

Recent Trends in Disability and Functioning Among Older Adults in the United States

A Systematic Review

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DISABILITY AND UNDERLYING physical, cognitive, and sensory limitations are not inevitable consequences of aging. Yet 20% of older US adults have chronic disabilities,¹ 7% to 8% have severe cognitive impairments,² roughly one third have mobility limitations,³ 20% have vision problems,⁴ and 33% have hearing impairments.⁴ Women, minorities, and persons of low socioeconomic status are especially vulnerable.^{5,6}

The cost of medical care for a disabled older person averages 3 times that for a nondisabled senior.⁷ Moreover, long-term care expenditures for older US residents with disabilities (including those receiving nursing home or community-based care) reached \$123 billion in 2000, with more than 65% paid by government.⁸ Families also provide substantial uncompensated informal care.⁹ As the number of older persons burgeons, the proportion needing assistance with daily tasks may also increase. Indeed, a fundamental question in geriatrics is whether recent mortality decline has been accompanied by a compression or expansion of periods of morbidity.¹⁰⁻¹²

In recent years, more than a dozen published studies have detailed changes

Context Several well-publicized recent studies have suggested that disability among older Americans has declined in the last decade.

Objectives To assess the quality, quantity, and consistency of recent evidence on US trends in the prevalence of self-rated old age disability and physical, cognitive, and sensory limitations during the late 1980s and 1990s and to evaluate the evidence on trends in disparities by major demographic groups.

Data Sources We searched MEDLINE and AGELINE for relevant articles published from January 1990 through May 2002 and reviewed reference lists in published articles.

Study Selection From more than 800 titles reviewed, we selected 16 articles based on 8 unique repeat cross-sectional and cohort surveys of US prevalence trends in disability or functioning among persons generally aged 65 or 70 years or older.

Data Extraction We evaluated survey quality according to 10 criteria, ranked the surveys as good, fair, or poor, and calculated for each outcome the average annual percent change.

Data Synthesis Among the 8 surveys, 2 were rated as good, 4 as fair, 1 as poor, and 1 as mixed (fair or poor, depending on the outcome) for assessing trends. Analyses of surveys rated fair or good showed consistency of declines in any disability (−1.55% to −0.92% per year), instrumental activities of daily living disability (−2.74% to −0.40% per year), and functional limitations. Surveys provided limited evidence on cognition and conflicting evidence on self-reported ADL (changes ranged from −1.38% to 1.53% per year) and vision trends. Evidence on trends in disparities by age, sex, race, and education was limited and mixed, with no consensus yet emerging.

Conclusions Several measures of old age disability and limitations have shown improvements in the last decade. Research into the causes of these improvements is needed to understand the implications for the future demand for medical care.

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in self-reports of disability and underlying functioning problems of older US adults. Although the evidence is sometimes conflicting, several well-publicized studies have suggested that rates of disability, severe cognitive impairment, and functional limitations have declined substantially.^{1-3,13,14} Whether such improvements extend to all types of such difficulties and all groups remains unclear. If improvements are pervasive and continue, the

effect on US health and economic well-being could be far reaching, with potentially more older persons able to

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For editorial comment see p 3164.

Table 1. Criteria for Evaluating Surveys of Recent Trends in Self-reported Disability and Functioning Among Older US Adults

Criteria	Good	Fair	Poor
Design	Independent repeat cross-sections	Panel design with aged in cohorts	Other
Population coverage	National including institutionalized	National noninstitutionalized	Nonnational, noninstitutionalized
Width of time frame, y	≥8	6-7	≤5
Frequency of measurement or number of time points	Annual or ≥5 times	Every 2 y or 3-4 times	>Every 2 y or 2 times
Comparability of interview methods	Identical	Change in mode	Change in disability or functioning questions
Quality of outcome measures	Detailed self-reports	Global self-reports	...
Loss to follow-up, %	Not applicable or <5	5-10	>10
Proxy, %	<10	10-20	>20
Missing data, %	<5	5-10	>10
Sample size	Large enough to detect 1%-2% change per year*	Large enough to detect 3%-5% change per year	Not large enough to detect 3%-5% change per year

*Based on a National Research Council report and follow-up.^{28,29} Generally 3000 observations or more per year were required for complex study designs to detect power of 0.80 with $\alpha = .05$.⁴⁹

work longer and relatively fewer needing medical and long-term care.¹⁵⁻¹⁸

To our knowledge, no systematic review of the quality, quantity, and consistency of this literature has been conducted to date. Herein, we synthesized and critiqued the evidence addressing 2 specific questions: What are the most recent trends in the prevalence of late-life disability and functioning? Are all socioeconomic and demographic groups benefiting equally, or are disparities widening or narrowing?

METHODS

To identify pertinent studies, we focused on 2 key dimensions of late-life health: (1) physical disability, defined as the inability to carry out independently specific roles or activities within a given environment; and (2) functional, cognitive, and sensory limitations, defined as the underlying difficulty a person has with specific physical, memory-related, and vision- and hearing-related tasks. For example, needing help with bathing or medication management may be considered a disability, whereas difficulty bending, remembering, or seeing may be considered limitations.

Although in practice not completely distinct, each of these broad categories reflects a critical step in the “disablement

process,” a framework developed by the Institute of Medicine and others.^{19,20} The framework describes the process of progressive changes through which disease and injury lead to limitations (in either organ function or in the function of the individual) and ultimately lead to disability (defined as the inability to carry out a specific role in a given environment). Although the questions vary from survey to survey, disability is most often measured by self-reports of either needing help or having difficulty with activities of daily living (ADL)²¹ and instrumental activities of daily living (IADL).²² Physical (also called functional) limitations are often measured by self-reported difficulty with specific body tasks proposed by Nagi²³ (such as reaching, bending, stooping); cognitive limitations have been measured with cognition tests or questions about memory; and sensory limitations are often measured by self-reports of vision or hearing difficulties. Although often internally consistent²⁴ these self-reported measures may not always agree with performance-based measures.²⁵ Moreover, these measures capture different dimensions of the disablement process and therefore will not necessarily move in concert over time at the population level or in the same direction for all subgroups.²⁶

Search Strategy

To identify studies focused on the late 1980s and 1990s, we searched MEDLINE and AGELINE for relevant articles published in English from January 1990 through May 2002. We used 3 categories of keywords: *trends*; *aging* or *older adults*; and *disability*, *cognitive impairment*, *functioning*, *vision*, or *hearing*. We contacted authors to identify additional articles, including those in press (however, conference presentations and reports in progress were not included). We also reviewed reference lists in all relevant published articles, including reviews²⁷⁻²⁹ and commentaries.^{15,26} More than 800 titles and/or abstracts were reviewed in all. We identified 27 articles and reports that related to the topic of old age disability or functioning trends for further review.

Study Selection

This set of studies was narrowed to those pertaining to prevalence estimates for the older US population (generally ages ≥65 or 70 years). Moreover, because of our focus on understanding recent changes, all studies chosen had to include at least 1 data point in the mid-1990s. We excluded studies focusing on the early 1980s or earlier,^{13,30-33} on century-long trends,^{34,35} or exclusively on trends in the institutionalized population³⁶⁻³⁸ or health care utilization.¹⁷ The remaining 16 reports^{1-4,14,16,39-48} were based on 8 unique surveys.

Evaluation Criteria

To assess trends, we evaluated these surveys on 10 criteria, each of which represents a potential threat to the validity of comparisons over time (TABLE 1). These criteria were developed based on a 1994 workshop report on disability trends prepared by the National Research Council,²⁸ as well as on a subsequent report to the government.²⁹

We did not explicitly evaluate the reliability of outcome measures, including intrarater reliability, for 3 reasons. First, survey question wording varies widely and no widely acceptable standard for measuring self-reported disability exists.

Table 2. Evaluation of Surveys Analyzed in Studies of Recent Trends in Self-reported Disability and Functioning Among Older US Adults*†

Survey	Study, y‡	Design (Sample Size)	Population	Survey Years (No. of Measurements)	Comparability of Methods	Outcome	Loss to Follow-up, %	Proxy, %	Missing, %
Good Rating									
National Health Interview Survey	Crimmins et al. ⁴¹ 1997 (1982-1993); Schoeni et al. ⁴⁷ 2001	Independent cross-sections (8000 per y)	Noninstitutionalized population ages ≥70 y	1982-1996 (15)	Sample frame redesigned in 1995	Need the help of other persons with personal care needs or, if not, in handling routine needs	...	NR	NR
National Long Term Care Survey	Manton et al. ¹⁴ 1997 (1982-1994); Manton and Gu, ¹ 1	Panel survey with aged-in cohorts (20 000 per y)	Medicare eligible population ages ≥65 y	1982-1999 (5)	Identical questions and field procedures	Use of help, supervision and equipment in the last week for 6 ADLs and 8 IADLs; disabilities that last or expected to last 3 or more months	~5 per wave	~20	NR
Fair Rating									
Asset and Health Dynamics of the Oldest Old Study	Freedman et al. ² 2001; Freedman et al. ⁴² 2002	Panel survey with aged-in cohort (7500 per y)	Noninstitutionalized population ages ≥70 y (sensitivity to exclusion of institutionalized population explored)	1993 and 1998 (2)	Mode assignment changed	Score of ≥8 out of 35 on modified Telephone Interview Cognitive Screen for self-respondents or report of poor memory and poor judgment by proxy	~8-10	~10	~10
Medicare Current Beneficiary Survey	Waidmann and Liu, ⁴⁸ 2000	Replenished panel survey (10 000 per y ages ≥65 y)	Medicare population ages ≥65 y	1992-1996 (5)	Identical questionnaire and field procedures	Difficulty, getting help, supervision or using equipment with 6 ADLs and 6 IADLs and difficulty with 5 functional limitations	NR	NR	NR
National Mortality Followback Study§	Liao et al. ⁴⁵ 2000	Retrospective interviews with next of kin of deceased cohorts (9200 in 1986; 6700 in 1993)	Sample of all adult deaths in the United States; limited analysis to persons who were ≥65 y at death	1986 and 1993 (2)	ADL questions changed from help or equipment use in 1986 to difficulty performing tasks in 1993; primary interview mode changed from mail in 1986 to telephone in 1993	ADL disability in last year of life: help or special equipment in 1986 and difficulty in 1993 in walking, bathing, dressing, using the toilet or eating; cognitive function in the last year of life: person had difficulty understanding where he/she was; remembering what year it was; and recognizing family members	NA	100 (by design)	NR
Supplements on Aging	Crimmins and Saito, ⁴⁰ 2000; Desai et al. ⁴ 2001; Freedman and Martin, ⁴⁴ 2000; Liao et al. ⁴⁶ 2001	Independent cross-sections (8000 per y)	Noninstitutionalized population ages ≥70 y	1984 and 1995 (2)	Fielding lag occurred in 1995 survey	Difficulty with and unable to carry out 7 ADLs, 6 IADLs, and 10 physical tasks; question on blindness, vision impairment, deafness, and hearing impairment	NA	~10	~10
Survey of Income and Program Participation	Freedman and Martin, ³ 1998; Freedman and Martin, ⁴³ 1999	Rotating panel survey (13 000 per y ages ≥50 y; 6000 per y ages ≥65 y)	Noninstitutionalized population ages ≥50 y	1984-1993 (4)	Identical procedures and questions	Difficulty seeing, lifting and carrying, walking up stairs, and walking ¼ mile	By wave 3, 12.3 in 1984 and 16.2 in 1993 (both death and loss to follow-up)	37	<5
Poor Rating									
Framingham Heart Study	Allaire et al., ³⁹ 1999	Cohort in which parents are compared with offspring and spouses (1700 per y)	Original cohort: white residents of Framingham, Mass, recruited in 1948-1951, aged 55-70 y in 1976-1978; offspring cohort: children and spouses of original cohort, with preferential recruitment of children of parents with heart disease, recruited in 1971-1978, aged 55-70 y in 1994	1976-1978 and 1994 (2)	Mode of interview changed from face-to-face to self-administered; ADL questions changed	Detailed Nagi (pushing, stooping, reaching, writing, standing, sitting, or lifting) and ADL (bathing, dressing, eating, or transferring) items; coded no limitation vs any limitation	NR	NR	NR

*Cutler¹⁶ includes 5 national surveys of older adults evaluated elsewhere in the Table: 1984, 1989, 1994, and 1999 National Long Term Care Survey; 1992 and 1996 Medicare Current Beneficiary Survey; 1984, 1989, and 1999 National Health Interview Survey supplemented with the 1985 and 1995 National Nursing Home Surveys; 1984 and 1995 Supplements on Aging to the National Health Interview Survey supplemented with the 1985 and 1995 National Nursing Home Surveys; 1984, 1990, and 1999 Survey of Income and Program Participation supplemented with the 1985 and 1995 National Nursing Home Surveys. Based on detailed self-reports, prevalence of total disability, physical impairment, and sensory impairment are reported. No overall rating was assigned herein due to lack of methodological details.

†NA indicates not applicable; NR, not reported; ADL, activities of daily living; and IADL, instrumental activities of daily living.

‡Study years are provided parenthetically if they are different from survey years.

§The National Mortality Followback Study is classified as fair for the purposes of evaluating changes over time in cognition in the last year of life, but because of changes in question wording the data set is rated as poor for measuring changes over time in ADL disability in the last year of life.

Second, these reliabilities are rarely reported in published studies. Third, the national surveys often rely on previously validated and widely accepted self-assessment scales²¹⁻²⁴ that generally demonstrate good internal consistency.^{24,25}

Several of the studies^{2,16,42,47} included sensitivity analyses that demonstrated robustness of findings to particular survey features that otherwise would have contributed to a designation as fair. For example, several studies explicitly addressed the exclusion of the institutionalized population by combining their results with data from national nursing home studies,^{2,16,42,47} and other studies have demonstrated robustness to missing data and loss to follow-up.^{2,42} In these instances we considered the relevant survey feature to be good rather than fair.

We assigned a summary rating (good, fair, or poor) to each survey based on the following rules: surveys with 2 or more poor features (out of 10) at the time of the analysis were designated to be poor; a rating of good was reserved for surveys with at least 5 good and no poor features; the remaining surveys were designated to be fair. To assess trends in disparities, we also considered whether the study included statistical tests for differences in trends over time, but we did not explicitly rate this factor.

RESULTS

Summary of Study Evaluations

As summarized in TABLE 2, the studies considered herein were based on 8 surveys, of which 2 were rated as good,^{1,14,41,47} 4 were rated as fair,^{2-4,40,42-44,46,48} 1 was rated as poor,³⁹ and 1 was given a mixed rating (fair or poor, depending on the outcome).⁴⁵

The 2 surveys classified as good offered different strengths and weaknesses. Studies based on the National Health Interview Survey,^{41,47} for example, shared the advantage of annual surveys of independent cross-sections of the population, but excluded the institutional population and contained only global (nondetailed) assessments of disability. In contrast, the National Long Term Care Survey,^{1,14} one of the best designed surveys for analyzing na-

tional disability trends, shared the following strengths: coverage of the full 1990 decade; inclusion of the institutional population; identical field procedures; detailed disability questions; low loss-to-follow-up rates. The only relatively weak feature of this survey for assessing trends (which may fluctuate from year to year) was that it was administered only once every 5 years.

Five data sets were rated as fair for assessing trends because at least 1 criterion was considered poor. For example, at the time it was analyzed, the Asset and Health Dynamics of the Oldest Old Study allowed comparisons of cognition in only 2 years, 1993 and 1998. The Medicare Current Beneficiary Survey was limited to a 5-year span of data (1992-1996) at the time it was analyzed.⁴⁸ The National Mortality Followback Studies changed its survey mode from in-person to telephone; moreover, although the cognition-related questions were stable, the disability questions were changed extensively and thus the survey is considered fair for assessing cognition but poor for assessing trends in ADL limitations prior to death. The Supplements on Aging to the 1984 and 1994 National Health Interview Surveys (SOA I and II) (analyzed in 4 studies^{4,40,44,46}) used different timing in their field procedures (ie, the SOA I was administered at the same time as the core National Health Interview Survey, and the SOA II was administered 7-17 months after the core). Finally, more than one third of reports in the Survey of Income and Program Participation (SIPP), analyzed in 2 studies,^{3,43} were provided by proxy respondents.

Only the Framingham Heart Study³⁹ was consistently assigned a poor rating. The study had 2 flaws for assessing national trends: it drew on a select sample and changed how it administered the survey (from in-person to over the telephone) and made extensive question changes.

Evaluation of Trends

TABLE 3 provides highlights of major findings from each survey rated as good or fair along with our calculations, where data allowed, of the average annual per-

cent change (calculated as a percentage of the base year). In TABLE 4, we summarize the findings across all surveys by survey rating for each major outcome category. For outcomes with estimates from at least 3 surveys rated either good or fair, we also summarize the high and low estimates of the average annual percent change.

Among the 3 surveys providing trend estimates for the prevalence of "any disability" (ie, defined as having ADL or IADL disability, or in some cases ADL or IADL or being institutionalized),^{1,14,41,47,48} all 3 showed statistically significant declines, with a high of -1.55% per year and a low of -0.92% per year.

Of the 6 surveys providing trend estimates for ADL disability, 4 were rated as good or fair but offered conflicting evidence resulting in a wide range of estimates of the average annual percent change, ranging from -1.38% per year to 1.53% per year.

Four surveys provided trend estimates for IADL disability and all were rated as good or fair. Although 3 of the 4 surveys assessed trends in only IADL disability (ie, IADL but not ADL disability)^{1,14,41,47,48} and the fourth assessed trends in any IADL disability (irrespective of ADL disability),^{40,46} all 4 surveys showed significant declines in the prevalence of IADL disability ranging from -2.74% per year to -0.40% per year.

Of the 4 surveys analyzed for functional limitation trends, 3 were rated as fair and 1 as poor. Of those surveys rated as fair, 2 showed declines.^{3,40,43,44,46} The only increase in functional limitations relied on the Medicare Current Beneficiary Survey⁴⁸; however, that analysis focused on a group with only functional limitations (but no ADL or IADL disability) and is thus difficult to interpret.

The 2 surveys, both receiving a rating of fair, that studied trends in cognitive limitations^{2,42,45} showed significant declines in severe cognitive impairment, 1 among noninstitutionalized persons aged 70 years and older and the other in the last year of life.

Finally, the 2 surveys^{3,4,40,43} that assessed sensory limitations had mixed results. Analysis of the Survey of Income

Table 3. Recent Trends in Self-reported Disability and Functioning Among Older US Adults: Detailed Findings From Surveys Rated Good or Fair*

Survey, by Outcome	Study, y	Major Finding	Average Annual % Change	
Good Rating				
Disability National Health Interview Survey	Crimmins et al, ⁴¹ 1997	Any disability: declined from 22.7% in 1982 to 20.2% in 1993 (significance of time parameter in age- and sex-adjusted models, $P < .05$)	-0.92	
		ADL disability: remained level between 1982 and 1993, fluctuating between 6.4% and 8.4%	...	
		Only IADL disability: declined from 14.5% in 1982 to 13.8% in 1993 (significance of time parameter in age- and sex-adjusted models, $P < .05$)	-0.40	
	Schoeni et al, ⁴⁷ 2001	Any disability: declined from 22.7% in 1982 to 19.3% in 1996 (significance of time parameter in age-, sex-, and proxy-adjusted models, $P < .05$); trends are robust to the exclusion of the nursing home population but may be sensitive to the growth in assisted living over this period	-1.00	
		ADL disability: remained level between 1982 and 1996, fluctuating between 6.4% and 8.4%	...	
		Only IADL disability: declined from 14.5% in 1982 to 10.9% in 1996 (significance of time parameter in age-, sex-, and proxy-adjusted models, $P < .05$)	-1.66	
	National Long Term Care Survey	Manton et al, ¹⁴ 1997	Any disability: age-adjusted estimates declined from 24.9% in 1982 to 21.3% in 1994 ($P < .05$)	-1.11
			ADL disability: age-adjusted estimates declined from 13.1 in 1982 to 11.9 in 1994 (no statistical test provided for any ADL disability)	-0.70
			Only IADL disability: age-adjusted estimates declined from 5.6% in 1982 to 4.3% in 1994 ($P < .05$)	-1.79
			Institutional population: age-adjusted estimates declined from 6.3% in 1982 to 5.2% in 1994 ($P < .05$)	-1.34
		Manton and Gu, ¹ 2001	Any disability: age-adjusted estimates declined from 26.2% in 1982 to 19.7% in 1999 ($P < .05$)	-1.55
			ADL disability: age-adjusted estimates declined from 13.6% in 1982 to 10.6% in 1999 (no statistical test provided for any ADL disability)	-1.38
Only IADL disability: age-adjusted estimates declined from 5.7% in 1982 to 3.2% in 1999 ($P < .05$)			-2.74	
Institutional population: age-adjusted estimates declined from 6.8% in 1982 to 4.2% in 1999 ($P < .05$)			-2.12	
Fair Rating				
Disability Medicare Current Beneficiary Survey	Waidmann and Liu, ⁴⁸ 2000	Any disability: declined from 35.3% in 1992 to 32.6% in 1996 (no statistical test provided for any disability)	-1.53	
		ADL disability: relatively constant from 18.0% in 1992 to 17.0% in 1996 ($P > .10$)	-1.11	
		Only IADL disability: declined from 13.7% in 1992 to 12.0% in 1996 ($P < .05$)	-2.48	
		Institutional population: constant at 3.6% ($P > .10$)	...	
Supplements on Aging	Crimmins and Saito, ⁴⁰ 2000	ADL disability: controlling for age, there was a significant increase between 1984 and 1995 in the mean number of ADL limitations (defined as unable to carry out independently) among men and women	...	
		IADL disability: controlling for age, the mean number of IADL limitations (defined as unable to carry out independently) declined significantly for women but not for men	...	
	Liao et al, ⁴⁶ 2001	ADL disability: age-adjusted increases for men from 12.5% in 1984 to 14.8% in 1995 ($P < .05$) and for women from 16.9% in 1984 to 18.6% in 1995 (defined as a lot of difficulty or unable)	1.53	
		IADL disability: no change in age-adjusted prevalence of any IADL disability (defined as a lot of difficulty or unable) for men or women. Declines for women in age-adjusted prevalence of ≥ 3 IADLs and for the following tasks: managing money, using the telephone, and doing heavy housework. Declines for men in age-adjusted prevalence of unable or a lot of difficulty using the telephone	-0.75 men -0.68 women	
Functional limitations				
Medicare Current Beneficiary Survey	Waidmann and Liu, ⁴⁸ 2000	Percentage with only functional limitations increased from 23.5% in 1992 to 25.2% in 1996 ($P < .05$)	1.45	
Supplements on Aging	Crimmins and Saito, ⁴⁰ 2000	Age-adjusted mean number of physical task unable to be performed declined significantly from 1984 to 1995 among women ($P < .05$) but not men	...	
	Freedman and Martin, ⁴⁴ 2000	Difficulty with upper body limitations declined from 5.1% in 1984 to 4.3% in 1995 ($P = .08$)	-1.31	
	Liao et al, ⁴⁶ 2001	Lower body limitations declined from 34.2% in 1984 to 28.5% in 1995 ($P < .001$)	-1.39	
Survey of Income and Program Participation	Freedman and Martin ^{3,43} 1998, 1999	A lot of difficulty or inability to perform tasks declined from 34.3% in 1984 to 31.2% in 1995 for men ($P < .05$) and from 45.2% to 41.5% ($P < .01$) for women. For women, declines were observed for 7 of the 10 tasks (all but standing, sitting, and grasping); for men, only limitations in stooping, crouching, or kneeling declined significantly	-0.75 men; -0.20 women	
		Any difficulty lifting and carrying declined from 23.5% in 1984 to 18.9% in 1993 ($P < .001$); climbing a flight of stairs declined from 24.5% in 1984 to 22.0% in 1993 ($P = .001$); walking 1/4 mile declined from 25.8% in 1984 to 22.3% in 1993 ($P < .001$) (≥ 50 y)	-1.45	
		Any difficulty: lifting and carrying declined from 33.8% in 1984 to 26.6% in 1993 ($P < .001$); climbing a flight of stairs declined from 34.9% in 1984 to 31.0% in 1993 ($P = .001$); walking 1/4 mile declined from 37.6% in 1984 to 31.5% in 1993 ($P < .001$) (≥ 65 y)	-1.62	

(continued)

Table 3. Recent Trends in Self-reported Disability and Functioning Among Older US Adults: Detailed Findings From Surveys Rated Good or Fair* (cont)

Survey, by Outcome	Study, y	Major Finding	Average Annual % Change
Cognitive limitations			
Asset and Health Dynamics of the Oldest Old Study	Freedman et al, ^{2,42} 2001, 2002	Severe cognitive impairment declined from 6.1 in 1993 to 3.6 in 1998 ($P < .001$)	-6.83
		Significant declines reported in Freedman et al ² were not sensitive to a wide variety of assumptions about cognition among those lost to follow-up, nonresponse, and living in institutions. Sensitivity analyses suggest that the percentage of all older US adults (including those in institutions) with severe cognitive impairment declined from 8.6 in 1993 to 7.1 in 1998 ($P < .05$)	-2.91
National Mortality Followback Study	Liao et al, ⁴⁵ 2000	Significant declines in cognitive dysfunction in the last year of life depending on sex and age	-3.28 men 65-84 y -1.72 men ≥85 y -2.38 women 65-84 y -1.87 women ≥85 y
Sensory limitations			
Supplements on Aging to the National Health Interview Survey	Crimmins and Saito, ⁴⁰ 2000	Age-adjusted prevalence of hearing trouble did not change significantly for men or women; age-adjusted prevalence of blindness remained constant	...
	Desai et al, ⁴ 2001	Reports of being blind remained constant between 1984 and 1995; deafness was about the same in 1995 as it was in 1984 (5.9% in 1984 and 7.5% in 1995)	...
Survey of Income and Program Participation	Freedman and Martin, ^{3,43} 1998, 1999	Reports of any difficulty seeing declined from 15.3% in 1984 to 11.6% in 1993 ($P < .001$, ≥50 y)	-2.42
		From 21.7% in 1984 to 16.8% in 1993 ($P < .001$, ≥65 y)	-2.26

*ADL indicates activities of daily living; IADL, instrumental activities of daily living.

Table 4. Trends in Self-reported Disability and Functioning Among Older US Adults: Summary of Findings by Survey Rating and Outcome

Variable	No. of Surveys			High, Low Estimates of Change, %*
	Decline	Increase	No Change	
Disability				
Any	2 Good; 1 fair			-1.55, -0.92
Activities of daily living	1 Good; 1 poor	1 Fair	1 Good; 1 fair; 1 poor	-1.38, 1.53
Instrumental activities of daily living	2 Good; 2 fair†			-2.74, -0.40
Limitations				
Functional	2 Fair‡; 1 poor	1 Fair‡		
Cognitive	2 Fair			
Vision	1 Fair		1 Fair	
Hearing	1 Fair			

*Average annual percent change based on surveys rated as good or fair. All estimates are based on trends that are statistically significant at the .05 level.

†For 1 study, results were stratified by sex and showed declines for women only.

‡Survey defined this outcome as having only functional limitations (no ADL or IADL disability).

and Program Participation^{3,43} showed large declines from 1984 to 1993 in the percentage of US adults aged 50 years and older and aged 65 years and older with difficulty seeing. Evidence from the Supplements on Aging to the National Health Interview Survey showed that rates of being blind or deaf or having hearing impairment remained constant between 1984 and 1995.^{4,40}

Evidence of Trends in Disparities

It is a common finding that the oldest old, women, blacks, and those with the least education have the greatest disability and limitation,⁶ but few studies

explicitly have focused on trends in disparities for major demographic and socioeconomic groups. Of the 8 surveys reviewed herein, 6 were analyzed for trends stratified by age, race, sex, or educational attainment or some combination thereof (TABLE 5) and all but 1 survey⁴⁵ were rated as fair or good. However, only 3 of these analyses included statistical tests for disparities.^{43,45,47} In TABLE 6, we categorized for each survey through inspection trends in disparities for each major outcome as narrowing, widening, or not changing and indicated in footnotes where statistical tests were conducted.

In one case¹ that rendered no clear pattern to the stratified trends by age, race, and education, this information was omitted from the summary table.

No narrowing or widening of differences is apparent in outcomes across age groups. Of the surveys rated as fair or good whose data were used in studies that included statistical tests, one showed no significant change for age disparities in any disability⁴⁷ and the other no significant change for age disparities in cognitive dysfunction prior to death.⁴⁵

The results for trends in sex disparities give the impression of narrowing, if any change at all. Narrowing sex differences in the mean number of IADLs and the percentage with 3 or more IADL disabilities,^{40,46} any functional limitations,^{3,40} and vision impairments³ were apparent (although not tested for) in some cases but were not evident in others focusing on the presence of any disability,⁴⁷ ADL disability,^{40,41,46} any IADL disability,⁴¹ or severe cognitive impairment.² The only study to test for sex disparities⁴⁷ did not find statistical evidence of a difference for men and women in trends in the prevalence of any disability.

Three of the surveys have been used to assess trends in disparities by race. Data from the Asset and Health Dy-

namics of the Oldest Old Study² showed larger declines in severe cognitive impairment between 1993 and 1998 for nonwhites than whites—suggesting the disparity between the races may be narrowing. The 1984 and 1993 Survey of Income and Program Participation³ showed larger declines among blacks than among whites or persons of other races with respect to 3 functional limitations

and vision limitations. However, in the only study that included tests for trends in disparities by race, Schoeni and colleagues⁴⁷ reported no statistically significant differences in disability declines between nonwhites and whites between 1982 and 1996, using data from the National Health Interview Survey.

Reports of trends in disparities by educational level have been inconsistent. De-

clines in any disability were significantly larger for those with more than a high school education compared with those with just a high school education or less.⁴⁷ Declines in severe cognitive impairment appeared to be largest among those with less than a high school education,² but there was no significant change in educational disparities in functional limitations and vision limitations over time.⁴³

Table 5. Trends in Disparities in Self-reported Disability and Functioning Among Older US Adults by Age, Sex, Race, and Education: Detailed Findings From Surveys Rated as Good or Fair*

Survey, by Rating	Study, y	Statistical Test for Trend Disparities	Major Findings
Age Disparities			
Good			
National Health Interview Survey	Crimmins et al, ⁴¹ 1997	No	ADL disability: between 1982 and 1993 the proportion with ADL disability was flat for all 5-year age groups for both men and women. Only IADL disability: between 1982 and 1993 the proportion with only IADL disability declined across all 5-year age groups for both men and women except women ages ≥ 85 y and men aged 75-79 y
	Schoeni et al, ⁴⁷ 2001	Yes	Any disability: between 1982 and 1996 all age groups experienced declines in disability and there were no statistically significant differences across age groups in these declines
National Long Term Care Survey	Manton et al, ¹⁴ 1997	No	Any disability: between 1982 and 1994 declines in disability prevalence were largest for persons ages 85 y and older
	Manton and Gu, ¹ 2001	No	Any disability: between 1982 and 1999 no clear pattern in disparities in chronic disability trends when stratified by age, race, and education
Fair			
Asset and Health Dynamics of the Oldest Old Study	Freedman et al, ² 2001	No	Severe cognitive impairment: between 1993 and 1998 declines in severe cognitive impairment largest for persons aged ≥ 85 y
National Mortality Followback Study	Liao et al, ⁴⁵ 2000	Yes	ADL disability: between 1986 and 1993 increases in the percentage with no ADL disability in the last year of life were significantly larger for those aged ≥ 85 y (vs those 65-84 y) ($P < .05$ for differences between men and women) Cognitive dysfunction: between 1986 and 1993 no significant differences across age groups in the increases in the percentage with no cognitive dysfunction in the last year of life ($P > .05$ for differences between men and women)
Survey of Income and Program Participation	Freedman and Martin, ² 1998	No	Functional limitations: between 1984 and 1993 declines in difficulty lifting, climbing, and walking larger for those aged ≥ 80 y than for those aged 50-64 or 65-79 y Vision limitations: between 1984 and 1993 declines in difficulty seeing larger for those aged ≥ 80 than for those aged 50-64 or 65-79 y
Sex Disparities			
Good			
National Health Interview Survey	Crimmins et al, ⁴¹ 1997	No	ADL disability: between 1982 and 1993 the proportion with ADL disability was flat for all 5-year age groups for both men and women Only IADL disability: between 1982 and 1993 the proportion with only IADL disability declined about the same amount across all 5-year age groups for both men and women except women aged ≥ 85 y and men aged 75-79 y
	Schoeni et al, ⁴⁷ 2001	Yes	Any disability: between 1982 and 1996 the prevalence of disability declined for both men and women, and there was not a statistically significant difference in these declines
Fair			
Asset and Health Dynamics of the Oldest Old Study	Freedman et al, ² 2001	No	Severe cognitive impairment: between 1993 and 1998, severe cognitive impairment declined significantly for both men and women
Supplements on Aging to the National Health Interview Survey	Crimmins and Saito, ⁴⁰ 2000	No	ADL disability: after controlling for age, between 1984 and 1994, the mean number of ADLs increased significantly by about the same amount for both men and women IADL disability: between 1984 and 1995 the mean number of IADLs declined only for women Functional limitations: between 1984 and 1995 the mean number of functional limitations declined only for women
	Liao et al, ⁴⁶ 2001	No	ADL disability: between 1984 and 1994 age-adjusted ADL disability prevalence increased a similar amount among men and women IADL disability: between 1984 and 1994 age-adjusted IADL disability prevalence declined for neither men nor women; however, the age-adjusted percentage with 3 or more IADL limitations declined for women but not men
Survey of Income and Program Participation	Freedman and Martin, ² 1998	No	Functional limitations: between 1984 and 1993 declines in the prevalence of difficulty lifting, climbing, and walking appear larger for women than for men Vision limitations: between 1984 and 1993 declines in the prevalence of difficulty seeing appear larger for women than for men

(continued)

COMMENT

We found that for older US adults the prevalence of any disability declined significantly during the 1990s and that estimates of the average annual decline ranged from -1.55% to -0.92% per year. However, these improvements did not hold across all specific measures of disability. To the contrary, late-life disability declines have been concentrated among IADL limitations, such as household chores, shopping, going outside, and medication management, and among limitations in basic physical tasks, such as lifting, climbing stairs, and walking. Estimates of the average annual rate of decline of the former ranged from -2.74 to -0.40 . The prevalence of severe cognitive impairment also may have declined, but this preliminary finding

needs to be verified with additional data sources and a longer study period. Limitations in hearing appear to have been constant over the last decade. The evidence is mixed for self-reported vision.

Perhaps most importantly, conflicting evidence exists about ADL disability, the most severe type of disability generally associated with long-term care needs. Of the surveys of fair or better quality for evaluating trends, only the National Long Term Care Survey found declines; the remaining surveys showed increases or no change. It remains unclear why the national surveys evaluated herein provided inconsistent evidence with respect to old age ADL trends. Potential methodological explanations include differences across surveys in how questions are worded

and in defining the specific ADL activities, whether the institutional population is included in the sampling frame, and whether the design is cross-sectional or panel based (the latter of which is subject to loss to follow-up). Analytic decisions about missing data, nonresponse weights, and the age-standardization of results may also contribute. Resolving these inconsistencies is an important next step for understanding whether declines in severe disability have been occurring.

Considerable gaps in our understanding of trends in disparities across major demographic groups remain. Although none of the results we reviewed suggested that the gaps were widening between old and young, men and women, or whites and nonwhites,

Table 5. Trends in Disparities in Self-reported Disability and Functioning Among Older US Adults by Age, Sex, Race, and Education: Detailed Findings From Surveys Rated as Good or Fair* (cont)

Survey, by Rating	Study, y	Statistical Test for Trend Disparities	Major Findings
Race Disparities			
Good			
National Health Interview Survey	Schoeni et al, ⁴⁷ 2001	Yes	Any disability: between 1982 and 1996, the prevalence of disability declined for both whites and nonwhites, but there was not a statistically significant difference in these declines
National Long Term Care Survey	Manton and Gu, ¹ 2001	No	ADL disability: between 1982 and 1989, the difference between blacks and nonblacks widened in the percentage with 1-2, 3-4, or 5-6 ADLs; between 1989 and 1999, the difference between blacks and nonblacks narrowed in the percentage with 1-2, 3-4, or 5-6 ADLs Only IADL disability: between 1982 and 1989 the difference between blacks and nonblacks widened in the percentage with only IADLs; between 1989 and 1999, the difference between blacks and nonblacks narrowed in the percentage with only IADLs Institutionalized: between 1982 and 1989 the difference between blacks and nonblacks widened in the percentage in an institution; between 1989 and 1999, the difference between blacks and nonblacks narrowed in the percentage in an institution
Fair			
Asset and Health Dynamics of the Oldest Old Study	Freedman et al, ² 2001	No	Severe cognitive impairment: between 1993 and 1998 severe cognitive impairment declined significantly for both whites and nonwhites; among self-respondents declines appeared larger for nonwhites than whites
Survey of Income and Program Participation	Freedman and Martin, ³ 1998	No	Functional limitations: between 1984 and 1993 declines in the prevalence of difficulty lifting, climbing, and walking appear larger for blacks than for whites and persons of other races Vision limitations: between 1984 and 1993 declines in the prevalence of difficulty seeing appear larger for blacks than for whites and persons of other races
Educational Disparities			
Good			
National Long Term Care Survey	Manton and Gu, ¹ 2001	No	Any disability: between 1982 and 1999 no clear pattern in disparities in chronic disability trends when stratified by age, race, and education
National Health Interview Survey	Schoeni et al, ⁴⁷ 2001	Yes	Any disability: between 1982 and 1996, the prevalence of disability declined only for those with 13 or more years of education; this trend was statistically different from the trend (or lack thereof) experienced by those with 0-8 ($P = .01$), 9-11 ($P = .02$), and 12 ($P = .06$) years of education
Fair			
Asset and Health Dynamics of the Oldest Old Study	Freedman et al, ² 2001	No	Severe cognitive impairment: between 1993 and 1998 the prevalence of severe cognitive impairment declined significantly for all education groups; among self-respondents declines appeared largest for those with less than 8 years of education
Survey of Income and Program Participation†	Freedman and Martin, ⁴³ 1999	Yes	Functional limitations: between 1984 and 1993 education disparities in difficulty lifting, climbing, and walking did not change significantly over time Vision limitations: between 1984 and 1993 education disparities in difficulty seeing did not change significantly over time

*ADL indicates activities in daily living; IADL, instrumental activities of daily living.

†The National Mortality Followback Study is classified as fair for the purposes of evaluating changes over time in cognition in the last year of life; because of changes in question wording the data set is rated as poor for measuring changes over time in ADL disability in the last year of life.

‡Freedman and Martin (1998)³ also used the Survey of Income and Program Participation to provide information on trends by education, but not tests of their statistical significance. Because the study listed above⁴³ uses the same survey data and does provide such tests, only it is included herein.

whether the gaps have narrowed or have remained stable for these groups over the last decade remains unclear. For educational disparities, the only study with statistical tests for disparities and based on survey data with a rating of good found the disability gap was widening. Notably, only 3 of the studies that analyzed disparities included statistical tests of disparities. Future work would do well to focus on rigorously examining trends in important disparities. A thorough understanding of trends in disparities is critical not only for identifying groups that might benefit from various health-related interventions but also for projecting the future course of population-level health trends.

Not all studies of late-life disability and functioning trends are equally valid. Only 2 out of the 8 surveys reviewed herein received a rating of good. The majority had at least 1 poor feature, which varied from survey to survey. Many studies failed to report critical pieces of information relevant for assessing the validity of findings or did not attempt to investigate sensitivity to missing data. And, with 2 exceptions,^{2,42} the studies reviewed herein relied on ratios of disability and functioning. Supplementation of self- and proxy-reported items with performance-based measures, which may evaluate capacity independent of changes in attitudes, environments, and adaptations, could help minimize issues related to item consistency and interpretation in future studies of disability trends.⁵⁰

Pinpointing explanations—including the role of medical care—for the population-level shifts in late-life health continues to be a high priority for future research. Thus far the search for potential explanations for improvements has been extremely limited in scope,¹⁶ with investigations focusing largely on shifts in the demographic and socioeconomic status of older adults^{2,3,43,47,48} and on changes in the late-life chronic disease profile and treatment of disease.⁴⁴ To date, the empirical evidence has not provided overwhelming support for any causal hypotheses, although the increase in educational attainment of the

older population has been consistently identified as correlated with these shifts^{2,3,43,47,48} and improvements in functioning have occurred despite increased reports of chronic conditions.⁴⁴ Our synthesis suggests that the search should be broadened to examine sets of factors related to the performance of IADLs and the physical and cognitive abilities that underlie them. For example, future research could focus on the role of the physical environment (meaning assistive technology and modifications to the home environment that may make these

tasks easier to carry out); efforts aimed at preventing, reversing, and generally slowing the progression of physically and cognitively disabling conditions (including innovations in the growing field of rehabilitative medicine); and events that occur earlier in life that may be linked to both education and late-life functioning.

Finally, despite studies suggesting continued declines in disability will offset the effects of population aging on the size of the older disabled population,^{18,48} the implications of our find-

Table 6. Trends in Disparities in Self-reported Disability and Functioning Among Older US Adults Summary*

Variable	No. of Surveys		
	Narrowed	Widened	No Change
Age			
Disability			
Any	1		1†
Activities of daily living	1†‡		1
Instrumental activities of daily living			1
Limitations			
Functional	1		
Cognitive	1		1†
Visual	1		
Sex			
Disability			
Any			1†
Activities of daily living			2
Instrumental activities of daily living	1		1
Limitations			
Functional	2		
Cognitive			1
Visual	1		
Race			
Disability			
Any			1†
Activities of daily living			
Instrumental activities of daily living			
Limitations			
Functional	1		
Cognitive	1		
Visual	1		
Educational achievement			
Disability			
Any		1†	
Activities of daily living			
Instrumental activities of daily living			
Limitations			
Functional			1†
Cognitive	1		
Visual			1†

*Hearing limitations data were not reported.

†Statistical test for trends in disparities included.

‡Study rated poor.

ings for the future demand for medical care suggest that caution is in order. Without better insight into the causes of these improvements, it remains unclear whether medical expenditures have fueled health improvements or whether health improvements will help save medical costs in the future. The lack of consensus on trends in severe personal care disability—clearly the most expensive form of disability—further contributes to the uncertainty as to whether the improvements in old age health witnessed to date will yield cost savings to

public programs paying for home- and community-based and institutional care. Certainly the relatively wide range of estimates across studies and dearth of consensus on trends in disparity suggests that predictions of the future size and composition of the older disabled population based on findings from a single study may be misleading. Predictions aside, the framework presented herein could well serve as a guide for assessing and maximizing the validity of future studies of old-age disability and functioning trends.

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