The Impact of Depressive Symptomatology on Physical Disability: MacArthur Studies of Successful Aging

Martha Livingston Bruce, PhD, MPH, Teresa E. Seeman, PhD, Susan S. Merrill, PhD, MPH, and Dan G. Blazer, MD, PhD

ABSTRACT

Objectives. The purpose of these analyses was to test the hypothesis that depressive symptomatology affects the risk of onset of physical disability in high-functioning elderly adults.

Methods. The data come from the MacArthur Study of Successful Aging, a community-based cohort of high-functioning adults aged 70 through 79 years who were assessed twice at a 2.5-year interval. Physical and cognitive status was assessed by performance as well as by self-report measures.

Results. In gender-stratified logistic regression models, high depressive symptoms as measured by the depression subscale of the Hopkins Symptom Checklist were associated with an increased risk of onset of disability in activities of daily living for both men and women, adjusting for baseline sociodemographic factors, physical health status, and cognitive functioning.

Conclusions. Joined with evidence that physical disability is a potential risk factor for depression, these findings suggest that both depressive symptoms and physical disability can initiate a spiralling decline in physical and psychological health. Given the important impact of activities-of-daily-living functioning on utilization of medical services and quality of life, prevention or reduction of depressive symptoms should be considered an important point of intervention. (*Am J Public Health.* 1994;84: 1796–1799)

Introduction

Recent findings from several follow-up studies of depressed medical and psychiatric patients indicated that a surprisingly wide spectrum of depressive phenomena have a range of negative consequences.[1-4] Despite evidence from community data that depression in elderly persons puts them at risk for mortality,[5-7] much less is known about other types of outcomes of late-life depression or the intermediary processes between depressive states and subsequent mortality in community populations. The relationship of depression with mortality, however, suggests that a shorter-term outcome of depressive syndromes may be decline in physical ability. We tested this hypothesis by assessing the effects of depressive symptomatology on the onset of physical disability as assessed by activities of daily living among a sample of high-functioning adults aged 70 through 79 years, using data from the MacArthur Study of Successful Aging.

Data from the MacArthur Study of Successful Aging offer a number of advantages for these analyses. First, the sample was drawn from population-based cohorts and reflects substantial socioeconomic and racial diversity. Second, the selection criteria for this study resulted in a baseline cohort of relatively healthy, high-functioning older men and women. Although the sample represents only the highest functioning elderly adults and not all community-dwelling elders, it is useful for our purposes in disentangling the causal relationships between depressive symptoms and physical disability. Because evidence indicates that poor physical functioning may also be a risk factor for depression,[8-10] the availability of a high-functioning sample enables us to obtain a "cleaner" picture of the effect of depressive symptomatology on subsequent physical disability, free of the confounding effects of poor initial physical functioning. Third, the assessment of physical performance abilities within this relatively high-functioning cohort and of reported medical conditions and health behaviors allows for more rigorous control of the possible confounding effects of baseline physical health status than is possible in most other data sets that assess depressive phenomena.

Methods

Sample

Data for these analyses come from the MacArthur Community Study, a three-site, longitudinal study of relatively high functioning men and women aged 70 through 79 years. As described in greater detail elsewhere,[11] subjects were subsampled on the basis of age and both physical and cognitive functioning from three community-based cohorts of the National Institute on Aging's Established Populations for Epidemiologic Studies of the Elderly (EPESE) in Durham, NC, East Boston, Mass, and New Haven, Conn.

Respondents from the three EPESE samples were screened on the basis of four criteria of physical functioning and two criteria of cognitive functioning to identify those functioning in the top third of the age group. The selection criteria included (1) reported no disability on the seven-item Activities of Daily Living Scale[12]; (2) reported no more than one mild disability item[13,14]; (3) held a 10-second semitandem balance; (4) stood from a seated position five times within 20 seconds; (5) scored 6 or more correct on the Short Portable Mental Status Questionnaire[15]; and (6) remembered three elements on a delayed-recall short story.

Of the 4030 age-eligible men and women, a cohort of 1313 subjects met all screening criteria; 1189 (90.6%) agreed to participate and provided informed consent. Interviews began May 1988; the cohort was reinterviewed approximately 2.5 years later. Attrition from the baseline cohort included 73 (6.1%) deaths and 58 (4.9%) persons who refused or were not relocated. Although the subgroup who subsequently died were disproportionately male, surviving nonparticipants did not differ significantly from the rest of the cohort on any of the baseline demographic or health status variables used in these analyses.

Measures

The outcome measure for this study was reported physical disability at follow-up as assessed by the seven-item Activities of Daily Living Scale (i.e., dressing, toileting, eating, bathing, grooming, transferring, and walking across a small room).[12] Because the eligibility criteria ensured that everyone in the sample started the study without any reported disability in activities of daily living, reported activities-of-daily-living disabilities at the follow-up interview were considered onset activities-of-daily-living disabilities. Note that because respondents at their first interview may have recovered from previous disabilities in activities of daily living, these onset disabilities represent first or recurrent onsets.

The independent variable of interest was depressive symptomatology at the first interview, which was assessed from the 11-item depression subscale of the Hopkins Symptom Checklist.[16] Consistent with other work,[17] we used the measure as a continuous variable by estimating a mean score for each respondent ranging from 1 (no symptomatology) to 4 (high symptomatology).

The analysis took into account a number of potential confounding variables in the relationship between depression and subsequent physical functioning. Variables assessing sociodemographic status included age (in years), race (White vs other), marital status (married vs not married), education (in years), and income (five categories). Because of gender differences in both the prevalence of depression[18] and disability levels,[19] analyses were stratified by gender.

Baseline measures of physical health status included three self-reported indicators of whether or not a respondent had been diagnosed by a health care provider with coronary heart disease, metabolic diseases, or musculoskeletal disorders. Additional assessments of physical health status were obtained by examination: (1) pulmonary functioning as assessed by peak expiratory flow rate with a Mini-Rite meter (range = 30.0–710.0); (2) relative weight as assessed by body mass index (kg/m^2; range = 14.49–43.89) and by waist to hip ratio[11]; and (3) mean systolic and diastolic blood pressures calculated from the second and third seated assessments.

Baseline physical ability was assessed by whether or not the respondent reported any mild disability on the three-item Rosow–Breslau Scale[14] or the five-item Nagi Scale.[13] Twenty five percent of the sample reported one such disability, the maximum allowed by the screening criteria. As described elsewhere,[19] a summary indicator of observed physical performance was based on five physical tasks involving both lower body function (balance and gait) and upper body function (strength and dexterity) and ranged from 0 (worst performance) to 5 (best performance). Additionally, an index of cognitive functioning was based on subjects' performances on a series of tasks (range = 0–89).[20]

Results

The subsample of MacArthur study respondents who completed both the baseline and the 2.5-year follow-up interviews is described in Table 1, stratified by gender. Depressive symptomatology as assessed by the depression subscale of the Hopkins Symptom Checklist ranged from 1.00 to 2.90 with a mean of 1.28 (SD = 0.29) indicating only mild, if any, depressive symptomatology in most of the population.

At the second interview, onset disability in activities of daily living was reported among 5.7% (26 of 450) of the men and

TABLE 1—Description of Sample, by Gender		
	Men, % (n = 450)	Women, % (n = 590)
Age, y		
70–74	58.9	53.7
75–79	41.1	46.3
Race		
White	83.1	79.2
Black	16.9	20.8
Education, y		
≤11	52.1	54.4
≥12	47.9	45.6
Income		
<$5000	26.7	57.5
$5000–9999	39.9	26.1
$10 000–14 999	14.8	9.3
>$15 000	18.6	7.1
Marital status		
Married	70.4	30.2
Not married	29.6	69.8
Disability, Rosow–Breslau or Nagi		
None	79.1	71.9
One	21.9	28.1
Chronic conditions		
None	27.6	24.7
One	41.2	40.7
Two or more	31.2	34.6
Cognitive functioning index		
Mean (SD)	53.08 (9.75)	53.29 (9.83)
Range	26.0–80.0	20.0–80.0
Depression score		
Mean (SD)	1.28 (0.29)	1.28 (0.29)
Range	1.00–2.90	1.00–2.73

4.1% (24 of 588) of the women. For both genders, problems with bathing and walking were most commonly reported.

The relationship between depression and onset of disability in activities of daily living is presented in Table 2. In this table, the first model presents odds ratios (ORs) estimated from an unadjusted logistic regression model. The second model was adjusted for baseline sociodemographic status and physical health status variables. Because, consistent with previous research,[21,22] we found gender differences in the factors associated with onset disability in activities of daily living, variables were

TABLE 2—The Relationship between Depression and Onset of Activities-of-Daily-Living Disability, as Assessed by Logistic Regression

	Unadjusted Model				Model Adjusted for Baseline Variables			
	Men (n = 450)		Women (n = 590)		Men (n = 450)		Women (n = 590)	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
1988 depressive symptoms	2.87	0.93, 8.81	4.27	1.47, 12.47	3.55	1.08, 11.68	5.47	1.77, 16.92
1988 covariates								
Mild disability					1.72	0.69, 4.30	1.08	0.43, 2.71
Physical performance					0.73	0.30, 1.80	1.54	0.58, 4.07
Cognitive functioning					0.93	0.89, 0.98	1.01	0.96, 1.05
Systolic blood pressure					0.97	0.94, 0.99	0.99	0.97, 1.01
Age					1.02	0.88, 1.18	1.18	1.00, 1.38
Metabolic disease					0.76	0.29, 2.02	2.61	1.10, 6.21
Body mass index					1.01	0.91, 1.13	1.12	1.02, 1.22

Note. Baseline variables tested but not found statistically significant include education, race, marital status, income, coronary heart disease, musculoskeletal disorders, and pulmonary functioning. ADL = activities of daily living; CI = confidence interval.

included in the adjusted model when they approached statistical significance ($P < .10$) in either the male or female model. Baseline mild disability and physical performance scores were included in both adjusted models regardless of statistical significance.

For both men and women, high levels of depressive symptoms at baseline were associated with increased risk for onset disability in activities of daily living. The effects of depression on onset activities-of-daily-living disability were stronger for women than men, with an odds ratio comparing one unit change in depression score of 4.27 ($P < .01$) for women and 2.87 ($P < .10$) for men.

The effects of depression on disability in activities of daily living were enhanced somewhat in both the male and female second models when controlling for baseline factors; the coefficients are statistically significant for women ($P < .01$) and men ($P < .05$). When the effects of baseline risk factors were controlled, a one-unit increase in depressive symptomatology was associated with a 3.55 increase in risk for onset disability in activities of daily living in men (vs a 2.87 increase in the unadjusted model). Other significant variables in the male model were cognitive functioning and systolic blood pressure; controlling for each of

these variables contributed to the increased effect of depression on onset disability in activities of daily living. For women, the effect of depression increased (OR = 5.47 [$P < .01$] vs unadjusted OR = 4.27) when controlling for the significant ($P < .05$) baseline effects of age and body mass (metabolic disease was also significant).

Discussion

Although gerontologists have become increasingly appreciative of the high level of comorbidity between physical health problems and depressive phenomena in elderly adults,[23,24] understanding the causal relationships in community-based data is a complex task. The analyses presented in this paper indicate that in a representative sample of community-dwelling, high-functioning men and women aged 70 through 79 years, depressive symptoms were associated with increased risk of subsequent onset disability in activities of daily living, even when controlling for baseline physical health and social status.

These findings are consistent with the growing literature on negative outcomes of depressive symptoms. Clinical data on depressed patients indicate that major depression increases the risk of

mortality,[25] work-related disability,[1] and impaired psychosocial functioning.[26,27] Data on general medical patients have demonstrated that changes in depressive symptomatology are synchronous with changes in physical and role functioning.[4,28] Community-based data are less consistent, in part reflecting greater variation in how depression is measured as well as the greater heterogeneity in the individuals included in the samples. These data generally indicate, however, that depressed older men and women have increased risk of mortality[5–7] and greater use of general medical services.[29] The evidence presented here that depressive symptoms are associated with increased risk of limitations in activities of daily living is particularly troubling given previous evidence that levels of activities of daily living are themselves risk factors for a range of negative outcomes, such as nursing home admissions,[30,31] hospital admission,[32,33] and mortality.[32,34,35] Thus, increased risk of physical disability may be seen as part of the process through which depressive symptoms act on these other outcomes.

The increased risk of disability in activities of daily living associated with depressive symptoms in the high-functioning MacArthur cohort is particularly striking because these subjects have little of the physical comorbidity (and little or no preexisting functional disability) that might be expected to augment an observed relationship between depression and onset of disability in activities of daily living. Thus, the MacArthur data suggest that depressive symptomatology represents a significant risk factor for disability in activities of daily living even when individuals are initially relatively high functioning. Indeed, one hypothesis generated from these findings that needs to be investigated with other sources of data is that the impact of psychosocial risk factors such as depressive symptoms may be strongest among individuals who have yet to experience the overwhelming effects of significant medical illness.

These analyses also complement another set of population-based research data indicating that physical disability is a risk factor for the onset of depressive disorders and symptoms in the elderly.[9,10] These two bodies of research suggest that depression and physical disability may feed on themselves, setting off a spiraling decline in physical and psychological health.

Because we assessed depressive symptoms and activities-of-daily-living

functioning at only two points in time, we were unable to identify the mechanism by which depression affects the performance of activities of daily living. Several causal pathways are possible. Indirectly, depressive symptoms may be prodromal of medical conditions that affect physical disability. Preliminary analyses of the follow-up data suggest, however, that onset medical conditions do not explain our results. Another more direct pathway may be that persistent somatic symptoms of depression, such as fatigue, affect physical disability levels over time.

Although each of these explanations may contribute to the observed relationships, we hypothesize that much of the effect of depressive symptoms on subsequent onset of physical disability may be a result of depressive symptoms undermining the effort needed to maintain physical functioning. This latter explanation suggests that physical disability reflects not only what a person is physically capable of doing but what a person is willing or emotionally able to do. In time, habitual restriction of activity may also affect what a person is physically capable of doing. The stronger association found among women in our sample suggests that future investigations into these hypotheses should also examine whether the pathway between depression and disability in activities of daily living differs by gender.

Regardless of the intervening processes, the identification of depressive symptoms as a risk factor for disability in activities of daily living is important. Although relatively prevalent in older adults, depressive symptoms often go unrecognized or are not taken seriously by clinicians and family members.[36] These analyses provide further evidence that depressive symptomatology is not a necessary component of "normal aging," but a potentially preventable condition with otherwise severe consequences. Given the important impact of activities-of-daily-living functioning on utilization of medical services and quality of life, prevention or reduction of depressive symptoms should be considered an important point of intervention. □

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