The Association of Late-Life Depression and Anxiety With Physical Disability

A Review of the Literature and Prospectus for Future Research

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Depression and anxiety disorders are associated with excess disability. The authors searched the recent geriatric literature for studies associating late-life depression or anxiety with physical disability. Studies showed depression in old age to be an independent risk factor for disability; similarly, disability was found to be a risk factor for depression. Anxiety in late life was also found to be a risk factor for disability, although not necessarily independently of depression. Increased disability due to depression is only partly explained by differences in socioeconomic measures, medical conditions, and cognition. Physical disability improves with treatment for depression; comparable studies have not been done for anxiety. The authors discuss how these findings inform current concepts of physical disability and discuss the implications for future intervention studies of late-life depression and anxiety disorders. (Am J Geriatr Psychiatry 2001; 9:113–135)

Disability can be defined as a restriction in or lack of ability to perform an activity because of impairment.[1] These activities can include interpersonal relationships, work or school, or physical activities; the latter (impairment) is defined as "physical disability," the focus of this review. Physical disability typically refers to difficulty, restriction, or dependence on others in performing activities of daily living (ADLs) or instrumental activities of daily living (IADLs). ADLs are self-care tasks, such as feeding oneself, dressing, bathing, toileting, and mobility. IADLs are less basic tasks that are necessary for independent living, such as preparing food, cleaning, and paying bills. Although they are described as "physical," these tasks clearly have a mental component as well.

In part, it is this mental component that makes *physical disability* a distinct concept from impairment in *physical performance*, such as objective measures of strength, speed, or range of motion; the two measures are only moderately correlated.[2] For example, in an ar-

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thritic person, impairment is decreased range of motion, whereas disability is need for assistance to prepare or eat food because of this decreased range of motion. Similarly, disability is a construct separate from *disease severity*. Even though disease is intuitively disabling, and more severe disease pathology is in general correlated with greater disability, the correlation is moderate or even low,[3,4] suggesting that "physical" disability is a complicated construct that includes elements of physical and mental functioning. However, physical disability should be distinguished from *quality of life*, an even broader measure that takes into account not only physical, social, and role disability, but also life satisfaction and pleasure. Measures of quality of life have a great deal of shared variance with depressive symptoms in elderly persons, and studies showing that depression affects quality of life may simply reflect this variance.[5]

Disability and Psychiatric Disordersas a Public Health Issue

According to the Global Burden of Disease study, unipolar major depression is the leading worldwide cause of disability in adults.[6] Anxiety disorders such as panic disorder and posttraumatic stress disorder were found to be important causes of disability as well. Although the Global Burden of Disease study represents the most comprehensive existing work regarding disability due to depression and anxiety, its results are less applicable to elderly patients because role disability (e.g., inability to work) accounted for much of the disability in the study. Role disability is a less important issue for elderly patients, in whom physical disability is most important: persons age 65 and older account for 54% of all physical disability in the United States,[7] a percentage that will increase as this age-group increases from 17% to 26% of the total adult population over the next 30 years.[8] An increase in physical disability is a strong predictor of nursing home placement and increased health care utilization;[9] similarly, late-life depression is linked to greater health care utilization.[10] It is hardly surprising, then, that depressed, disabled elderly patients are high health care utilizers.[10] Evidence of a secular trend for lower disability rates in the oldest age-group[11] gives cause for optimism that appropriate management of common medical conditions in elderly patients will result not only in advances in longevity but in decreased disability as well. Depressive syndromes, including major depressive disorder and minor depression, are common in elderly patients, similar in prevalence to younger age-groups.[12] Though anxiety disorders may be less prevalent in older age-groups,[13] their prevalence is still high, and they are often comorbid with depression.[14] From these perspectives, excess disability due to depression and anxiety in elderly patients is an important public health issue in terms of burden of disease and health care costs.

Objective

Although there is a consensus that late-life depression leads to, amplifies, and is a consequence of physical disability,[15–18] a review of the literature in 1988 concluded that studies at that time could neither elucidate the pathways between late-life depression and disability nor determine the effectiveness of interventions in relieving disability in the context of late-life depression.[15] Although the literature in young-adult populations shows that anxiety disorders are also associated with increased disability,[19–21] there is no consensus regarding the association of late-life anxiety disorders with disability. This article reviews recent advances in our knowledge of the association of late-life depression and anxiety with physical disability. We specifically sought to answer two main questions: First, how do late-life depression and anxiety disorders cause or amplify physical disability? Second, how should the findings be applied to future late-life depression and anxiety intervention studies? Conversely, we also sought to determine how disability causes or amplifies depression and anxiety. The answers to these questions provide important insights into the nature of physical disability and provide directions for mental health intervention research aimed at reducing or preventing excess disability in late life.

METHODS

We used MEDLINE and PsycInfo searches to find articles relating late-life depression or anxiety to disability. Search terms were *depression*, *depressive disorders*, *anxiety*, *anxiety disorders*, *panic disorder*, *social phobia*, *obsessive–compulsive disorder*, and *generalized anxiety disorder*, in combination with *activities of daily living*, *disabled persons*, and *disability evaluation*, and in combination with *aged*, for the time frame 1990–2000. Additional articles were identified by the

authors' knowledge of the literature and review of citations in retrieved articles. Studies of mixed-age populations were included if the average age of the study population was ≥61. Case reports and reviews were excluded, as were articles specific to dementia. If the same subject population was analyzed by more than one study, only one study was tabulated. Studies of overall quality of life or physical performance but not physical disability were excluded.

RESULTS

Depression and Disability

The search yielded 66 studies meeting the above criteria associating depression and disability. Of these, 16 were cross-sectional community studies, 9 were longitudinal community studies, 18 were cross-sectional clinical observational studies, 18 were longitudinal clinical observational studies, and 5 were intervention studies.

Instruments used to measure depression and disability. Many studies identified depression with either the Center for Epidemiologic Studies–Depression scale (CES-D)[22] or the Geriatric Depression Scale (GDS).[23] These screening instruments are non-diagnostic: they have high sensitivity, but lower specificity for major depression, when medically ill elderly patients are included.[24] The most common instruments used to measure disability were the Katz Index of ADL,[25] the Lawton Physical Self-Maintenance Scale and the Index of IADL,[26] the Medical Outcomes Study (MOS) physical functioning scale,[27] and the Functional Independence Measure (FIM).[28] Several other studies used derivations of these instruments; thus, they account for most disability measurements in these studies.

The Katz Index assesses degree of dependence in bathing, dressing, toileting, transfers, continence, and feeding. It is rated by observation or interview with the patient. It was developed to measure disability of elderly and chronically ill patients with stroke or hip fracture. The Lawton scales comprise six ADL items and eight IADL items, assessing degree of dependence. Rating is typically done by observation or by the patient. These scales were developed to evaluate disability in elderly people in the community and in institutions. The MOS physical functioning scale comprises 10 self-report items assessing limitations in ADLs and IADLs. This scale was developed for measuring variations in outpatients with relatively high levels of functioning; it concentrates primarily on IADLs. The FIM is an observer-rated scale (usually done by a rehabilitation therapist) that assesses independence in 18 items covering self-care, mobility, communication, and social cognition. It was developed to measure progress and outcomes in rehabilitation settings. All of these scales are well-validated in medically ill geriatric populations.

Community studies. The 16 cross-sectional community studies are shown in Table 1.[29–44] All but three studies found a significant association between depression and disability in ADLs and IADLs in multivariate analyses, controlling for age, gender, education, income, cognition, physical performance measures, and medical conditions. Of the three negative studies, the first two were small studies of select populations: the first was a group of 89 retired Catholic sisters;[31] the second was a group of 84 nonagenerians and centenarians in residential settings.[43] The third negative study included self-rated health as a covariate, finding that depression was not associated with IADL disability.[40] Perception of health is a measure with considerable shared variance with both disability and depression.[40,45] However, another study found that depression was significantly associated with ADL disability, controlling for self-rated health.[33]

As a whole, these studies show a significant and independent association between depression and disability. Most studies expressed the strength of the association in terms of a correlation coefficient, which ranged from 0.10 to 0.54, or an odds ratio, which ranged from 1.9 to 4.9.

Table 2[46–54] shows nine longitudinal community studies. Three[46,51,53] of six[47–49] studies found baseline depression to be an independent risk factor for disability during the follow-up period, controlling for baseline medical conditions, social support, education, age, gender, and cognitive impairment. The three positive-effect studies examined subjects who were not disabled at baseline. In these initially non-disabled populations, the existence of depression at baseline was associated with a 60%-or-higher increase in risk for disability.[46,51,53] Baseline characteristics accounted for less than half of this increased risk. Adjustment for incident medical problems during the follow-up period,[51] health behaviors such as smoking and inactivity,[51] and baseline physical

TABLE 1. Cross-sectional community studies

Article	Characteristics: *N*	Characteristics: Age: Mean (Range)	Instruments Used: Depression	Instruments Used: % With Depression	Instruments Used: Disability	Results
Barberger-Gateau et al., 1992[29]	2,792	75 (65+)	CES-D >16 (male) or >22 (female)	13.6%	ADL: Katz Index IADL: Lawton scale	Depression was associated with increased ADL and IADL disability, controlling for age, gender, education, urbanicity, sensory impairment, and cognition.
Beekman et al., 1997[30]	646	(55–85)	CES-D ≥16 (for minor) and DIS diagnosis (for major)	12.9% (minor) and 2.0% (major)	ADL/IADL: modified from MOS	Both minor and major depression were associated with increased ADL and IADL disability, controlling for age, gender, education, urbanicity, marital status, medical conditions, and functional limitations.
Bienenfeld et al., 1997[31]	89	(65–92)	Subscale from GHQ	N/A	ADL/IADL: Multilevel Assessment Instrument	Depression was not associated with increased ADL/IADL disability in bivariate analysis.
Black et al., 1998[32]	2,823	73 (65+)	CES-D ≥16	26%	ADL: Katz Index	Greater ADL disability was associated with depression in men and women, controlling for age, education, financial strain, social support, and medical conditions.
Dentino et al., 1999[33]	1,681	78 (70+)	CES-D ≥16	9%	ADL: Katz Index, Rosow-Breslau, and Nagi scales IADL: Lawton scale	Greater ADL but not IADL disability was associated with depression, controlling for age, gender, race, education, self-rated health, and life satisfaction.
Forsell et al., 1994[34]	1,304	85 (75+)	DSM-III-R criteria, physician interview	5.9% (major) 8.3% (dysthymia)	ADL: Katz Index	Increased ADL disability was associated with both mood symptoms (depressed mood, poor sleep and appetite, guilt and suicidality) and motivational symptoms (poor concentration and energy, psychomotor retardation), controlling for age, gender, and cognition.
Ganguli et al., 1999[35]	1,554	67 (57–95)	GDS–Hindi version	10%	ADL: EASI	In a rural India sample, depressive symptoms were associated with disability, controlling for age, gender, and literacy.
Grigsby et al., 1998[36]	1,158	73 (60+)	CES-D	N/A	ADL: Katz Index, SAILS IADL: OARS, SAILS	Depressive symptoms were associated with increased ADL and IADL disability, controlling for age, ethnicity, gender, education, and cognition. Correlation of depression with self-report disability measures (Katz Index, OARS) was higher than for observed disability measure (SAILS).

(continued)

TABLE 1. Cross-sectional community studies *(continued)*

Guccione et al., 1994[37]	1,769	74 (64–95)	Modified CES-D >3	9.1%	IADL: adapted from multiple scales	Depression was associated with increased IADL disability, controlling for age, gender, and medical conditions.
Laukkanen et al., 1993[38]	800	(65–84)	Modified BDI	N/A	ADL/IADL: Lawton scales	Depressive symptoms were associated with increased ADL and IADL disability, controlling for cognition and medical conditions.
Laukkanen et al., 1997[39]	706	75	CES-D	N/A	ADL: study-specific instrument	Depressive symptoms were associated with increased ADL disability in one of four population subgroups, controlling for physical performance measures such as balance and strength, and visual impairment.
Mulsant et al., 1997[40]	880	76 (65+)	Modified CES-D	N/A	IADL: OARS	Depression was not significantly associated with greater IADL disability after controlling for self-rated health, age, gender, education, medical conditions, and health care utilization.
Ormel et al., 1998[41]	5,279	70 (57+)	Depression subscale of HADS >7	17.4%	ADL/IADL: MOS physical functioning scale and study-specific instrument	Depression was associated with increased ADL and IADL disability, controlling for gender, age, socioeconomic status, and medical conditions. Amount of correlation was greater than or equal to most medical conditions.
Prince et al., 1997[42]	654	76 (65–98)	Modified CARE	17.7%	ADL: modified Katz Index	Increased ADL disability was associated with depression, controlling for age, cognition, and life events.
Ravaglia et al., 1997[43]	84	98 (90–106)	GDS >20	15.5%	ADL: Katz Index	Depression was not associated with greater ADL disability in either univariate or multivariate analysis, in this small nonrandom sample.
West et al., 1998[44]	1,948	(55+)	CES-D ≥16	9.1%	ADL: Nagi, Rosow-Breslau scales	Greater ADL disability was associated with depression, controlling for age, income, education, medical illness, physical performance, and social support.

Note: ADL: Activities of Daily Living; BDI: Beck Depression Inventory; CARE: Comprehensive Assessment and Referral Evaluation; CES-D: Center for Epidemiologic Studies–Depression scale; DIS: Diagnostic Interview Schedule; EASI: Everyday Abilities Scale for India; GDS: Geriatric Depression Scale; GHQ: General Health Questionnaire; HADS: Hospital Anxiety/Depression Scale; IADL: Instrumental Activities of Daily Living; MOS: Medical Outcomes Study; OARS: Older Americans' Resources and Services Instrument; SAILS: Structured Assessment of Independent Living Skills.

TABLE 2. Longitudinal community studies

Article	Subject Characteristics: *N*	Subject Characteristics: Age: Mean (Range)	Subject Characteristics: Follow-Up Interval, years	Instruments Used: Depression or Anxiety	Instruments Used: % Depressed (initial)	Instruments Used: Disability	Results
Bruce et al., 1994[46]	1,038	(70–79)	2.5	Hopkins Symptom Checklist	N/A	ADL: Katz Index	In this population of subjects with no baseline ADL disability, baseline depression predicted incident ADL disability, controlling for baseline physical and cognitive function, age, medical illness, and body mass index.
Gallo et al., 1997[47]	653	66 (50+)	13	DIS[a]	Major: 1.8% Minor:15.8%	ADL/IADL: study-specific instrument	Baseline depression predicted greater ADL and IADL disability at baseline and incident during follow-up. After controlling for age, cognition, gender, ethnicity, education, and medical conditions, only increased IADL disability was predicted and only in the nondysphoric depression group.
Hebert et al., 1999[48]	504	80 (75+)	2	GDS	N/A	ADL/IADL: Functional Autonomy Measurement System	Baseline depressive symptoms did not predict greater disability at follow-up, controlling for age, living situation, social support, weight loss, falls, morbidity index, cognition, and baseline disability.
Kempen et al., 1999[49]	574	72 (57–93)	2	HADS depression subscale	N/A	ADL: subscale of GARS	In a highly disabled population, baseline depressive symptoms did not predict greater follow-up disability. However, worsening depressive symptoms during follow-up were associated with greater follow-up disability.
Kennedy et al., 1990[50]	1,457	(65+)	2	CES-D ≥16	11.2%[b] (incident) 7.7% (persistent)	ADL: not specified	Baseline and especially incident ADL disability predicted incident depression, controlling for medical conditions, income, social support, life events, and cognition.

(continued)

TABLE 2. Longitudinal community studies *(continued)*

Penninx et al., 1999[51]	6,244	73 (65+)	6	CES-D ≥20	7.9%	ADL: Katz Index, mobility subscale from Rosow-Breslau	In this population of subjects with no baseline ADL disability, baseline depression predicted incident ADL disability; relative risk 1.67 and 1.73 for incident ADL and mobility disability, respectively. Adjustment for age, gender, education, income, physical activity, social support, baseline medical conditions, and incident medical conditions reduced relative risk to 1.45 and 1.37.
Roberts et al., 1997[52]	2,219	65 (50–95)	1	DSM symptoms adapted from PRIME-MD	8.7% at baseline 9.0% at 1 year	ADL: study-specific instrument	Baseline ADL disability predicted incident and persistent depression in univariate analysis.
Tinetti et al., 1995[53]	927	80 (72+)	1	CES-D ≥16 (depression) and STAI ≥32 (anxiety)	22% (depression) 49% (anxiety)	ADL: Katz Index	Baseline depression and anxiety predict greater ADL disability at follow-up, controlling for baseline physical performance, sensory impairments, cognition, and medication use. In those with no disability at baseline, depression, but not anxiety, was a significant predictor of disability at follow-up.
Zeiss et al., 1996[54]	680	63 (50+)	2	SADS	14% (incident MDD)	ADL/IADL: Study-specific instrument	Baseline disability (including sensory impairments) predicted incident depression, controlling for age, gender, and medical conditions.

Note: ADL: Activities of Daily Living; CES-D: Center for Epidemiologic Studies–Depression scale; DIS: Diagnostic Interview Schedule; GARS: Groningen Activity Restriction Scale; GDS: Geriatric Depression Scale; HADS: Hospital Anxiety and Depression Scale; IADL: Instrumental Activities of Daily Living; MDD: major depressive disorder; SADS: Schedule for Affective Disorders and Schizophrenia; STAI: Spielberger State Trait Anxiety Inventory.

[a]In this study, subjects with depression were divided into major depression (5+ DIS symptoms) and minor depression (3–4 symptoms), and those with minor depression were subdivided into dysphoric depression (mood/interest item-positive) and nondysphoric depression (mood/interest item-negative).

[b]Rate of subjects with emergent depression over a 2-year period (defined as increase in CES-D score to 16 or more as well as at least 5-point increase).

performance measures such as strength[46,53] or sensory impairments[53] did not change the increased risk. Of the three studies that did not show depression to predict onset of disability, one contained wide confidence intervals that included a two-fold increased risk.[47] Another negative study also found minimal or no significant risk of disability onset associated with poor social support and cognitive status,[48] both of which are known risk factors for disability. The third study did not find baseline symptoms of depression predictive of change in self-rated disability but did find that increased depressive symptoms over time were associated with worsening disability as well as worsening performance-rated functioning.[49] This finding suggests that, whereas stable or improving depressive symptoms are not associated with increased disability, worsening depression is associated not only with increased self-rated disability, but also with more impaired physical performance on objective scales.

Three studies found disability to be a risk factor for the onset of depression. These studies controlled for age, gender, medical conditions, and income.[50,52,54] One study also showed that the appearance of disability tended to coincide with the emergence of depression.[50] Overall, these results suggest that depression and disability increase risk for each other. The risk is partly mediated by differences in baseline medical illness, social support, education, and income.

Clinical observational studies. Table 3[55–72] shows 18 cross-sectional clinical observational studies. They include medical outpatients,[62,66,67] medical[65,70] or rehabilitation[57] inpatients, long-term care residents,[59,72] and psychiatric inpatients and outpatients.[55,61,65] All but two studies[57,72] found an association between depression and disability in these clinical populations. Similar to community studies, this association remained significant even after controlling for disease severity relating to heart failure[64] or arthritis;[66] in fact, disability was more strongly associated with depression than with disease severity. Of the two negative studies, one is difficult to interpret because of a small sample size of 61 subjects;[57] the other was conducted in highly disabled nursing home patients.[72]

Three studies of elderly depressed patients in psychiatric settings examined correlates of disability.[55,61,69] Two found a significant relationship of disability with degree of social support and cognitive impairment.[55,69] Specifically, cognitive deficits in initiation and perseveration were associated with increased disability in a depressed population.[55] These two studies also found increased disability in more severely depressed subjects, consistent with a study of nursing home residents that found more disability with major depression than with minor depression.[59] In contrast, two primary care studies found that subsyndromal depression was as strongly associated with disability as was major depression.[62,67]

Taken as a whole, these studies replicate findings from cross-sectional community studies; that is, there is a significant association between depression and disability that cannot be accounted for by greater medical illness in depressed subjects.

Table 4[73–90] shows 18 longitudinal clinical observational studies, which included a wide variety of inpatient and outpatient settings. Some followed progression of disability over time in subjects who were assessed for depression at baseline,[76,80,88] similar to previously mentioned longitudinal community studies. They found depression to be a risk factor for increased incidence of disability, even in one study that controlled for baseline disability.[88] One study also found that patients who became depressed were likely to become disabled at the same time.[76]

Several studies followed patients after an incident event such as a stroke,[74,80] hip fracture,[83,84] medical inpatient admission,[79] diagnosis of heart disease,[89] or admission to a rehabilitation setting.[78,82,85,87,90] These studies evaluated the effects of depression on the recovery process—whether depression would be associated with less functional improvement. In all studies of post-stroke patients,[74,80,87] and post-hip fracture patients,[83,84] subjects with depression at baseline were less likely to regain pre-stroke levels of functioning, but this was not true in patients treated for heart disease.[89] Three[82,85,87] of five[78,90] rehabilitation-setting studies found less improvement in disability in depressed individuals. One of these studies controlled for length of stay,[85] and two controlled for initial functional status,[85,87] which are known predictors of improvement during rehabilitation.

Of two prospective studies[73,86] examining predictors of depression, one[86] found that baseline disability predicted onset of depression. Also, three studies found that change in disability coincided with change in depression: improvement in disability was associated with improvement in depression,[75,81] and worsening disability was associated with worsening depression.[76]

TABLE 3. Cross-sectional clinical-observational studies

Article	Subject Characteristics: *N*	Subject Characteristics: Age: Mean (Range)	Subject Characteristics: Location/ Characteristics	Instruments Used: Depression or Anxiety	Instruments Used: Disability	Results
Alexopoulos et al., 1996[55]	75	73 (60+)	Inpatient and outpatient psychiatric services; all subjects with major depression	SADS, Ham-D	ADL/IADL: Multilevel Assessment Instrument	Disability by self-rating was associated with severity of depression, medical burden, social support, and age. Several depressive symptoms (anxiety, depressive ideation, psychomotor retardation, and weight loss) correlated most highly with disability. Disability by interviewer rating was associated with initiation-perseveration problems from dementia scale but not with depressive severity.
Bond et al., 1998[56]	642	78 (65+)	Community-residing outpatients 6 months after hospital admission	HADS	ADL: Clackmannan Disability Scale	Of patients living in the community 6 months after a stroke or hip fracture, those with anxiety or depression (41%) were more likely to have ADL disability than those without anxiety or depression.
Egan et al., 1992[57]	61	77 (65–92)	Rehab. inpatients after hip fracture	GDS	ADL: Barthel Index	Depression was not significantly associated with increased ADL disability at discharge, nor was age, mental status, health, or social support.
Ehmann et al., 1990[58]	45	67 (51–85)	Outpatients with Parkinson's disease	BDI	ADL: study-specific scale	Depressive symptoms were correlated with greater ADL disability in univariate analysis.
Katz et al., 1995[59]	1,057	84	Residential and skilled-nursing patients	GDS and SADS	ADL: Lawton scale	Those with MDD (12.2%) had more disability than those with minor depression (18.4%), who in turn had more disability than non-depressed patients, controlling for medical conditions.
Kurlowicz, 1998[60]	73	72 (65–83)	Patients 6 weeks after elective hip-replacement surgery	GDS	ADL/IADL: Functional Status Index	Depression and ADL/IADL disability were associated.
Lyness et al., 1993[61]	71	72 (60+)	Psychiatric inpatients with major depression	SCID, Ham-D	ADL/IADL: Lawton scales	Depressive severity associated with increased IADL but not ADL disability, controlling for GAF score, age, gender, education, medical conditions, and disability due to medical illness.
Lyness et al., 1999[62]	224	71 (60+)	Primary care outpatients	SCID, Ham-D	ADL/IADL: Lawton scales	Depressed subjects were divided into major depression (6.5%), minor depression (5.2%), and subsyndromal depression (9.9%). All three groups had greater ADL/IADL disability than non-depressed subjects, controlling for age, gender, education, site, and medical conditions.
Menza and Mark, 1994[63]	104	65	Outpatients with Parkinson's disease	Zung Depression Scale	ADL: Rapid Disability Rating Scale	Depression was associated with increased ADL disability in Parkinson's patients, controlling for severity of illness and personality dimensions.

(continued)

TABLE 3. Cross-sectional clinical-observational studies *(continued)*

Murberg et al., 1998[64]	119	66	Outpatients with CHF	Zung Depression Scale	ADL/IADL: study-specific scales	Depression scores correlated with increased ADL/IADL disability, controlling for severity of CHF.
Ramasubbu et al., 1998[65]	626	63	Inpatients with stroke	GDS and SADS	ADL: Barthel Index	One week after stroke, depression, present in 16%, was associated with increased ADL disability, controlling for lesion volume and degree of neurological impairment.
Salaffi et al., 1991[66]	61	64 (51–79)	Outpatients with osteoarthritis of knee	Zung Depression and Anxiety Scales	ADL/IADL: AIMS physical dimension	Both depression and anxiety were associated with increased ADL/IADLdisability, controlling for radiographic score of extent of knee damage.
Schulberg et al., 1998[67]	104	69	Primary care outpatients with CES-D scores >10	SCID, Ham-D	ADL/IADL: MOS physical functioning scale	Major and subsyndromal depression were equally associated with ADL/IADL disability.
Shmuely et al., 1995[68]	70	77 (65+)	Outpatients of a low-vision clinic	GDS and DSM-III-R checklist	ADL/IADL : Functional Assessment Scale	Depression, present in 39%, was associated with greater ADL/IADL disability, controlling for visual impairment, medical conditions, medication use, age, and gender.
Steffens et al., 1999[69]	211	70 (60+)	Depressed subjects from inpatient and outpatient psychiatry	modified DIS	ADL/IADL: composite of several scales	In subjects with major depression, greater IADL disability was associated with the following depressive symptoms: depressive severity, mood, anhedonia, anxiety, psychomotor retardation, weight loss, cognitive impairment. Greater ADL disability was associated with psychomotor retardation only.
Steffens et al., 1999[70]	335	67	Cardiology inpatients with CAD	modified DIS	ADL/IADL: composite of several scales	Depression, present in 8%, was associated with greater ADL and IADL disability, controlling for age and medical severity.
Yohannes et al., 1998[71]	96	78 (70–93)	Medical outpatients with COPD	BASDEC	ADL/IADL: Nottingham Extended ADL Scale	Depression, present in 46% of COPD patients, was associated with greater ADL/IADL disability, controlling for age, gender, and performance measures of impairment such as FEV1 or walking test.
Yu et al., 1993[72]	133	85	Female nursing-home residents	CES-D	ADL: Katz Index	Greater ADL disability was associated with depression, controlling for age and cognition.

Note: ADL: Activities of Daily Living; AIMS: Arthritis Impact Measurement Scale; BASDEC: Brief Assessment Schedule Depression Cards; BDI: Beck Depression Inventory; CAD: coronary artery disease; CES-D: Center for Epidemiologic Studies–Depression Scale; CHF: congestive heart failure; COPD: chronic obstructive pulmonary disease; DIS: Diagnostic Interview Schedule; FEV1: forced expiratory volume (1 sec.); GAF: Global Assessment of Function; GDS: Geriatric Depression Scale; HADS: Hospital Anxiety and Depression Scale; Ham-D: Hamilton Rating Scale for Depression; IADL: Instrumental Activities of Daily Living; MOS: Medical Outcomes Study; SADS: Schedule for Affective Disorders and Schizophrenia; SCID: Structured Clinical Interview for DSM Axis I disorders.

TABLE 4. Longitudinal clinical-observational studies

Article	Subject Characteristics: *N*	Subject Characteristics: Age: Mean (Range)	Subject Characteristics: Location/ Characteristics	Subject Characteristics: Follow-Up Interval	Instruments Used: Depression or Anxiety	Instruments Used: Disability/ Functioning	Results
Andersen et al., 1995[73]	259	69 (25–80)	Medical inpatients with stroke	1 year	Ham-D	ADL: Barthel Index	Greater baseline post-stroke ADL disability did not predict incident depression.
Astrom 1996[74]	80	73 (44–100)	Medical inpatients with stroke	3 years	DSM-III-R criteria for GAD	ADL: Katz Index	GAD, highly comorbid with depression, was significantly associated with greater ADL dependence at all follow-up periods except at initial hospital discharge.
Barbisoni et al., 1996[75]	123	78 (60–93)	Rehabilitation admissions	27 days (mean)	GDS	ADL: Tinetti scale	Response to rehabilitation (improvement in ADL disability score) associated with improved depressive symptoms, especially when markedly disabled on admission.
Callahan et al., 1998[76]	342	66 (60+)	Primary care outpatients: 266 with depression, 82 without	45 months (mean)	CES-D	ADL/IADL: SIP physical scale	Increased ADL/IADL disability during follow-up was associated with increase in depressive symptoms, controlling for baseline disability.
Covinsky et al., 1997[77]	467 (ADL) 336 (IADL)	(70+)	Medical inpatients	3 months	GDS	ADL: Katz Index; IADL: Lawton; IADL scale	Depressive symptoms were associated with increased ADL and IADL disability at follow-up, controlling for baseline disability, cognition, gender, age, race, marital status, living arrangement and medical conditions. Greater disability was associated with higher depressive symptom severity.
Diamond et al., 1995[78]	40	77	Rehabilitation inpatients	26 days (mean)	GDS≥11	ADL/IADL: FIM	Depression on discharge was associated with greater ADL/IADL disability on discharge, but not after controlling for admission disability.
Dunham and Sager, 1994[79]	197	(70+)	Medical inpatients	1 month post-discharge	GDS≥11	ADL/IADL: MOS physical functioning scale	Depression (present in 24% on admission) was significantly associated with greater ADL/IADL disability one month after discharge, controlling for disability on admission.
Herrmann et al., 1998[80]	136	75 (24–101)	Neurology inpatients with stroke	1 year	Zung, MADRS	ADL/IADL: FIM	Depression on follow-up (at 3 months or at 1 year) was significantly associated with poorer functional outcome on follow-up (at both 3 months and 1 year).
Koenig and George, 1998[81]	119	70 (60+)	Medical inpatients, depressed and disabled at baseline	1 year (median)	DIS, Ham-D	ADL: Katz Index, IADL: OARS	Depression and disability tended to change synchronously: either both remained or both improved synchronously in two-thirds of cases.
MacNeill and Lichtenberg, 1998[82]	372	78 (60–99)	Rehabilitation admissions	19 days (mean)	GDS	ADL: FIM motor subscale	Depression correlated with greater ADL disability on admission and greater chance of institutionalization upon discharge. Among those institutionalized, depression predicted greater ADL disability on discharge, controlling for admission function.

(continued)

TABLE 4. Longitudinal clinical-observational studies *(continued)*

Magaziner et al., 1990[83]	333	78 (65+)	Hip fracture patients	1 year	CES-D	ADL/IADL: OARS	Depressive symptoms predicted lower improvement of ADL but not IADL disability, controlling for baseline disability, cognitive status, age, gender, medical conditions, and social support.
Mossey et al., 1990[84]	196	78 (59+)	Women treated surgically for hip fracture	1 year	CES-D	ADL/IADL: composite of several scales	Those with persistent high depressive symptoms were three times less likely to walk independently and nine times less likely to return to prefracture disability level, compared to persistently low depressive symptoms throughout follow-up period.
Nanna et al., 1997[85]	423	78 (60–99)	Rehabilitation inpatients	18 days (mean)	GDS	ADL: FIM	Depressive symptoms on admit predicted lower improvement in ADL but not mobility disability, controlling for admission ADL, race, gender, age, education, medical conditions, cognition, and length of stay.
Oxman and Hull, 1997[86]	147	69 (55–91)	Inpatients undergoing cardiac surgery	6 months	Ham-D	ADL/IADL: SIP physical subscale	Greater ADL/IADL disability 1 month after surgery predicted depression 6 months after surgery, controlling for baseline depression and social support.
Paolucci et al., 1998[87]	440	64	Rehabilitation admissions with stroke	111 days (mean)	Ham-D≥18	ADL: Barthel Index	Depression, present in 28% on admission, predicted lower improvement in ADL disability.
Starkstein et al., 1992[88]	92	66	Neurology outpatients with Parkinson's disease	1 year	Present State Examination	ADL: Northwestern Disability Scale	Patients with major but not minor depression had a greater increase in ADL disability compared to non-depressed, matched for baseline disability and duration of illness.
Sullivan et al., 1997[89]	198	63 (45–79)	Outpatients with newly-diagnosed CAD	1 year	Ham-D; Hamilton Anxiety Scale	ADL/IADL: Functional Status Questionnaire	High levels of anxiety and depression at baseline predicted greater baseline disability, controlling for severity of CAD and overall medical illness, but not lower improvement in disability during treatment.
Van de Weeg et al., 1999[90]	85	61 (27–81)	Rehabilitation inpatients post-stroke	5 months	DSM III-R criteria	ADL/IADL: FIM and Rehabilitation Activities Profile	Depressed post-stroke patients had greater admission and follow-up ADL/IADL disability, but depressed and nondepressed patients showed similar rates of improvement over the follow-up period.

Note: ADL: Activities of Daily Living; CAD: coronary artery disease; CES-D: Center for Epidemiologic Studies–Depression scale; DIS: Diagnostic Interview Schedule; FIM: Functional Independence Measure; GAD: generalized anxiety disorder; GAF: Global Assessment of Function; GDS: Geriatric Depression Scale; Ham-D: Hamilton Rating Scale for Depression; IADL: Instrumental Activities of Daily Living; OARS: Older Americans' Resources and Services Instrument; MADRS: Montgomery-Asberg Depression Rating Scale; MOS: Medical Outcomes Study; SIP: Sickness Impact Profile.

Overall, these longitudinal studies found depression to be a predictor of both greater disability in medically ill subjects and less recovery from disability after medical events. Similar to findings in longitudinal community studies, baseline and incident disability were also predictors of depression.

Intervention studies. Table 5[91–95] shows five depression intervention studies. Four studies were 6-to-12–week placebo-controlled antidepressant trials, using nortriptyline,[91,95] fluoxetine,[92] or both;[94] in three[91,92,95] of the four,[94] the active treatment group showed greater improvement in physical functioning than the placebo group. One study recruited healthy community elderly subjects, finding a 4% improvement in disability attributable to medication.[92] The other three studies, which recruited only medically ill subjects, showed larger improvements in disability attributable to medication.[91,94,95] The most recent study found nortriptyline to be superior to fluoxetine (but not placebo) in post-stroke rehabilitating patients in improving recovery of ADLs, as measured by the FIM.[94] One study assessed objective measures of disease severity, such as expiratory volume and walking endurance in addition to the self-report measures of disability;[91] although disability measures improved, disease severity measures did not, suggesting that the improvement in disability was independent of disease severity.

A psychotherapy study recruited medical inpatients with subsyndromal depression and followed them for 1 year after 10 sessions of interpersonal counseling.[93] Although the study found a positive treatment effect on depression symptoms and self-rated health, there was no significant effect on physical functioning.

Anxiety and Disability

Of the 66 studies previously reviewed, 5 also assessed either symptoms of anxiety (with screening instruments)[53,56,66,89] or anxiety disorders (with a psychiatric interview).[74] A longitudinal community study found that symptoms of anxiety were as strong a predictor of increased disability on follow-up as were depressive symptoms.[53] Three clinical observational studies showed that anxiety correlated highly with disability[66,74,89] and predicted greater follow-up disability.[74] All five studies found high comorbidity between depression and anxiety, but no studies controlled for one of the two when examining the impact of the other. Thus, these studies suggest that anxiety, similar to depression, is a risk factor for disability, but they do not establish anxiety as a risk independent of depression. No intervention studies assessed the relationship between anxiety and disability.

DISCUSSION

Summary of Findings

A significant association between depression and disability was found in community and clinical settings. This association persisted when possible confounds, such as age, gender, education, medical burden, social support, income, and cognitive status, were controlled. The association with increased disability was present whether the disorder was diagnosed as major depression or depressive symptoms assessed by a screening instrument. Some,[47,62,67] but not all[59,88] studies of minor depression found similar associations with disability. A significant association between anxiety and disability was found as well, but the association of anxiety and disability independent of depression was not assessed by any studies.

Thus, the cross-sectional studies in this review support the assertion that depression is disabling, but they are not able to separate the extent of this assertion, as compared with the equally valid assertions that disability is "depressogenic," or that other underlying factors (such as poverty or cerebrovascular disease) are both disabling and depressogenic. Longitudinal studies are helpful in identifying risk factors and delineating the pathways of causality.[96] Studies in this review showed both that depression is a risk factor for disability[46,51,53] and that disability is a risk factor for depression.[50,52,54] Other longitudinal studies found that depression and disability, when present, usually occurred simultaneously:[49,50,76,81] either both would worsen, both would remain, or both would improve. This "synchrony of change" between depression and disability has also been described in younger-aged populations,[97] and it reinforces the construct of depression as a disabling illness. Longitudinal studies found that anxiety was a predictor for disability, independent of the same confounds as for depression, but not necessarily independent of depression.[53,74] Most intervention studies showed significant improvements in self-rated physical disability of subjects receiving antidepressant medication, relative

TABLE 5. Intervention studies

Article	Subject Characteristics: *N*	Subject Characteristics: Age: Mean (Range)	Subject Characteristics: Study Description	Instruments Used: Depression	Instruments Used: Disability/ Functioning	Results
Borson et al., 1992[91]	30	61 (42–76)	6-week placebo-controlled study of nortriptyline in ambulatory depressed COPD patients	SCID	ADL/IADL: SIP physical scale	Subjects taking nortriptyline had improved disability (mean 29% decrease in physical scale), greater than placebo. There was no improvement in objective measures of lung function (FEV1, ABG, or 12 minute walk distance).
Heilingenstein et al., 1995[92]	532	68 (60+)	6-week placebo-controlled study of fluoxetine in outpatients with major depression	DSM-III-R criteria	ADL/IADL: MOS physical functioning subscale	Subjects taking fluoxetine had an improvement in disability (mean 4% increase in physical functioning subscale), significantly greater than placebo.
Mossey et al., 1996[93]	76	(60+)	10 sessions of interpersonal counselling vs. usual care in patients recently hospitalized for medical illness, with subsyndromal depression	GDS >10 but not major depression or dysthymia	ADL/IADL: Lawton scales	At 6 months, subjects in the interpersonal counseling group had a significantly greater improvement in depressive symptoms and self-rated health but not physical disability, compared to usual care.
Robinson et al., 2000[94]	56	67	12-week placebo-controlled study of notriptyline vs. fluoxetine in depressed post-stroke patients	Present State Examination	ADL/IADL: FIM	Subjects who received nortriptyline had greater reduction of depressive symptoms and greater improvement in disability, compared to fluoxetine, but not compared to placebo.
Sullivan et al., 1993[95]	92	62	12-week placebo-controlled study of nortriptyline in depressed patients with chronic tinnitus	DSM-III-R criteria, Ham-D	IADL: composite of several scales	Subjects taking nortriptyline had a significantly greater improvement in disability scales, compared to placebo.

Note: ABG: arterial blood gas; ADL: Activities of Daily Living; COPD: chronic obstructive pulmonary disease; DIS: Diagnostic Interview Schedule; FEV1: forced expiratory volume (1 sec.); FIM: Functional Independence Measure; GAF: Global Assessment of Function; GDS: Geriatric Depression Scale; Ham-D: Hamilton Rating Scale for Depression; IADL: Instrumental Activities of Daily Living; MOS: Medical Outcomes Study; SCID: Structured Clinical Interview for DSM Axis I disorders; SIP: Sickness Impact Profile.

to placebo, supporting the hypothesis that depression is a treatable source of excess disability.

Methodologic Issues in Interpreting Study Findings as Evidence of Causality

Three methodologic concerns must be addressed before presuming that depression is a causal risk factor for disability. First, the association may be due to unrecognized confounds. Many factors associated with both depression and disability, such as low income or education, greater medical illness burden, and poorer social support, were included as covariates,[46,51,53] but other confounds may not have been recognized or adequately controlled for. For example, dementia is highly disabling and associated with high rates of depression. Late-onset depression may be a sentinel event for incipient dementing illness due to cerebrovascular disease or Alzheimer's disease, which is eventually disabling.[98] Although most studies controlled for cognition, no study included careful screening for incipient dementia, nor did any study use neuroimaging measures of white-matter hyperintensities,[99] subcortical brain lesions on magnetic resonance imaging that are associated with both depression[100] and disability.[101] One study concluded that subcortical lesions causing disability, which then led to depression, may be the pathway explaining the relationship between these brain lesions and depression.[102]

The second concern is potential shared variance between the instruments used to measure depression and disability. For example, the CES-D contains items such as "I felt that everything I did was an effort." and "I could not get going." However, a factor analysis of the CES-D found that all items, rather than simply the somatically-oriented ones, were significantly associated with greater disability in elderly patients.[103] This finding suggests that association between depression and physical disability is not simply due to shared variance of some of the measured items.

The third concern is that depressed individuals might inflate self-ratings of disability because of mood-related pessimism or a personality profile such as high neuroticism, which could lead individuals to view themselves as more disabled.[104] Supporting this assertion, some studies have found that depression is associated with greater self-reported disability than is predicted by performance measures.[2,105] However, two longitudinal studies have found decrements of objective ratings of physical functioning such as strength and walking speed attributable to depressive symptoms;[49,106] in one of these studies, self-reported disability correlated better with performance measures in depressed individuals.[49] Also, some studies in this review used observer-rated instruments, such as the FIM, finding greater disability associated with depression.[55,78,80,85,90] Thus, the association between depression and physical disability appears not to be simply a result of inflated self-reports of disability in depressed subjects. Nevertheless, this is a valid concern for intervention studies, where treatment of depression simply improves perceptions of disability, a similar situation to that seen with insomnia in depression, where pharmacotherapy often produces subjective but not objective improvements in sleep.[107] Thus, intervention studies of depressive and anxiety disorders should augment self-reports of disability with observer-rated scales or performance evaluations, such as the FIM used in the most recent intervention study.[94]

How Do Late-Life Depression and Anxiety Disorders Cause or Amplify Physical Disability?

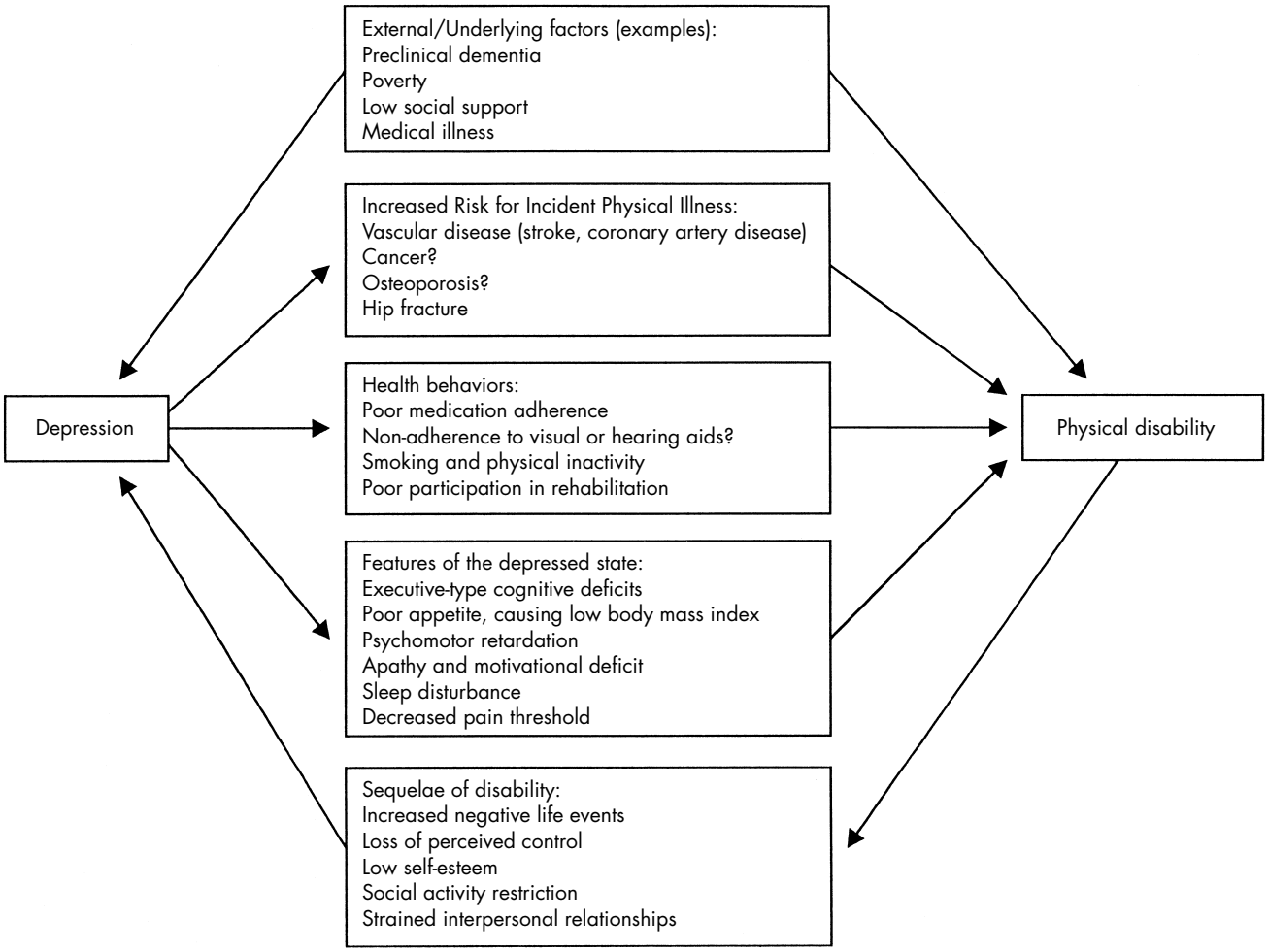
The studies reviewed delineate many mechanisms by which depression could lead to disability (see Figure 1). These mechanisms can be placed within two major causal categories: The depressed state itself is disabling, and/or depression causes increased disability from other medical conditions, either by increasing the risk for these conditions or by poorer health behaviors in depressed individuals with these medical conditions.

The depressed state is disabling. Executive-type cognitive impairments due to depression may explain why depressed individuals could be more disabled, especially with IADLs. Alexopoulos found that depressed individuals with initiation–perseveration deficits had greater global disability.[55] Poor appetite can lead to low body mass index, associated with disability;[108] prospective studies controlling for cognition and body mass index found that these accounted for some of the increased disability associated with depression.[46,51,53] Psychomotor retardation is frequently seen in depressed individuals.[109,110] One study[69] found a significant association between depressive psychomotor retardation and increased disability; the observation that psychomotor retardation is closely related to such physical-performance measures as strength and walking speed underscores the interrelationship between de-

pression and physical functioning. Closely related to psychomotor retardation is the apathy and diminished motivation often seen in depression;[111] anhedonia was found in one study to be significantly associated with disability.[69] Sleep disturbance, common in depressed elderly patients, has an independent association with disability.[112] Depression can also confer a lower threshold to pain, which can lead to activity restriction.[113] At present, it is not known to what extent each of these components of depression is responsible for associated physical disability in elderly patients. Future studies should identify not only the extent to which these separable components of depression are disabling, but also the type of disability attributable to the components. This future study will not only reinforce the concept of depression as a disabling illness, but also show us more about the complex nature of physical disability in terms of its cognitive and emotional elements.

Depression increases the risk of several common and disabling medical conditions. Depressed individuals with cardiovascular illness have greater incidence of stroke-related[114] and cardiac-related mortality.[115] This may be due to poor health behaviors, such as smoking or physical inactivity, which are risk factors for vascular illness; also, depression itself may cause coronary and cerebrovascular events.[116–118] Elevated cortisol levels[119] and other signs of immune dysfunction[33] associated with the depressed state may lead to the increased risk of cancer seen in some[120] but not all[121] studies. Depression may increase risk for osteoporosis,[119] which, combined with the increased incidence of falls in depressed elderly patients,[122] leads to an increase in the risk of hip and other fractures.[122] The increased prescription[123] of potentially adverse and sedating[124] medications in depressed individuals also may account for

1. Model of depression and disability



an increase in falls and fractures. Thus, depression increases risk for heart attack, stroke, hip fracture, and possibly cancer and osteoporosis, all major sources of disability in elderly patients. An increase in these conditions may not be the main mechanism by which depression leads to disability, however, given that studies controlling for either the occurrence of these medical conditions during the follow-up period[51] or severity of medical conditions[77,80] continued to show greater disability in depressed elderly patients.

Poorer health behavior in depressed individuals could amplify disability due to a medical condition. Depressed individuals have poorer treatment adherence,[125,126] thereby reducing the benefits of medical treatments. Sensory impairments such as poor vision or hearing may be more disabling to depressed elderly persons because of their noncompliance in the use of visual or hearing aids. Similarly, smoking and physical inactivity, associated with late-life depression,[51,120,127] may lead not only to incident medical conditions but to increased disability in those who are already medically ill. The classic example of this would be the patient who does not quit smoking after a coronary artery bypass graft. Finally, rehabilitation from conditions such as hip fracture or stroke is a major way to reduce disability from these conditions; studies show that depressed elderly patients have poorer rehabilitation outcomes.[82,85,87,94] It is believed that depressed individuals may participate more poorly in their rehabilitation,[128–130] although research supporting this idea is minimal.[131] As a result of this belief, however, depressed individuals may be excluded from rehabilitation, as found in one study.[132] So although depressed individuals have greater health care utilization, their adherence to care and to appropriate health behaviors is poorer. One prospective study found that health behaviors such as smoking, alcohol use, and inactivity did not account for the increased risk of disability due to depression.[51] The extent of increased disability resulting from treatment non-adherence or non-participation has not been assessed.

Anxiety, a risk factor for disability, is common in depressed elderly patients.[14] One study found anxiety and depression to be equal predictors of disability;[53] thus, the pathways by which anxiety and depression lead to disability may be very similar. However, given the absence of prospective studies assessing late-life anxiety disorders in association with disability, it is not known how, or whether, anxiety disorders cause excess disability in elderly patients. Also, it is not known whether comorbid anxiety confers additional disability beyond that due to depression. The lack of disability data on anxiety disorders may be due to the perception that anxiety is rare in old age unless secondary to depression.[13] Because comorbid depression and anxiety may be a more severe condition than depression alone,[133] observational studies should identify both conditions, as well as the potential additive or interactive risks of comorbid anxiety and depression on disability.

How Should the Findings be Applied to Intervention Studies of Late-Life Depression and Anxiety?

The simplest answer to this question is that depression and anxiety intervention studies should include disability as an outcome measure.[134,135] The National Institute for Mental Health now emphasizes the need for studies that show clinical effectiveness of interventions.[136] As a result of this stance, we can expect that many, if not most, future intervention studies will contain functional-outcome measures. Thus, it is important that these future studies be constructed with an understanding of currently existing studies. The five intervention studies in this review assessed whether antidepressant medication or psychotherapy reverses physical disability in subjects with late-life depression. The largest of the studies found only a 4% improvement in physical functioning attributable to medication.[92] One might conclude from this small change that late-life depression is not a modifiable risk factor for physical disability. However, this study, like most antidepressant efficacy studies, recruited community subjects with minimal disability, allowing little room for improvement in disability. An intervention study with medically ill outpatients[91] found a 29% improvement in disability. Thus, in a more medically ill population, such as an inpatient or rehabilitative setting, depression interventions may show greater effectiveness in improving disability outcomes.

A disability outcome measure could have usefulness in some intervention studies where traditional symptom measures may not be sensitive to active-placebo differences. For example, the waxing and waning nature of anxiety leads to high placebo response and nonsignificant active-placebo differences in many anxiety disorder studies,[137] which may explain the lack of published controlled intervention studies in late-life anxiety disorders. However, disability measures may not be as sub-

ject to these rapid changes over time and thus may be used to detect active-placebo differences. Similarly, controlled trials of interventions for subsyndromal depression have difficulty finding an active-placebo difference in depressive symptom measures.[138] If minor depression causes excess disability, then disability measures could be more sensitive than symptom measures as outcome measures during treatment for minor depression.[139,140] Continuation and maintenance studies of depression show that continued active treatment prevents recurrence of symptoms as well as providing a modest improvement in symptoms.[141] However, maintenance psychiatric treatment may also prevent or improve physical disability symptoms, reinforcing the effectiveness of maintenance treatment.

There are now global intervention studies that have as their main outcome the prevention of disability in frail elderly patients.[142] These interventions already include management of depression; however, greater knowledge of mechanisms by which depression or anxiety causes excess physical disability could inform these multicomponent intervention studies. For example, if depressed individuals suffer increased disability as a result of poor medication compliance with antihypertensive or diabetic medications, the addition of treatment adherence monitoring to depression management would be critical for treatment of disability.[143] Rapid diagnosis and treatment of depression and anxiety in rehabilitation settings may lead to improved participation in rehabilitative efforts. Psychoeducation involving a patient's social support system or caregiver may improve disability via improved medication compliance[144] or improved quality of social support. Individuals with decreased social support may benefit from case management and specific psychotherapeutic regimens such as interpersonal or cognitive–behavioral therapy.[93] Some of these approaches are in use in selected geriatric settings, whereas others have been recommended but not widely implemented. Future studies should evaluate the additive effects of intervening at the level of mechanisms linking depression and disability. This would allow identification of individuals who might expect to benefit most from a multi-pronged approach.

In all of these situations, psychiatric interventions may show a significant effect on disability reduction or prevention. Disability leads to high health care utilization, so cost-effectiveness analysis of these interventions should take into account their beneficial effects on disability.[145] This evidence could help communicate the value of these interventions to health professionals in nonpsychiatric settings, where appropriate psychiatric interventions are underutilized.[146] Also, patients and families may be more receptive to mental health interventions if they believe these will prevent or improve disability, one of the most feared consequences of aging.[147]

How Does Disability Cause or Amplify Late-Life Depression and Anxiety?

Several prospective studies within this review found that physical disability is a risk factor for depression.[50,52,54] This finding is not surprising, since the onset of disability is a major stressor that leads to loss of perceived control and lower self-esteem.[148] Physically disabled persons also appear to endure a higher number of negative life events.[149] Also, physical disability can lead to restriction of valued social or leisure activities,[113] isolation, and reduced quality of social support,[69] all of which are psychosocial risk factors for depression (Figure 1). Future studies should consider whether these psychosocial sequelae of disability are modifiable risk factors for depression; that is, the idea that psychosocial interventions for a physically disabled elderly person may prevent or treat depression. Medical rehabilitation itself may successfully treat symptoms of depression, as was found in some studies,[75,150] suggesting that physical disability could be a modifiable risk factor for depression and that depressed individuals should not be excluded from rehabilitation efforts. These studies also remind us of the innate similarities between rehabilitation and psychotherapy: both involve engaging an individual's strengths and support structure to understand and overcome their functional deficits. Studies of the course of psychiatric symptoms during recovery from disability are needed. The bi-directional causality between depression and disability suggests that rehabilitation and medical inpatient settings will be increasingly important settings both to observe and intervene in the course of depression.

CONCLUSIONS

Recent literature has revealed much about the mechanisms by which late-life depression causes or amplifies physical disability. These mechanisms relate the features of the depressed state itself, such as cognitive impair-

ment and motivation depletion, to physical disability. Understanding these disabling effects of depression helps to better inform our concept of "physical" disability and refine it as a construct with physical, cognitive, and emotional components. Similar studies of anxiety disorders are needed in order to determine whether and by what mechanism anxiety increases risk of disability independently of depression. Depression also appears to increase the long-term risk of disability, possibly mediated by a higher incidence of physical illness and poorer health behaviors. Intervention studies in medically ill subjects, such as those in hospital or rehabilitative settings, may be more likely to show clinically significant effects of psychiatric treatment on disability outcomes. Multi-pronged interventions may target multiple mechanisms of excess disability. Assessing the ability of interventions to prevent as well as reverse disability may enhance studies of treatments for anxiety and subsyndromal depression as well as studies of maintenance treatments for depression. Because disability is a risk factor for depression, the possibility of preventing or treating depression in rehabilitation settings should be explored. Psychiatric interventions may find more favor in medical settings if there is proof that these interventions reverse or prevent disability. Thus, the measurement of physical disability in psychiatric illness may have the most usefulness as a tool for communicating the effectiveness of mental health interventions and in underscoring the inseparability of "mental" and "physical" health in later life.[17]

The authors acknowledge Ester Saghafi, M.Ed., MLS, for her help with the literature review.

This work was supported by NIMH grants P30 MH 52247, K05 MH00295, K01 MH01613, R37 MH43832, R01 MH37869, R01 MH59318, and T32 MH19986.

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