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Anxiety Symptoms and Decline in Physical Function over 5 Years in the Health, Aging and Body Composition Study

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Abstract

OBJECTIVES—To examine the relationship between anxiety and functional decline.

DESIGN—A 5-year longitudinal cohort study of well-functioning adults.

SETTING—The Health, Aging and Body Composition (Health ABC) Study.

PARTICIPANTS—Two thousand nine hundred forty adults aged 70 to 79 (48% male, 41% black), initially free of self-reported mobility difficulty.

MEASUREMENTS—In 1997/98, presence of three anxiety symptoms (feeling fearful, tense or keyed up, or shaky or nervous) from the Hopkins Symptom Checklist were ascertained. Physical function was examined over 5 years using the Health ABC performance battery (continuous range 0–4) consisting of chair stands, usual and narrow course gait speed, and difficulty with standing balance and self-reported mobility, defined as difficulty walking one-quarter of a mile or difficulty climbing 10 steps.

RESULTS—Participants with anxiety symptoms had similar baseline physical performance scores. After adjustment for potential confounders, subjects with anxiety symptoms had similar declines in physical performance over 5 years as participants without anxiety symptoms. Adults with anxiety symptoms were more likely to report incident mobility difficulty, with a hazard ratio of 1.4 (95% confidence interval =1.3–1.6), compared with adults without anxiety symptoms. These results

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persisted after adjustment for depressive symptoms, demographics, comorbidity, and use of antianxiety, depressant, and sedative hypnotic medications.

CONCLUSION—Anxiety symptoms are not associated with declines in objectively measured physical performance over 5 years but are associated with declines in self-reported functioning. Future studies are needed to determine why anxiety has a differential effect on performance-based and self-reported measures of functioning.

Keywords

aged; anxiety symptoms; depressive symptoms; functional decline

Anxiety symptoms are common, affecting from 8% to 18% of community-dwelling older adults and up to half of those with depression,^{1–3} and can be quite debilitating.⁴ Several studies link depressive symptoms to functional decline,^{5,6} but despite the strong interrelationship between anxiety and depression, few have examined anxiety symptoms' unique contribution to functional decline.^{7,8}

Functional decline is an important consequence of increasing frailty in older adults, characterized by decreasing physical performance and increased reliance on others for assistance in mobility and other basic activities of daily living. Such decline represents an important precursor of disability, loss of independence, and death.^{9,10} Performance-based and self-report measures have been used to measure functional status, and both are strongly associated with disability and mortality. These measures complement one another, and both can be used to describe decline.¹¹

Prior longitudinal studies of anxiety symptoms and disability suggest high co-occurrence of depression and anxiety.⁷ These studies have used a variety of screening instruments to define anxiety symptoms, including the Hospital Anxiety and Depression Scale, the Spielberger State Trait Anxiety Inventory, and the Hopkins Symptom Checklist,^{8,12,13} but none have examined the effect of anxiety symptoms on incident disability independent of depressive symptoms. To better understand the relationship between anxiety symptoms and functional decline, longitudinal data from participants in the Health, Aging and Body Composition (Health ABC) Study were analyzed. It was hypothesized that older adults with anxiety symptoms would experience greater declines in self-reported mobility difficulty and performance-based functional decline over 5 years.

METHODS

Study Population

Potential participants in the Health ABC Study were identified using Medicare beneficiary lists in Pittsburgh, Pennsylvania, and Memphis, Tennessee.¹⁴ Recruitment from the entire black community was needed at both sites to meet recruitment goals. A total of 3,075 adults aged 70 to 79 participated. All participants signed informed consent, and the institutional review boards at the University of California at San Francisco, the University of Tennessee, Memphis, and the University of Pittsburgh approved this study. Participants were well functioning at baseline in 1997/98, because study exclusions were self-reported difficulty with walking one-quarter of a mile, climbing 10 steps without resting, performing basic activities of daily living, and requiring a walking aid. Respondents missing information on anxiety symptoms ($n=34$) or self-reported physical function ($n=4$) were excluded from the analysis. For respondents who died over the 5-year follow up ($n=417$), proxy informants were queried regarding their physical function before death, and of these, 97 reports were not given. Thus, the primary analytic cohort for this study contained 2,940 subjects.

Anxiety Symptom Measurement

During the baseline visit, a standardized questionnaire was administered to collect information on several health conditions and symptoms. Anxiety symptoms were ascertained using three items from the anxiety subscale of the Hopkins Symptom Checklist, a reliable and valid instrument¹⁵ that performs similarly to a physician interview for anxiety.¹⁶ The three items concerned feeling fearful, nervous or shaky inside, and tense or keyed up. Participants were first asked whether they had experienced the symptom at all in the previous week; those responding, “yes” were asked how frequently the symptom was experienced: a little, quite a bit, or a lot. Anxiety symptoms were considered present when any two symptoms occurred at least a little of the time or any one symptom occurred at least quite a bit. This definition is similar to that used in other population-based studies of older adults.^{17,18} In addition, two alternate, more-stringent definitions of anxiety symptoms were used. The first, severe symptoms, was defined as having all three symptoms at least a little of the time.⁸ The second required persistent symptoms, that is, having anxiety symptoms at baseline and at follow-up 5 years later.

Functional Decline

Functional decline was determined using performance-based measures and self-reported difficulty over the 5 years of follow up. Details of the Health ABC performance battery and scoring have been described previously.¹⁹ In brief, this battery includes five repeated chair stands, progressively more-challenging tests of standing balance (semitandem, full-tandem, and single leg stands) each held for 30 seconds, a 6-m walk to determine usual gait speed, and a narrow walk in which participants were instructed to walk between lines of colored tape 20 cm apart at their usual pace. Performance on chair stands was evaluated using a rate of chair stands per second. For the standing balance test, the time of each stand was held was summed for a maximum of 90 seconds. Gait speed was noted for both walks. Failure on the narrow walk yielded a score of 0 and consisted of stepping on or outside the tape two or more times over 6 m. Up to three trials were permitted. Performance was divided by the maximum possible performance for older adults on each test to create ratio scores that were summed for the four tests to obtain a continuous scale ranging from 0 to 4, with a lower score indicating poorer function.¹⁸

The self-report measures consisted of presence and level of difficulty walking one-quarter of a mile and climbing 10 steps without resting. Incident walking and stair-climbing limitation were defined as report of any difficulty or inability to walk one-quarter of a mile or climbing 10 steps, respectively. Self-reported lower extremity limitation was defined as the first new report of walking or stair climbing difficulty. For participants who died, proxy informants were asked whether the participant had difficulty with either function before death. If the proxy reported difficulty, limitation was considered present.

Covariates

Depressive symptoms were measured using the Center for Epidemiologic Studies Depression Scale,²⁰ which has sensitivity of 97%, specificity of 84%, and positive predictive value of 85%, making it a good screening instrument for depression,²¹ and were considered present if the participant had a score of 16 or greater.

Other covariates examined were grouped in categories. Sociodemographic variables were age (continuous), race (black or white), sex, study site (Pittsburgh or Memphis), years of education (continuous), family income less than \$10,000, and marital status (married or not). Comorbidities were positive history of myocardial infarction, stroke, hypertension, diabetes mellitus, visual impairment, hearing impairment, and poor sleep, defined as frequently not getting enough sleep or feeling sleepy during the day. Lifestyle factors encompassed current

smoking, drinking three or more alcoholic drinks per week, and physical activity (continuous), measured as total kcal expended per week for recreational and daily activities.

From a medication inventory of prescription and over-the-counter medications, separate indicator variables were created for use of antianxiety medications such as benzodiazepines and barbiturates; antidepressants such as selective serotonin reuptake inhibitors, tricyclics, and monoamine oxidase inhibitors (yes/no); or any sedative hypnotics, including antihistamines, hypotensive agents, opioids, anticonvulsants, trazodone, benzodiazepines, barbiturates, other anxiolytics, codeine, and melatonin.

Statistical Analyses

Bivariate associations were examined between anxiety symptoms and Health ABC performance score using analysis of variance testing. To evaluate the overall association between anxiety symptoms and performance-based functional decline over 5 years, mixed-effects regression models were calculated, with change in Health ABC performance score as the outcome (range 0–4). This model contained indicator variables for anxiety symptoms. Three correlation structures used in mixed-effects regression models with repeated measures were assessed: unstructured, Huynh-Feldt and compound symmetry. The model with the smallest Akaike information criterion (best fit) was chosen.

To evaluate the association between anxiety symptoms and self-report of limitations (walking, stair climbing, and lower extremity), a series of Cox proportional hazards models were calculated, with the origin as the baseline visit and time calculated to the onset of a functional limitation or censoring at the 5-year study follow-up. Each model contained an indicator variable for anxiety symptoms.

To account for differences in baseline physical performance, the baseline physical performance score was added to all models of self-reported functional outcomes. To test whether depressive symptoms mediated the association between anxiety symptoms and functional decline, an indicator for depressive symptoms was added to the models described above. In addition, other potential covariates were tested if they were associated with anxiety symptoms at a level of 0.10. To assess whether the use of anxiety, depressive, or sedative hypnotic medication altered the association between anxiety symptoms and functional decline, indicators representing the use of these medications were added to the covariates model. Each model was tested for fit and accuracy. Lastly, two sensitivity analyses were conducted in which the more stringent definitions of anxiety symptoms (severe and persistent) were used. All analyses were repeated with the alternate definitions.

RESULTS

The mean age of study participants was 73.6 ± 3 , 41% were black, 52% were female, 50% were from Pittsburgh, they averaged 13 years of education, 13% had a household income less than \$10,000, and 45% were not married. Demographic characteristics were similar for participants with and without anxiety symptoms, except that those with anxiety symptoms were more likely to be female ($P < .001$) and unmarried ($P = .003$) (Table 1). Participants with anxiety symptoms were more likely to have hypertension, vision impairment, hearing impairment, poor sleep, and depressive symptoms and to take antianxiety or antidepressant medication than participants without anxiety symptoms ($P < .05$ for all).

Participants with anxiety symptoms had lower (worse) unadjusted baseline physical performance scores (2.11) than participants without anxiety symptoms (2.19) ($P = .002$). These participants declined at a similar rate (-0.32 points over the 5-year study period) as participants without anxiety symptoms (-0.35 points over 5 years), $P = .25$ (Figure 1). After applying

mixed-effects regression modeling, adults with anxiety symptoms had similar baseline physical performance scores (-0.06 , $P=.25$) and similar least squared mean change in performance over 5 years as those without anxiety symptoms (-0.02 , $P=.26$). After adjustment for depressive symptoms, neither anxiety nor depressive symptoms were associated with baseline physical performance (anxiety symptoms, $P=.55$; depressive symptoms, $P=.06$) or physical performance change over 5 years (anxiety symptoms, $P=.42$; depressive symptoms, $P=.40$).

In contrast, adults with anxiety symptoms alone had a 40% greater hazard of developing self-reported mobility limitations (hazard ratio (HR) =1.4, 95% confidence interval (CI) =1.2–1.6) than those without symptoms, independent of baseline physical performance. Similar relationships were found for self-reported walking and stair climbing limitations (Table 2). Additional adjustment for depressive symptoms and sociodemographics, comorbidities, and lifestyle factors attenuated but did not eliminate the associations. Several covariates slightly reduced the relationship between anxiety symptoms and self-report of mobility difficulty: depressive symptoms (HR =1.5, 95% CI =1.2–1.8), history of hypertension (HR =1.4, 95% CI =1.3–1.5), hearing impairment (HR =1.2, 95% CI =1.0–1.4), poor sleep (HR =1.3, 95% CI =1.2–1.6), and more than three alcoholic drinks per week (HR =0.8, 95% CI =0.7–0.9). Further adjustment for antianxiety, antidepressant, and sedative-hypnotic medication did not alter the results appreciably. There was no statistically significant interaction between anxiety and depressive symptoms for self-reported mobility difficulty, walking, or stair climbing limitation ($P=.49$ to $.70$).

Two sensitivity analyses were conducted using stricter definitions of anxiety symptoms. There was no association between severe anxiety symptoms, that is, experiencing at least a little of the three anxiety symptoms, and baseline physical performance ($P=.41$) or change in physical performance over 5 years ($P=.32$). Severe anxiety symptoms were associated with a 70% greater hazard of self-reported mobility limitation (HR =1.7, 95% CI =1.3–2.1) than for adults without these limitations. Similar associations were observed for incident self-report of walking limitation (HR =1.5, 95% CI =1.2–1.9) and self-report of stair climbing limitation (HR =1.6, 95% CI =1.2–2.0). Persistent anxiety symptoms were associated with a 40% greater hazard of self-reported mobility limitation (HR =1.4, 95% CI =1.2–1.8) than for adults without persistent anxiety. Similar relationships were found for self-reports of incident walking limitation (HR =1.5, 95% CI =1.2–1.9) and self-reports of stair climbing limitation (HR =1.5, 95% CI =1.2–1.9).

DISCUSSION

In this population-based cohort of 2,900 well-functioning older people, anxiety symptoms were not associated with declines in objectively assessed measures of physical performance over 5 years of follow-up. In contrast, anxiety symptoms were associated with greater hazard of self-reported mobility limitation, including difficulty walking and stair climbing. This finding was stronger for persistent and severe anxiety and was independent of depressive symptoms and other potential confounders. It is not clear why the association between anxiety and performance-based functional decline and self-reported mobility limitation differed. One possibility is that there is a mismatch between the limited, isolated tasks measured as part of the performance testing and the complex tasks performed by individuals in nonstructured environments such as their homes. Another possibility is that anxiety biases reports of mobility difficulty, causing subjects to report mobility difficulty out of proportion to their actual functional deficits.

Prior epidemiological studies have suggested that physical performance declines are sensitive measures for early functional decline. In these studies, physical performance served as a more-sensitive marker for change in function than self-reported decline. Thus, there has been a recent

trend toward using physical performance as a criterion standard over self-reported measures of function in epidemiological studies. The current study suggests that anxiety symptoms are associated with self-reported measures of function and not performance-based measures. This is counterintuitive, because according to prior literature, decline is generally realized in performance first and self-reported outcomes later.

Self-reported mobility limitation and physical performance decline are important outcomes in older adults. There is a substantial literature on the association between self-reported limitations as a predictor of mortality. For example, a recent predictive index suggested that mobility limitation is associated with twice the hazard of mortality (HR =2.1, 95% CI =1.8–2.4).²² Other studies have suggested that physical performance markers are strong independent predictors of mortality,²³ which are considered better than clinical history.²⁴ Because self-reported measures of mobility and objective physical performance are predictors of mortality, it is important to understand each in the context of anxiety symptoms.

Studies of the relationship between anxiety symptoms and functional decline in older adults are limited; only a few have been longitudinal,^{8,12,13} and only one prior study assessed whether the effect of anxiety was independent of depressive symptoms and simultaneously considered self-reported and performance-based measures of function. Similar to the current study, this study found that anxiety symptoms were associated with self-reported disability after controlling for physical performance,⁸ although the findings of this prior study are only applicable to older women with existing limitations. The current work provides the most-comprehensive analysis of the effect of anxiety symptoms on functional decline because of the extended follow-up, use of self-reported and performance based measures of function, and adjustment for depressive symptoms.

This study provides evidence that the relationship between anxiety and function differs for subjective (self-report) and objective (physical performance) measures, but the data do not indicate why these relationships differ. The first possible reason is a fundamental difference between the limited, isolated tasks performed in a structured environment compared with the complex tasks performed in a nonstructured environment, which in this study, were assessed using objective performance-based measures and self-reported measures, respectively.

A second potential explanation for the mismatch is that anxiety biases self-reported measures of functioning. This might occur, because anxiety affects confidence and self-efficacy without resulting in any meaningful decrement in ability to perform functional tasks. For example, it is possible that, during performance testing in a standardized, supportive, and safe environment, participants can perform at or near their peak capacity,²⁵ whereas outside this environment, anxious individuals may not be able to perform at their peak capacity and may have more functional difficulties. Future studies of the relationship between anxiety and functional decline will need to include performance measures that closely mimic measures of day-to-day functioning such as a real-world stair climbing task to determine whether anxiety-associated decline is related to differential task performance or reporting bias.

Older adults with anxiety symptoms may report increased mobility limitation, because, in their usual environment, they feel less confident in their mobility. This may be due to a variety of reasons, such as poor lighting, uneven walkways, lack of a companion, and fear of falling. A substantial literature indicates that older adults who are afraid of falling may avoid mobility activities, even if they are able to perform them.^{26–28} Related to this point is that activity restriction might represent a type of phobic behavior in older adults. Potential correlates could include lack of confidence, fear of falling, and a manifestation of the phobic behavior.

The findings did not show a lower hazard for functional decline for participants taking antianxiety, antidepressant, or sedative-hypnotic medication. This could be due to limited

power or confounding by indication, because presumably only participants who had severe anxiety or depression were given these medications. Randomized, placebo-controlled trials of the effects of anxiety and depression treatment on self-report of mobility difficulty are necessary to determine whether treating these symptoms has the effect of increasing functional performance and decreasing reports of limitation. Because older adults taking antidepressants and sedative hypnotics are more likely to fall,²⁹ sedative-hypnotic use in older adults with anxiety symptoms should be further evaluated.

Some potential limitations of this study warrant comment. Depressive and anxiety symptoms were assessed using standardized instruments commonly used in epidemiological studies, but these evaluations did not include detailed clinical history of lifetime anxiety or depressive symptoms, so it was not possible to address whether a clinical diagnosis or cumulative burden of these symptoms over the life-course influenced decline. A definition of severe anxiety symptoms was used that has not been assessed in a clinical setting; therefore, the analyses using the severe definition should be interpreted with caution. In addition, this study used a medical chest inventory to indicate anxiety, depression, and sedative-hypnotic medication use that did not account for when the medication was taken or the indication.

The outcome measures also have some limitations. For example, the self-reported functional decline measures used in this study have not been validated for older adults with anxiety. In addition, it is possible that having the same informant report on anxiety symptoms and incident functional limitations introduces an informant bias, particularly if an anxious subject is more likely to report functional limitation because of another mechanism such as fear of falling. Future studies of anxiety symptoms and functional limitations could address this issue by comparing the self-reports of limitation to reports from a proxy informant and by comparing self-reports of limitation to objective measures that closely model day-to-day activities, such as stair climbing.

In summary, in older adults, anxiety symptoms predict functional decline as assessed using self-reported but not objective performance-based measures. Future studies are needed to examine the reasons underlying anxiety's differential effect on performance-based and self-reported measures of functioning.

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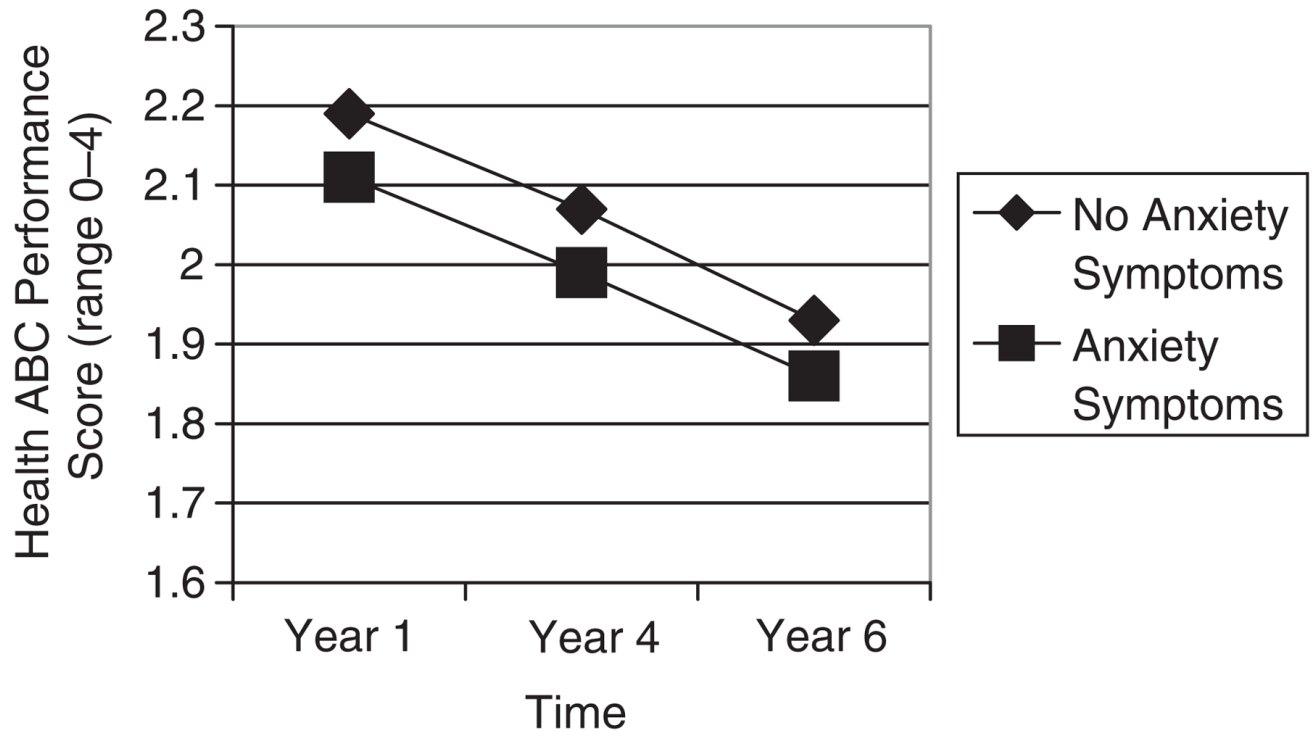


Figure 1. 5-year change in the Health, Aging and Body Composition (Health ABC) Study physical performance score by presence of anxiety symptoms. y-axis: Health ABC performance score (range 0-4).

Table 1

Baseline Characteristics of the 2,940 Health, Aging and Body Composition Study Participants

Characteristic	No Anxiety Symptoms (n =2,392, 81%)	Anxiety Symptoms* (n =548, 19%)	P-value†
Age, mean ± SD	73.6 ± 3	73.6 ± 3	.79
Black, %	42	40	.44
Female, %	50	63	<.001
Pittsburgh study site, %	50	49	.61
Education, years, mean ± SD	13 ± 3	13 ± 3	.67
Family income <\$10,000, %	14	12	.53
Not married, %	44	51	.003
Myocardial infarction, % ‡§	11	13	.30
Stroke, % ‡	2	3	.54
Hypertension, % ‡	49	57	<.001
Diabetes mellitus, % ‡	15	14	.34
Vision impairment, % ‡	3	4	.05
Hearing impairment, % ‡	8	12	.005
Poor sleep, % ‡	8	18	<.001
>3 alcoholic drinks/week, %	18	15	.06
Current smoker, %	12	12	.71
Depressive symptoms, % §	2	16	<.001
Antianxiety or antidepressant medication, %	10	24	<.001

* Anxiety symptoms defined using the Hopkins Symptom Checklist (1 symptom quite a bit or 2 symptoms a little).

† Calculated using t-tests and chi-squared statistics.

‡ Self-reported medical history.

§ Center for Epidemiologic Study Depression Scale score ≥16.

SD =standard deviation.

Anxiety Symptoms and Time to Self-Report of Walking, Stair Climbing, and Lower Extremity Limitations in Health, Aging and Body Composition Study Participants over 5 Years (N =2,940)

Table 2

Self-Reported Mobility Limitation*	Anxiety Symptoms	Incident Limitation %	Hazard Ratio (95% Confidence Interval)	
			Base Model [†]	+ Depressive, Symptoms [‡] + Covariates [§]
Lower extremity	Yes	76	1.4 (1.2–1.6)	1.3 (1.2–1.5)
	No	62	1.0	
Walking	Yes	70	1.4 (1.3–1.6)	1.3 (1.2–1.5)
	No	56	1.0	
Stair climbing	Yes	62	1.3 (1.2–1.5)	1.2 (1.1–1.4)
	No	48	1.0	

* Incident limitation defined as the first report of having any difficulty walking one-quarter of a mile (walking), climbing 10 steps (stair climbing), or both (lower extremity limitation).

[†] Base model includes indicator term for presence of anxiety symptoms and baseline performance score.

[‡] Base model with additional adjustment for Center for Epidemiologic Study Depression Scale score ≥ 16 and baseline performance score.

[§] Additional adjustment for sociodemographics (age, sex, race, study site, marital status) and all significant ($P < .10$) covariates, including comorbidities (hypertension, vision impairment, hearing impairment), management/lifestyle (drinking alcohol ≥ 3 times per week and feeling sleepy during the day), and baseline performance score.