First, poor mental health may distort individuals' perceptions of the world and their life, including their ability to perform physical activities. This could lead to a biased report of their physical limitations in which they overestimate difficulties. Because the SF-36 mental health subscale assesses primarily symptoms of depression and anxiety, those who score poorly may actually have clinical depression and/or anxiety. Individuals who suffer from depression may have a negative outlook and an inability to enjoy life (anhedonia). Individuals with severe anxiety (e.g., generalized anxiety disorder) have inappropriate worries about multiple aspects of their life, and they may avoid doing certain social activities. Thus, a distorted perception of reality—because of depression or anxiety—is one possible explanation of why poor mental health might influence self-reported physical health.

Another possible explanation for the relationship between worse mental health scores and more self-reported physical limitations after adjustment for measured physical performance is that those with worse mental health have low mental energy that leads to true limitations in their ability to perform daily physical activities. It has been reported that individuals with low mental health on the SF-36 have significantly lower scores on the vitality subscale (26). This effect may not be captured in measures of physical performance obtained in the artificial setting of a research study. Thus, this explanation postulates that the self-reported physical limitations of individuals with low mental health scores are valid, but the limitations are really the result of their poor mental health and low energy rather than a physiological or anatomical problem.

Limitations

This was a cross-sectional study and thus demonstrates the association between mental health and self-reported physical limitations but does not explain causality. The tests of physical functioning that we employed may not capture all aspects of physical limitations. We acknowledge that this could lead to an overestimation of the magnitude of the effect of mental health. However, because of the large magnitude of the effect of mental health on physical limitation, we believe that this effect would not be reduced to zero even if a more comprehensive battery of physical tests were utilized. Similarly, we acknowledge that the questions used to assess self-reported physical limitations cannot capture the entire range of physical activities. We studied a relatively healthy group of participants aged 45 to 64 years. Thus, there may be selection bias, such as a healthy volunteer effect. However, such an effect would likely lead to the underestimation of the observed association between mental health and self-reported physical functioning.

Further study in a wider age range is needed to evaluate generalizability to other age groups or groups with more severe physical limitations. Affective disorders are episodic in nature and the effect of this cannot be determined by this cross-sectional study. The study would need to be repeated in a longitudinal cohort if the findings are to be generalized to longitudinal associations.

Based on our findings, it is important to take into account mental health when comparing self-reported physical limitations between groups. Many studies examining disparities of disability using nationally representative population data (e.g., National Health and Nutrition Examination Survey and the National Health Interview Survey) have reported on difference in physical limitations by gender or race/ethnicity (27,28). Often mental health is not taken into account and may contribute significantly to these differences in physical functioning.

Acknowledgments

We thank Liza DeJesus, Viviana Deltas, Danielle Doria, David Liss, and Charles Zei for their help with data collection. We would also like to thank Mickey Eder, PhD, for supporting recruitment efforts at the ACCESS Community Health Network. We would also like to acknowledge the staff members at MetroHealth Medical Center's Physical Medicine and Rehabilitation clinic and General Internal Medicine clinic; ACCESS Community Health Network's Pilsen Family Health Clinic and Plaza Medical Center; and Northwestern Medical Faculty Foundation Internal Medicine clinic for their assistance with this project.

Supported by Grant R01AG022459 (Principal Investigator, Joseph J. Sudano Jr) from the National Institute of Aging.

Glossary

BMI, body mass index; CI, Confidence Interval; SD, standard deviation; SF-36v2, SF-36v2 Health Survey.

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TABLE 1Participant Characteristics (*N* = 1024)

Variable	
Age, mean ($\pm$ SD)	53 ($\pm$ 6)
Female	56
Race/ethnicity	
White	33
Black	31
Latino	32
Other	4
Education in years, median (range)	13 (1-23)
Body mass index, mean ($\pm$ SD); kg/m ²	27 ($\pm$ 4)
Hypertension	38
Coronary disease	9
Diabetes mellitus	16
Lung disease	19
Arthritis	38
Cancer	8
Stroke	3

Values are given as percentage unless otherwise stated.

TABLE 2

Performance-Based Measures Stratified by Gender

	Men Mean ($\pm$ SD)	Women Mean ($\pm$ SD)	<i>p</i> Value ^a
Adjusted ^b upper extremity strength	0.64 ($\pm$ 0.23)	0.40 ($\pm$ 0.16)	<.001
Adjusted ^b lower extremity strength	0.54 ($\pm$ 0.23)	0.40 ($\pm$ 0.18)	<.001
Repeated arm curls; number in 30 s	21 ($\pm$ 5)	19 ($\pm$ 5)	<.001
Repeated chair rise; number in 30 s	17 ($\pm$ 7)	15 ($\pm$ 5)	<.001
Back scratch; cm	-14 ($\pm$ 15)	-8 ($\pm$ 12)	<.001
Dexterity; s	18 ($\pm$ 4)	16 ($\pm$ 3)	<.001

^a *p* value for *t* tests.

^b Adjusted by dividing by participant's weight.

TABLE 3**Models of Self-Reported Physical Functioning**

	Model 1	Model 2	Model 3
Mental health; per 10 point decrease	-4.8 (-4.2, -5.3) **	-4.5 (-4.0, -5.1) **	-3.0 (-2.5, -3.6) **
Age		-0.2 (-0.4, 0.0)	0.05 (-0.1, 0.2)
Female		-1.9 (-4.3, 0.6)	1.7 (-1.1, 4.5)
Race/ethnicity			
Black		0.9 (-2.1, 4.0)	1.9 (-0.8, 4.7)
Hispanic		6.8 (3.5, 10.1) **	5.0 (2.0, 8.0) *
Other		1.9 (4.1, -7.8)	-0.7 (-6.0, 4.5)
Education		0.8 (0.4, 1.2) **	0.4 (0.1, 0.8) *
Body Mass Index			
Overweight		-2.5 (-5.3, 0.8)	-0.05 (-2.7, 2.6)
Obese		-8.0 (-11.1, -5.0) **	-2.2 (-5.2, 0.8)
Performance-based measures			
Upper extremity strength			15.7 (8.0, 23.3) **
Lower extremity strength			1.3 (-5.6, 8.2)
Repeated arm curls			-0.1 (-0.4, 0.1)
Repeated chair rise			1.2 (1.0, 1.5) **
Back scratch			0.1 (0.03, 0.22) *
Dexterity			-0.6 (-0.9, -0.2) *

Model 1 = unadjusted model.

Model 3 = adjusted for age, gender, race/ethnicity, education, and Body Mass Index.

Model 3 = adjusted for age, gender, race/ethnicity, education, Body Mass Index, and performance-based measures.

*
 $p < .05$

**
 $p < .001$.