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Research Article

Depressive Trajectories and Risk of Disability and Mortality in Older Adults: Longitudinal Findings From the Health, Aging, and Body Composition Study

Rachel A. Murphy,[1,2] Ashley K. Hagaman,[3] Ilse Reinders,[2,4] Jeremy A. Steeves,[5] Anne B. Newman,[6] Susan M. Rubin,[7] Suzanne Satterfield,[8] Stephen B. Kritchevsky,[9] Kristine Yaffe,[7] Hilsa N. Ayonayon,[7] Daniel S. Nagin,[10] Eleanor M. Simonsick,[11] Brenda W. J. H. Penninx,[12] and Tamara B. Harris[2] for the Health ABC Study

[1]School of Population and Public Health, University of British Columbia, Vancouver, Canada. [2]Laboratory of Epidemiology and Population Science, National Institute on Aging, Bethesda, Maryland. [3]School of Human Evolution and Social Change, Arizona State University, Tempe. [4]Department of Health Sciences and the EMGO+ Institute for Health and Care Research, VU University, Amsterdam, the Netherlands. [5]Cancer Prevention Fellowship Program, National Cancer Institute/Division of Cancer Control and Population Sciences, Rockville, Maryland. [6]Center for Aging and Population Health, Department of Epidemiology, University of Pittsburgh, Pennsylvania. [7]Department of Psychiatry, University of California at San Francisco. [8]Department of Preventive Medicine, University of Tennessee Health Science Center, Memphis. [9]Department of Internal Medicine, Wake Forest School of Medicine, Winston Salem, North Carolina. [10]Heinz College, Carnegie Mellon University, Pittsburgh, Pennsylvania. [11]Translational Gerontology Branch, National Institute on Aging, Baltimore, Maryland. [12]Department of Psychiatry and the EMGO+ Institute for Health and Care Research, VU University Medical Center, Amsterdam, the Netherlands.

Address correspondence to Rachel A. Murphy, PhD, School of Population and Public Health, University of British Columbia, Vancouver, V6T1Z3, Canada. Email: rachel.murphy@ubc.ca

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Abstract

Background. Depression and disability are closely linked. Less is known regarding clinical and subclinical depressive symptoms over time and risk of disability and mortality.

Methods. Responses to the Center for Epidemiologic Studies Short Depression scale (CES-D10) were assessed over a 4-year period in men (n = 1032) and women (n = 1070) aged 70–79 years initially free from disability. Depressive symptom trajectories were defined with group-based models. Disability (2 consecutive reports of severe difficulty walking one-quarter mile or climbing 10 steps) and mortality were determined for 9 subsequent years. Hazard ratios (HRs) were estimated using Cox proportional hazards adjusted for covariates.

Results. Three trajectories were identified: persistently nondepressed (54% of men, 54% of women, mean baseline CES-D10: 1.16 and 1.46), mildly depressed and increasing (40% of men, 38% of women, mean baseline CES-D10: 3.60 and 4.35), and depressed and increasing (6% of men, 8% of women, mean baseline CES-D10: 7.44 and 9.61). Disability and mortality rates per 1,000 person years were 41.4 and 60.3 in men and 45.8 and 41.9 in women. Relative to nondepressed, men in the mildly depressed (HR = 1.45, 95% confidence interval [CI] 1.11–1.89) and depressed trajectories (HR = 2.12, 95% CI 1.33–3.38) had increased disability; women in the depressed trajectory had increased disability (HR = 2.02, 95% CI 1.37–2.96). Men in the mildly depressed (HR = 1.24, 95% CI 1.01–1.52) and depressed trajectories (HR = 1.63, 95% CI 1.10–2.41) had elevated mortality risk; women exhibited no mortality risk.

Conclusions. Trajectories of depressive symptoms without recovery may predict disability and mortality in apparently healthy older populations, thus underscoring the importance of monitoring depressive symptoms in geriatric care.

Key Words: Depression—Mood—Aging—Geriatric—Function

Depression is a pervasive public health problem; nearly 1 in 5 adults in the United States report at least mild depressive symptoms (1). The impact of depression on health is considerable. Depressive disorders are one of the leading causes of disability worldwide (2) and are projected to become the leading cause by 2030 (3). Depression is also associated with increased mortality risk in general populations (4,5) and in those with chronic disease (6).

Although the link between depressive disorders and disability is well established (2), depressive disorders are commonly characterized as present or absent, which does not recognize subclinical levels. Depressive symptoms rather than presence or absence of depression may be important to examine among older adults who may have less obvious symptoms than younger persons and/or are less willing to express their feelings, leading to lower likelihood of physician diagnosis (7). Similar to depressive symptoms (8), early detection of functional decline is linked with improved prognosis: a greater likelihood of recovery and/or improvement (9).

Studies have also been limited by cross-sectional measures of depressive symptoms that do not capture the temporality of symptoms that underlie depressive disorders. Thus, approaches that model depressive symptoms over time have the potential to provide important insight. The limited number of studies with prospectively described depressive trajectories suggests that symptoms generally persist or increase and may follow different trajectories in men and women (10–15).

Increased depressive symptoms are observed among individuals with health conditions including type 2 diabetes, cardiovascular disease, cancer, arthritis, and asthma (16). Studies also show that these health conditions are linked to increased risk of disability and mortality (17). Likewise, unhealthy behaviors such as smoking, alcohol consumption, low physical activity, and obesity are more common among individuals with depression (18) and are linked with disability and mortality (19,20). Low socioeconomic status and race are also related to both depression and adverse health outcomes (21).

The purpose of this study was to examine 4-year trajectories of depressive symptoms in older adults initially free from disability using a group-based mixture method in relation to subsequent risk of disability and mortality. We hypothesized that depressive symptoms would generally increase over time, but there would be variability in patterns such that individuals in the highest depressive symptom trajectory would have the highest risk of disability and mortality.

Methods

The Health, Aging, and Body Composition (Health ABC) Study is a prospective longitudinal study of 3,075 Black and White men and women aged 70–79 years (22,23). Participants were recruited from a random sample of White Medicare beneficiaries and all age eligible Black residents in areas surrounding Memphis, TN and Pittsburgh, PA. Individuals were eligible to participate if they reported no difficulty walking one-quarter mile, walking up 10 steps without resting, or performing mobility-related activities of daily living. Exclusion criteria were active cancer treatment in the prior 3 years, planned move in the next 3 years, or participation in a randomized trial or lifestyle intervention. Baseline data (Year 1) were collected between April 1997 and June 1998. All participants provided signed informed consent, and the study was approved by the institutional review boards of the clinical sites and the coordinating center.

Depressive symptoms were assessed at Years 1, 3, 4, 5, 6, 8, 10, and 11 (15). For this analysis, depressive symptoms from Year 1 to Year 5 were used to model trajectories in the absence of disability in relation to subsequent development of disability and mortality (Figure 1). A 4-year period also provides sufficient time to observe resolution of transient depressive symptoms and new onset of symptoms. A longer period would necessitate exclusion of participants who develop disability or die. This design was previously used to evaluate patterns of weight change in relation to disability and mortality (24). Depressive symptoms were assessed using the Center for Epidemiologic Studies Short Depression scale (CES-D10) (25). The CES-D10 captures depressive symptoms during the previous week. Individuals indicated the way they felt or behaved in response to 10 questions from 0–3 (0 = rarely or none of the time; 1 = some or a little of the time; 2 = occasionally or a moderate amount of time; and 3 = most or all of the time). Summed scores range from 1 to 30, higher scores indicate greater depressive symptoms. A score of 8 or greater is indicative of significant depressed mood (25).

Disability was determined every 6 months from Year 5 to Year 14 using self-reported severe difficulty walking one-quarter mile or climbing 10 steps (26) at two consecutive times. Reports had to involve the same function (eg, walking or steps). If participants reported severe difficulty at one visit but died before the next contact, difficulty was presumed to persist until death. Time to disability or censorship was determined from the Year 5 visit date to the first report of severe difficulty or last date of contact.

Mortality was determined from death certificates, hospital records, and interview with next of kin. Time to death or last contact if not deceased was calculated from Year 5 to Year 14.

Participants with less than three depressive assessments were excluded (n = 481) as a minimum of three assessments is necessary to provide stable trajectory estimates (27). Participants who developed disability or died before Year 5 (N = 425) or missing covariates were also excluded (n = 67) except for wealth and income (missing categories created) because of known nonresponse. The analytical sample was thus 1,032 men and 1,070 women. Excluded men and women were older, more likely to be Black, be less educated, have lower income and wealth, smoke and consume alcohol, have cardiovascular disease, diabetes, and higher baseline CES-D10 scores than their included counterparts ($p < .05$ for all). Excluded women had higher body mass index (BMI) than included women ($p < .001$). There was no significant difference in BMI among men ($p = .21$) although the direction of the relationship was the same.

All variables with the exception of prevalent disease at Year 5 were from study baseline due to potential effects of depressive

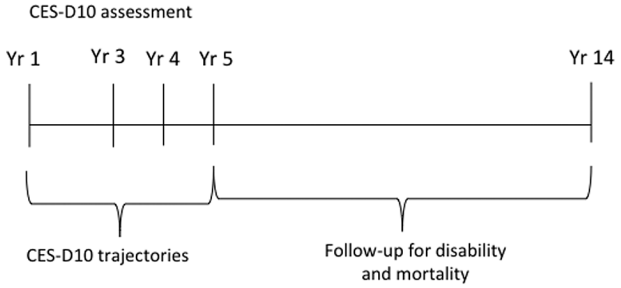

Figure 1. Timeline of depressive symptom assessment and follow-up for disability and mortality.

symptoms on covariates at later assessments. Sociodemographic confounders included age, race, and study site. Three indicators of socioeconomic status were used (28); education: less than high school, high school graduate, or postsecondary, family income: less than $10,000, $10,000–25,000, $25,000–50,000, more than $50,000, or missing, and wealth: none, one–two, or three–seven of money market accounts, savings bonds or treasury bills, home ownership or investment property or housing, a business or farm, stock or stock mutual funds, a retirement account or KEOGH account, and other investments. These indicators were used because they reflect different dimensions of socioeconomic status (29). Education is a sociocultural dimension that represents social class in an early life stage, income reflects a later life stage, and wealth reflects availability of material resources over the life course. Behavioral confounders included lifetime smoking: never, current, or former, alcohol consumption: never, less than once a week, 1–7 times a week, or more than once a day, and self-reported physical activity. BMI (kg/m^2) was calculated from measured height and weight. Disease confounders included type 2 diabetes, cardiovascular disease, cancer, arthritis, and asthma determined from self-report, medications, and clinical assessments at baseline and throughout the 4-year depressive symptom assessment period. Cognitive status was assessed from the Modified Mini-Mental State Exam (3MS). 3MS scores less than 80 or less than 75 for individuals with less than a high school education were used to identify participants with low 3MS scores (30).

Statistical Analysis

Depressive symptoms, disability, and mortality are all known to differ between ethnic groups and men and women (5,21,31). Thus interaction terms for CES-D10 scores with sex and race were modeled in minimally adjusted models that also included the direct effects of sex and race (age, study site, education, sex, race, and CES-D10). Interactions were significant for sex (p = .01) but not for race (p = .62), thus results were sex stratified. Trajectories of depressive symptoms were determined using a group-based mixture method that identifies distinct homogenous clusters of trajectories within a population over time (32,33), which in this analysis is an individuals' age at the time of CESD-10 assessment. This method, which has been used to describe depressive trajectories (11,34), fits two components simultaneously: a censoring normal mixed model of the CES-D10 score as a function of time and a latent class model using the multinomial logistic regression of the trajectory classification. The number of trajectories was determined from (a) Bayesian Information Criterion, (b) posterior probabilities of group membership (27), and (c) presence of a minimum of 5% of participants per trajectory. Trajectories were tested for linear, quadratic, and cubic trends.

We first assessed global differences in participant characteristics among the three depressive symptom trajectories with one-way analysis of variance or chi-square tests. Pairwise comparisons were then assessed with t tests for continuous variables and chi-square tests for binary variables with Bonferroni adjustment for multiple comparisons. Hazard ratios (HRs) and 95% confidence intervals (CIs) for disability and mortality risk were estimated by Cox regression models (reference group: trajectory 1, nondepressed). The proportional hazards assumption was tested using Schoenfeld residuals. BMI and smoking did not meet assumptions (in mortality models only) and were therefore modeled as time varying. Model 1 was adjusted for age, race, study site, and education. Model 2 was additionally adjusted for behavioral, medical, and sociodemographic confounders: BMI, smoking status, alcohol consumption, physical activity, chronic disease, wealth, and income. Model 3 was adjusted for Model 2 covariates plus disease prevalence at Year 5 to determine how incident disease during the trajectory period affects risk estimates. Sensitivity analysis was conducted excluding individuals with baseline low 3MS scores (N = 97). The discriminative properties of depressive symptom trajectories versus the conventional approach of presence/absence of depression (CES-D10 ≥ 8) at baseline for disability and mortality prediction are reported using Somer's D (Supplementary Table 3). All p values are two tailed (α = 0.05). Data were analyzed with STATA version 12.1.

Results

There were three depressive symptom trajectories for men and women. The minimum mean posterior probability was .86, indicating a high likelihood that an individual's trajectory pattern fits within the broader trajectory group (Supplementary Table 1). The lowest two trajectories in men followed linear relationships, whereas the upper trajectory followed a quadratic pattern (Figure 2A. All trajectories followed linear relationships in women (Figure 2B). In men and women, the lowest trajectory was characterized by

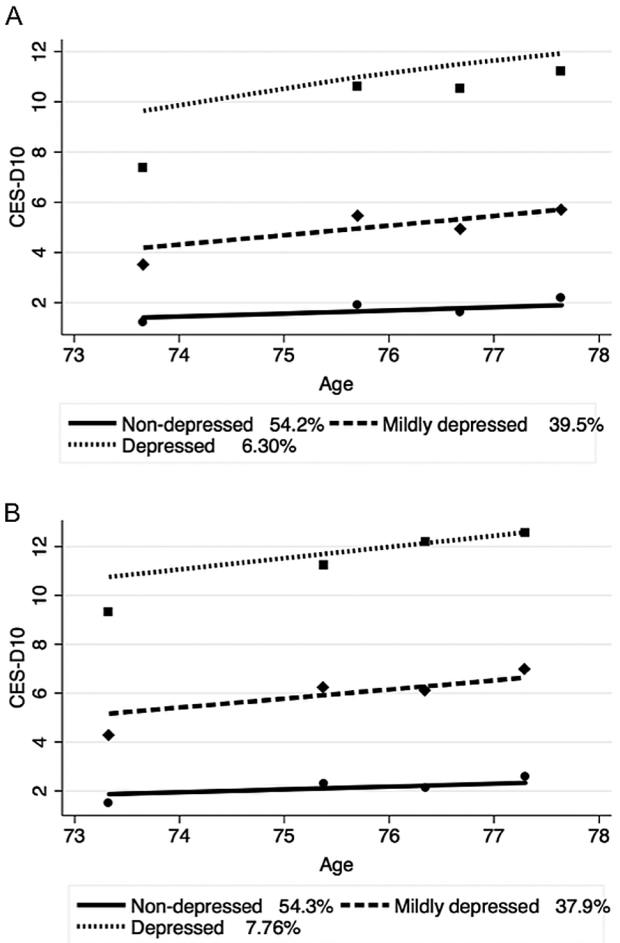

Figure 2. Depressive symptom trajectories from baseline (1997–1998) to Year 5 (2001–2002) in men (**A**) and women (**B**) from the Health ABC Study. Markers represent mean age at study visit.

persistently low depressive symptoms (nondepressed). Trajectory 2 was characterized by moderate depressive symptoms that increased over time (mildly depressed). Trajectory 3 was characterized by depressed mood (baseline CES-D10 score >8) that increased over time (depressed). There was no evidence of a recovering depressive trajectory. The mean (*SD*) changes in CES-D10 score over the 4-year period were 0.92 (2.48) for nondepressed, 2.29 (4.02) for mildly depressed, and 4.00 (6.34) for depressed (p trend < .001) in men and 1.02 (2.64) for nondepressed, 2.82 (4.62) for mildly depressed, and 3.22 (6.83) for depressed (p trend < .001) in women.

Across depressive symptom trajectories, men and women in the depressed trajectory were more likely to be younger and Black and to have less education, lower income, and arthritis (p trend < .05, Table 1). Wealth, BMI, and physical activity additionally varied across trajectories in men, whereas in women the prevalence of diabetes and cardiovascular disease varied across trajectories (p trend < .05). Differences between trajectories were also observed. The mildly depressed (men only) and depressed trajectory were younger than the nondepressed trajectory and less educated, and the mildly depressed and depressed trajectory had a higher prevalence of Black participants than the nondepressed trajectory. In men, BMI was higher in the mildly depressed and depressed trajectories, physical activity was higher, income and wealth were lower in nondepressed relative to mildly depressed, the prevalence of cancer was higher in the depressed trajectory versus nondepressed, and arthritis was more prevalent in the mildly depressed relative to nondepressed. In women, the nondepressed trajectory had higher income and wealth, a lower prevalence of diabetes than the mildly depressed, and a lower prevalence of arthritis than the depressed trajectory.

Over a median (*SD*) follow-up of 7.55 (2.84) years and 7.98 (2.69) years, 264 men (41.4 per 1,000 person years) and 318 women (45.8 per 1,000 person years) developed disability. Men in the mildly depressed and depressed trajectories had increased disability risk

Table 1. Baseline Characteristics by Depressive Symptoms Trajectories in 1,032 Men and 1,070 Women in the Health ABC Study

	Men				Women			
	Nondepressed	Mildly Depressed	Depressed	p Trend	Nondepressed	Mildly Depressed	Depressed	p Trend
N (%)	559 (54.2)	408 (39.5)	65 (6.30)		581 (54.3)	406 (37.9)	83 (7.76)	
Age, y, mean (*SD*)	74.2 (2.86)*	73.1 (2.71)†	72.2 (2.66)‡	<.001	73.8 (2.82)*	73.0 (2.77)†	72.3 (2.57)†	<.001
Race, Black, %	27.9*	36.0†	38.9*,†	.01	37.0*	45.3†	41.0*,†	.03
Site, Pittsburgh, %	53.3*	52.7*	47.7*	.69	49.6*	49.8*	56.6*	.47
Education, %				<.001				<.001
<High school education	17.7*	27.9†	33.9†		16.0*	21.2†	28.9‡	
High school education	25.4*	26.5*	23.1*		37.2*	41.4*	48.2†	
>High school education	56.9*	45.6*	43.1*		46.8*	37.4*,†	22.9‡	
Family income, %				.001				.02
<$10,000	3.22*	8.09†	6.15*,†		10.8*	14.3*	13.3*	
$10,000–$25,000	25.4*	32.8*	38.5*		31.8*	38.2*	47.0*	
$25,000–$50,000	33.5*	29.7*	32.3*		27.5*	22.7*	19.3*	
≥$50,000	27.9*	19.6*	18.5*		13.4*	8.87†	7.23*,†	
Missing	10.0*	9.80*	4.62*		16.4*	16.0*	13.3*	
Wealth, %				<.001				.01
No assets	14.9*	24.3†	30.8*		21.3*	31.8†	31.3†	
1–2	27.2*	29.4*	26.2*		26.7*	24.4*	27.7*	
3–7	48.3*	35.5*	41.5*		35.8*	31.5*	31.3*	
Missing	9.66*	10.8*	1.54*		16.2*	12.3*	9.64*	
Smoking, %				.17				.30
Never	33.5*	28.9*	21.5*		60.9*	60.3*	53.0*	
Former	57.8*	62.5*	64.6*		32.0*	30.5*	33.7*	
Current	8.77*	8.58*	13.9*		7.06*	9.11*	13.3*	
Alcohol consumption, %				.69				.87
Never	41.7*	39.0*	35.4*		52.0*	55.9*	55.4*	
<Once/week	18.8*	21.8*	26.2*		23.8*	21.9*	25.3*	
1–7 times/week	26.7*	27.5*	29.2*		20.5*	19.0*	15.7*	
>1/day	12.9*	11.8*	9.23*		3.79*	3.20*	3.61*	
Body mass index, kg/m², Mean (*SD*)	26.5 (3.57)*	27.4 (3.76)†	28.3 (4.32)†	<.001	27.0 (5.01)*	27.3 (5.27)*	27.2 (5.31)*	.74
Physical activity, kcal/kg/week	1728 (2645)*	1316 (2032)†	1219 (1447)*,†	.02	842 (1413)*	797 (1406)*	990 (2132)*	.55
Diabetes, %	13.4*	17.7*	16.9*	.18	8.09*	13.1†	8.43*,†	.03
Cardiovascular disease, %	27.6*	25.3*	29.2*	.13	12.4*	18.7*	21.7*	.04
Cancer, %	17.5*	20.8*	13.9†	<.001	16.4*	16.3*	16.9*	.28
Arthritis, %	41.1*	50.5†	52.3*,†	.03	55.9*	61.6*,†	72.3†	.03
Asthma, %	2.50*	4.17*	4.62*	.30	2.58*	3.94*	6.02*	.19

Note: Baseline characteristics are presented according to depressive symptoms trajectories over a 4-year period. p Trend represents global comparisons by trajectories. Varying symbols (*, †, ‡) indicate significant differences between trajectories from pairwise comparisons with Bonferroni adjustment for multiple comparison: p = .017 (0.05/3 comparisons) for binary variables and means, p = .006 for three-level variables (education and smoking, 0.05/9), p = .004 (0.05/12) for wealth and alcohol consumption, and p = .003 (0.05/15) for income.

relative to men in the nondepressed trajectory (Figure 3A, Table 2). In women, there was increased disability risk across trajectories from nondepressed to depressed (Figure 3B, Table 2 Model 1 p trend = .002) and the depressed trajectory was associated with greater risk. Associations remained significant with adjustment for behavioral, medical, and sociodemographic confounders (Model 2) and Year 5 disease prevalence (Model 3). Exclusion of participants with low 3MS scores negligibly affected risk estimates. The HRs (95% CIs) in men were 1.50 (1.13–1.98) and 2.19 (1.35–3.54) for the mildly depressed and depressed trajectories and in women were 1.05 (0.81–1.34) and 2.02 (1.37–2.98), respectively.

After a median (*SD*) follow-up of 8.96 (2.73) years and 9.02 (2.27) years, 454 men (60.3 per 1,000 person years) and 355 women died (41.9 per 1,000 person years). Of the deceased individuals, 29.7% (men) and 33.8% (women) had developed disability. Compared with the nondepressed trajectory, mildly depressed and depressed trajectories were associated with increased mortality risk in men (Figure 3C, p trend = .001) but not in women (Figure 3D, p trend = .86). Adjustment for behavioral, medical, and sociodemographic confounders (Model 2) and Year 5 disease prevalence (Model 3) did not attenuate associations. Risk estimates were similar with exclusion of participants with low 3MS scores, among men HR (95% CI) 1.22 (0.98–1.51) and 1.64 (1.10–2.46) for mildly depressed and depressed trajectories as well as among women HR (95% CI) 0.92 (0.73–1.17) and 1.02 (0.67–1.58).

Associations between baseline depression, disability risk, and mortality risk were similar to the analysis of depressive symptom trajectories (Supplementary Table 2). Men who were depressed had increased disability and mortality risk, whereas women who were depressed had an increased risk of disability but not of mortality. However, the magnitude of the risk associated with baseline depression was lower. For example, men who were depressed at baseline had disability risk of HR 1.62 (95% CI 1.03–2.44) versus HR 2.12 (1.33–3.38) for men in the depressed trajectory group.

Discussion

This study furthers the understanding of relationships between depressive symptoms, disability, and mortality. Group-based models identified three depressive trajectories none of which suggested recovering depressive symptoms despite a generally healthy population. Rather, nearly 50% of participants had increasing depressive symptoms. In line with our hypothesis, the depressed trajectory had increased risk of disability independent of other risk factors. Risk was particularly pronounced in men; 112% increased disability risk and 63% increased mortality risk in the depressed trajectory compared with the nondepressed trajectory. Among women, the risk for disability was 102% higher for the depressed compared with the nondepressed trajectory, but unlike men, no associations were observed with mortality. There was increased risk of disability (45%) and mortality (24%) in men but not in women at subclinical levels of depressive symptoms, thus emphasizing the importance of early detection and monitoring of symptoms in geriatric care.

Based on risk ratios, these results suggest stronger associations between depressive symptom trajectories and disability than mortality. This may reflect biological processes that occur earlier in the pathway of health decline, while relationships with mortality may not have been adequately captured during the 9-year follow-up in

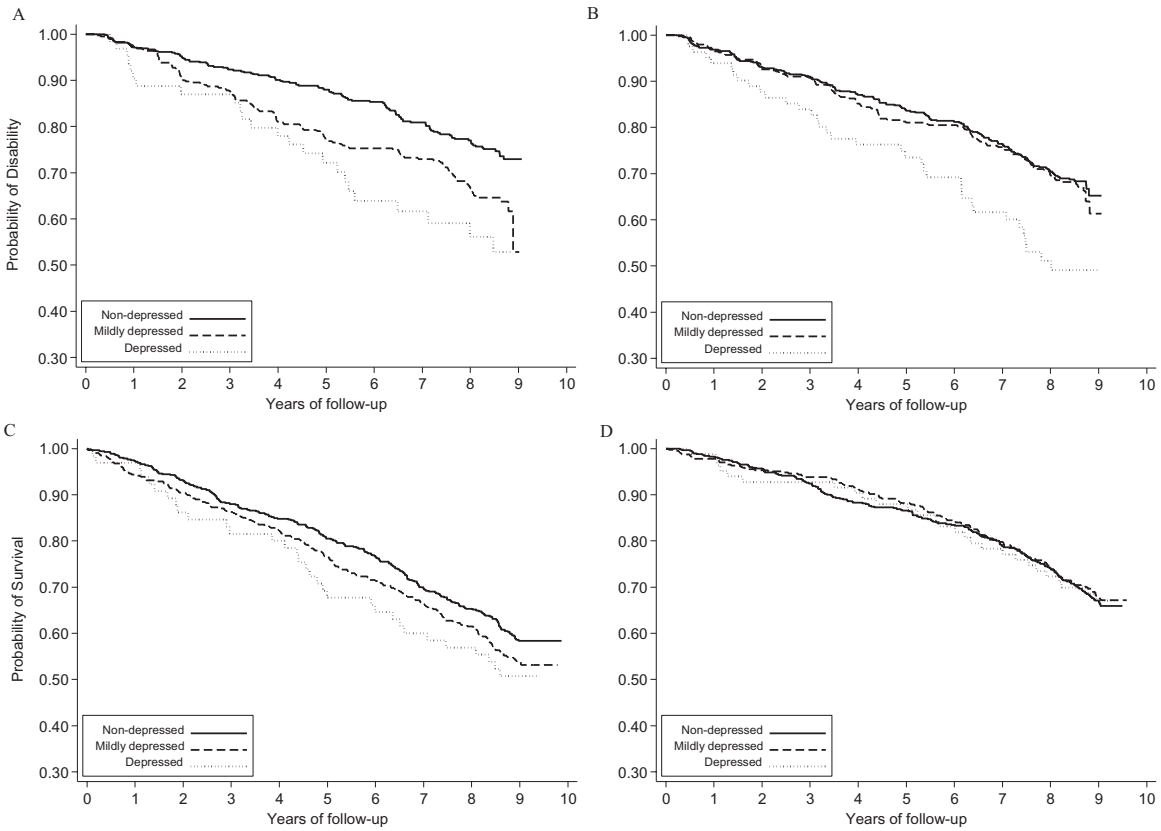

Figure 3. Kaplan–Meier curves of cumulative incidence of disability in men (**A**) and women (**B**), and mortality in men (**C**) and women (**D**) by depressive symptom trajectories. Y-axis represents probability of survival (**A** and **B**) or probability of remaining disability free (**C** and **D**).

Table 2. Hazard Ratios and 95% CIs for Disability and Mortality by Depressive Symptom Trajectories

Trajectory	Baseline CES-D10		Person Time (y)	*N* Events	Event Rate	Model 1		Model 2		Model 3	
	Mean	*SD*				HR	95% CI	HR	95% CI	HR	95% CI
Disability											
Men											
Nondepressed	1.16	1.61	3634	119	32.8	1.00		1.00		1.00	
Mildly depressed	3.60	2.81	2401	121	50.4	1.67	1.28–2.17	1.45	1.11–1.89	1.41	1.08–1.85
Depressed	7.44	4.42	340.8	24	70.4	2.55	1.62–4.00	2.12	1.33–3.38	2.13	1.34–3.38
p Trend	<.001					<.001		<.001		<.001	
Women											
Nondepressed	1.46	1.67	3831	163	42.6	1.00		1.00		1.00	
Mildly depressed	4.35	2.96	2636	119	45.1	1.12	0.88–1.43	1.04	0.81–1.34	1.04	0.81–1.33
Depressed	9.61	4.70	477.7	36	75.4	2.09	1.44–3.03	2.02	1.37–2.96	2.01	1.37–2.97
p Trend	<.001					.002		.01		.01	
Mortality											
Men											
Nondepressed			4153	232	55.8	1.00		1.00		1.00	
Mildly depressed			2902	190	65.5	1.28	1.05–1.57	1.24	1.01–1.52	1.25	1.02–1.53
Depressed			439.0	32	72.9	1.58	1.08–2.30	1.63	1.10–2.41	1.55	1.05–2.29
p Trend						.002		.005		.005	
Women											
Nondepressed			4585	196	42.8	1.00		1.00			
Mildly depressed			3234	132	40.8	0.99	0.79–1.24	0.93	0.74–1.16	0.91	0.72–1.15
Depressed			649.4	27	41.6	1.08	0.71–1.62	1.01	0.67–1.54	1.03	0.68–1.58
p Trend						.86		.73		.71	

Note: CES-D = Center for Epidemiologic Studies Depression Scale; CI = confidence interval; HR = hazard ratio. Event rate: per 1,000 person years. Model 1 was adjusted for age, race, education, and study site. Model 2 was adjusted for Model 1 + body mass index, diabetes, cardiovascular disease, cancer, arthritis, asthma, smoking status, alcohol consumption, physical activity, wealth, and income. Model 3 was adjusted for Model 2 + prevalent diabetes, cardiovascular disease cancer, arthritis, and asthma at Year 5.

this generally healthy population. The divergence between depressive symptoms, mortality, and disability is notable because of potential implications for disability-free survival and quality of life; for example, women with depressive trajectories had increased disability risk but survival was similar to the nondepressed trajectory.

A complex relationship between depression and chronic disease has been hypothesized to explain relationships between depression, disability, and mortality. Depression appears to precede chronic diseases, and chronic diseases may amplify depressive symptoms (35). Our analysis focused on depressive symptoms rather than clinical depression but even still, adjustment for chronic diseases minimally affected risk estimates. Residual confounding is possible, as participants with chronic disease were not excluded; however, our results align with prior studies (5,36,37). Unhealthy behaviors such as smoking, alcohol consumption, and low physical activity are more common in depressed individuals (38,39) but explained a small portion of risk relationships in our sample, suggesting the presence of alternative biological pathways linking depression to disability and mortality.

Relationships between depressive symptoms, disability, and mortality were more consistent among men despite generally lower CES-D10 scores than women. Previous work also found that men were more likely to transition from depression to death than women (40). Conversely, Penninx and colleagues (36) reported greater risk among women for depression and development of mobility disability. Comparability is limited by key study differences: cross-sectional measure of depression (yes/no, CES-D ≥20) versus trajectories of CES-D10 scores. Women are more than twice as likely to be diagnosed with depression as men (41,42), which likely reflects differences in depressive symptoms and care seeking (43). Men may have lower diagnostic scale scores because manifestations of depression such as anger and substance abuse may differ from women and traditional diagnostic symptoms (43). Disability and mortality risk may occur at a lower depressive threshold in men than in women. This may explain why the mildly depressed trajectory was associated with disability and mortality in men but not in women. In line with this, a study of older adults found that minor depression increased the mortality risk in older men but not in older women (5). Changes in depressive symptoms in old age may also vary by gender (10,11,34). The depressed trajectory followed a quadratic relation in men versus a linear relationship in women and characteristics that differed by trajectories varied for men and women (BMI and physical activity differed across trajectories in men only).

The repeated measure of depressive symptoms in a well-characterized population of older adults is a strength of our study. This provides important insight into depressive symptoms in old age beyond a single assessment of depressive symptoms. Even in the absence of major depressive symptoms, worse symptomology was a risk factor for disability and mortality (men only). Second, because participants were initially well functioning, we have greater confidence in the direction of the relationship whereby increasing mild (men only) and depressive symptoms are associated with increased disability risk. A limitation is the CES-D10 assessment, which is designed to capture two aspects of depression: depressed mood and

lack of positive affect in the prior week, and it is not comparable with criteria in the Diagnostic and Statistical Manual of Mental Disorders or with International Classification of Disease-10 codes. However, the CES-D10 has high sensitivity and specificity for major depression diagnoses in older adults (44) and validity across a range of populations (45,46). The CES-D10 takes only 5–10 minutes to complete and is a useful screening tool already in place in many geriatric care settings. However, these community-dwelling older adults likely have lower prevalence of major depression than older adults in acute care settings or long-term care facilities which may limit generalizability. The analytical sample was also healthier than the Health ABC population because the sample was selected on multiple measures of CES-D10, subsequent disability and mortality. However, despite the healthy population, risk for disability was striking among men and women in the depressed trajectory, and risk may be even greater among less healthy populations.

Conclusions

These results illustrate the importance of monitoring depressive symptoms in older adults. Assessment of depressive symptoms over a period of only 4 years predicted impending disability in men and women. Depressive symptom trajectories predicted mortality in men but not in women, suggesting gender risk differences that are important to explore further. This population had a low initial prevalence of major depressive symptoms, and elevated disability and mortality risk occurred in trajectories with initial mean CES-D10 scores ranging from 3.6 to 9.6. This provides convincing evidence that even at subclinical levels, increasing depressive symptoms are clinically relevant in older adults and particularly among older men. This has public-health importance and implications for health management and treatment of depressive symptoms.

Supplementary Material

Supplementary material can be found at: http://biomedgerontology.oxfordjournals.org/

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