CHRONIC CONDITIONS AND THE DECLINE IN LATE-LIFE DISABILITY*

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Using data from the 1997–2004 National Health Interview Survey (NHIS), we examine the role of chronic conditions in recent declines in late-life disability prevalence. Building upon prior studies, we decompose disability declines into changes in the prevalence of chronic conditions and in the risk of disability given a condition. In doing so, we extend Kitigawa's (1955) classical decomposition technique to take advantage of the annual data points in the NHIS. Then we use respondents' reports of conditions causing their disability to repartition these traditional decomposition components. We find a general pattern of increasing prevalence of chronic conditions accompanied by declines in the percentage reporting disability among those with a given condition. We also find declines in heart and circulatory conditions, vision impairments, and possibly arthritis and increases in obesity as reported causes of disability. Based on decomposition analyses, we conclude that heart and circulatory conditions as well as vision limitations played a major role in recent declines in late-life disability prevalence and that arthritis may also be a contributing factor. We discuss these findings in light of improvements in treatments and changes in the environments of older adults.

Evidence continues to mount that the prevalence of disability in late life has been declining in the United States (see, e.g., Crimmins 2004; Cutler 2001; Freedman, Martin, and Schoeni 2002; Manton and Gu 2001; Manton, Gu, and Lamb 2006; Wolf, Hunt, and Knickman 2005) despite increases in reports of chronic diseases (Crimmins and Saito 2000; Freedman and Martin 2000). Most of the decline has been in limitations in instrumental activities of daily living (IADLs), particularly for such activities as managing money, shopping for groceries, and doing laundry (Spillman 2004), although declines in difficulty and help with activities of daily living (ADLs) have also been identified (Freedman et al. 2004).

Two of the most commonly cited frameworks for thinking conceptually about disability—namely, the disablement process (Institute of Medicine 1991) and the International Classification of Functioning, Disability, and Health (World Health Organization 2002)—both recognize that health conditions intersect with the environment to cause activity limitations. Yet, only a few studies to date have attempted to link trends in health conditions and limitations. For example, Freedman and Martin (2000) analyzed data from the Supplements on Aging to the National Health Interview Survey and found for the 70 and older population that despite increases in reports of chronic conditions, the percentage of older Americans with upper- and lower-body limitations declined between 1984 and 1995. The study concluded that associations between several major diseases—most prominently arthritis—and functional limitations waned during that time period and that functional limitations would have decreased even more had obesity not also risen. Based on the same data sources, Crimmins and Saito (2000) found increases in reports of chronic

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conditions but declines in reports of limitations in ADLs and IADLs among women reporting such conditions.

Although consistent with a slowing of the progression of disease, these empirical patterns could also be generated by a trend toward diagnosis of conditions at earlier, and therefore less-debilitating, stages. However, with few exceptions, national survey data generally do not have detailed measures of disease progression measured consistently over time. One way to avoid confounding as a result of earlier diagnosis is to track the subset of the population who report that specific conditions cause their disability. Selection of less-severe cases into the condition pool should not affect the proportion of the population who report that a given condition causes disability.

The approach that we propose requires distinguishing conditions that are reported to cause disability from those that simply co-occur with disability. The distinction is not merely one of semantics. Consider two older women who both report having diabetes and arthritis as well as limitations in daily activities. One woman may have arthritis that is debilitating to the point of interfering with mobility, but her diabetes may be mild and controlled with oral medication. In this case, arthritis may be reported as the reason for activity limitations, and diabetes may be considered to be a condition that simply co-occurs with the limitations. Suppose that the other woman has diabetes that has progressed to the point at which poor vision and neuropathy make carrying out daily activities without help difficult, but she has only mild arthritis. In this case, diabetes may be reported as a cause, and arthritis may be considered to be a co-occurring condition. In our analysis, we refer to conditions that respondents report as causing their disability as "causal conditions" and refer to conditions that respondents report having but that they do not identify as causing disability as "comorbid conditions." This language is not meant to imply that chronic conditions are the sole cause of disability or that we are able to demonstrate causality with cross-sectional survey data. Indeed, we recognize that in practice, multiple causal and contributing factors may act together with the environment to create the circumstances under which a disability may occur (Verbrugge, Lepkowski, and Imanaka 1989). The reports upon which we rely simply reflect chronic conditions that are perceived to cause disability.

Introducing the notion of causal conditions also helps to establish some directionality between an individual's disease and disability status. In the absence of such directionality, researchers generally interpret data on the co-occurrence of disease and disability as the former causing the latter, ignoring the fact that disability may cause secondary conditions to emerge (Institute of Medicine 1991). Consider cases in which an individual has a disabling accident that leads to severe depression, or another individual who has a mobility limitation that leads to heart disease because of lack of physical activity. In these cases, declines in disability may lead to concurrent declines in chronic disease. Thus far, decomposition analyses of chronic disease's role in disability trends have not addressed these complexities.

An additional shortcoming of prior analyses on this topic is that they have typically relied on only two cross sections. Previous studies have cautioned about drawing conclusions about trends from only two data points, in part because substantial year-to-year variation in disability prevalence may occur. Crimmins, Saito, and Reynolds (1997), for example, pointed out that analysis of changes in disability prevalence can be sensitive to the base year and that ignoring intra-interval data can lead to conclusions that are not robust.

This paper uses eight years of data from the National Health Interview Survey (NHIS) to update analyses of linkages between chronic disease and disability among older Americans. Building on prior studies, we decompose disability declines into changes in the prevalence of chronic conditions and in the risk of disability among those who report having a given condition. In doing so, we extend Kitagawa's (1955) decomposition technique to take advantage of the annual data points in the NHIS. We then repartition these traditional decomposition components, based on reports of conditions causing respondents' disability.

METHODS

Data

We used the 1997–2004 NHIS.[1] Conducted by the National Center for Health Statistics, the NHIS is a repeated, cross-sectional survey of the noninstitutionalized U.S. population. During the family core interview, information was collected for each family member in the household on a variety of topics, including activity limitations and the conditions that cause such limitations. All adult members of the household who were at home at the time of the interview were invited to participate and to respond for themselves. For adults not at home during the interview, proxy responses were provided by a knowledgeable adult family member residing in the household who was designated as the main family core respondent. In addition, one randomly selected adult per family received an adult questionnaire containing more in-depth questions on chronic conditions and functioning. Final response rates—calculated by cumulating rates for household (88%), family (98%), and adult samples (94%)—averaged 74% for 1997–2004 (range: 70%–80%).

We limited the analysis to respondents aged 65 and older in the adult sample (N = 48,585, ranging from 5,577 to 6,972 per year). The sampling plan followed a multistage area probability design that permitted representative sampling of the adult population. The adult sample weights therefore allowed generalization to the civilian noninstitutionalized population. Proxy responses to the adult questionnaire were not allowed in 1997–1999 but were subsequently introduced in 2000. To make estimates comparable over time, we eliminated from the adult samples in 2001–2004 cases in which proxies provided responses (N = 693 or 1% of the sample, ranging from 169 to 189 per year; note that these cases could not be identified in 2000) and reweighted the adult sample in later years to match the strategy used in earlier years.

Although our sample was generalizable to the noninstitutionalized older adult population, about 1.5 million older adults lived in nursing homes in 2000, which was a decline of about 2% from 1990 (He et al. 2005). Omitting the institutionalized from our analysis could have biased estimates of aggregate changes toward understating improvements in disability and overstating increases in disease. The omission of respondents who completed the sampled adult portion of the interview via proxies also may have biased estimates, most likely downward.

Measures

The family core interview asked about several types of activity limitations, including ADL and IADL disability. Limitations in ADLs were assessed with the question, "Because of a physical, mental, or emotional problem, do you/does anyone in the family need the help of other persons with personal care needs, such as eating, bathing, dressing, or getting around inside this home?" Limitations in IADLs were assessed with the question, "Because of a physical, mental, or emotional problem, do you/any of these family members need the help of other persons in handling routine needs, such as everyday household chores, doing necessary business, shopping, or getting around for other purposes?" We considered positive responses to either question as having a disability.

The interviewer then asked what condition(s) or health problem(s) caused the family member to have difficulty with [previously named activities]. Respondents were given a response card with 18 categories and were allowed to report multiple causes. We focused here on the 12 causes for which the NHIS also collected consistent information as part of its more general questions about chronic conditions and impairments: cancer, heart problems, stroke, hypertension, lung/breathing problems, depression/anxiety/emotional problems, diabetes, weight problem, arthritis/rheumatism, back/neck problem, hearing problem, and

1. The NHIS was extensively redesigned in 1997. We therefore focus on the 1997–2004 period.

vision problem. Although far from exhaustive, this list includes the most frequently cited causes of disability, and 81% of older adults with ADL or IADL limitations reported one or more of these causes. The most salient omissions for our purposes were fractures and injuries, the assessment of which changed over time, but which we found in exploratory analyses (not shown) to remain relatively flat over this period as a cause of disability. Also omitted was dementia, which was not assessed, although we found that senility remained stable as a cause of disability.

Because some causes were already quite aggregated (e.g., lung/breathing problem, cancer, and depression/anxiety/emotional problem), we combined the remaining causes into groups according to either body systems (e.g., heart problem, hypertension, and stroke as heart and circulatory conditions; and arthritis/rheumatism and back/neck problem as musculoskeletal conditions) or conditions that were meaningfully related in other ways (e.g., hearing and vision problems as sensory limitations; and weight problem, which we combined with information about obesity, and diabetes as metabolic conditions). The resulting seven condition groups are listed in column 1 of Table 1 along with the corresponding wording for conditions that respondents may have reported as causing their disability (column 2).

Information on the general presence of chronic conditions, not linked to disability, was taken from responses to the adult questionnaire. For all but joint-related conditions, identical questions were asked in each year. (See column 3 of Table 1 for details, including reference periods.) For joint-related conditions, we used the following: for 1997–2001, an indicator of joint pain in the past 12 months that was not the result of only an injury; for 2002–2004, ever having a diagnosis of arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia. We assessed the likely influence of this change in wording by comparing the joint pain indicator in 2001 (56%) with an item that asked about ever having arthritis in the same year (52%) and by reviewing studies of the prevalence of gout (3% among older adults), lupus (< 0.05% among adults), and fibromyalgia (3%–4% among older adults) (Lawrence et al. 1998). Based on this evidence, we calculated that estimates of arthritis/joint pain in 2002–2004 were about 3–4 percentage points higher than they would have been if the wording had not changed.

Two additional conditions deserve comment: mental distress and obesity. Our measure of severe mental distress was based on responses to the K6, which is a six-item scale (range 0–24) reflecting symptoms in the past 30 days (sadness, restlessness, nervousness, hopelessness, feeling worthless, and feeling that everything was an effort). We used a cut point of 13 or higher to reflect severe mental distress (Kessler et al. 2002). Although obesity is not a chronic disease per se, but instead a reflection of an imbalance among physical activity, nutrition, and metabolic activity, we also included a measure of obesity, based on self-reports of height and weight. We used a cut-off of a body mass index (BMI) greater than or equal to 30 to indicate obesity. We also explored whether being overweight ($25 \leq \text{BMI} < 30$) or underweight ($\text{BMI} < 18.5$) mattered; only a few individuals with BMI at these levels reported that a weight problem caused their disability, so we excluded these variables from the analysis.

To help assess the quality of self-reported data on conditions and self- and family-provided information on conditions causing limitations, we looked to the literature. Prior studies (see, e.g., Bush et al. 1989; Simpson et al. 2004; Skinner et al. 2005) showed excellent agreement between self-reported conditions by older adults and medical records/physician reports for well-defined, chronic conditions (such as hypertension, diabetes, cancer, heart attack, and stroke). However, for conditions and symptoms that were less well defined, such as arthritis and lower-back pain, self-reported prevalence tended to be higher than prevalence obtained through physician assessments. Moreover, to the extent that self-reports of conditions and reasons for disability may be influenced by medical care use, some groups may have systematically lower levels of self-reported conditions (particularly

Table 1. Condition Measures, 1997–2004 National Health Interview Survey

Assigned Condition Group	Conditions Respondents Report as Cause of Disability	Conditions Respondents Report Having (reference period)
Cancer	Cancer	Cancer (ever)
Heart and Circulatory Conditions	Heart problem; hypertension/high blood pressure; stroke problem	Heart disease: coronary heart disease, angina, heart attack, any other heart condition or heart disease (ever); hypertension/high blood pressure (ever); stroke (ever)
Lung Conditions	Lung/breathing problem	Asthma (ever), emphysema (ever)
Mental Distress	Depression/anxiety/emotional problem	Symptoms of severe mental distress (in the past 30 days)
Metabolic Conditions	Diabetes; weight problem	Diabetes (ever); obesity (BMI ≥ 30)
Musculoskeletal Conditions	Arthritis/rheumatism; back or neck problem	Arthritis/joint pain (ever/in the past 12 months)[a]; low back pain or neck pain (in the past 3 months)
Sensory Impairments	Hearing problem; vision problem	A lot of trouble hearing or deaf (current); trouble seeing even when wearing glasses or contacts (current)

[a]Doctor ever told you that you had some form of arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia assessed for 2002–2004 and joint pain due to cause other than injury assessed in the past 12 months for 1997–2001. See the text for details.

for asymptomatic conditions, such as hypertension). Despite these complexities, Ferraro and Su (2000) found that survey-based, self-reported conditions were stronger predictors of disability than examination-based, physician-reported conditions, thus suggesting that self-reports may be of value in modeling relationships between morbidity and disability.

There is less evidence with respect to the validity of respondent and proxy reports about conditions causing activity limitations. As we mentioned earlier, information from the family core interview on conditions causing limitations could be provided by either the sampled adult or family (proxy) respondent. Subjects and proxies have been shown to provide comparable assessments of ADLs and IADLs (Neumann, Araki, and Gutterman 2000), and one study suggested that older adults were able to accurately report conditions that cause their disability (Ettinger et al. 1994), but we were unable to identify studies assessing family members' ability to provide proxy responses to such questions about conditions. However, we found that in our sample, cross-tabulations of chronic conditions (self-reported in the sampled adult interview) by reasons for disability (reported during the family core interview) resulted in low levels of inconsistencies. That is, for any given condition, generally less than 1% of individuals who did not mention that they had a given condition reported (or had a proxy report) that condition as a cause of their ADL or IADL limitation. In these conflicting cases, we assumed that the condition did not cause the individual's disability. Sensitivity analyses that assumed the opposite (i.e., that the individual had the condition and that it caused his or her disability) led to substantially similar conclusions to those presented here, except in the case of arthritis, as we discuss later.

Analyses

We first assessed changes in the prevalence of each condition, in the probability of disability given each condition, and in the probability of reporting disability *and* that a particular condition caused the limitation. We tested for trends in each of these outcomes individually by using linear regression models with year entered as a continuous variable.

All statistical tests were based on adjusted standard errors that accounted for the complex NHIS sampling design.

We then implemented two approaches to decompose the change in disability into its condition-related components. We first adapted Kitagawa's (1955) formula to take advantage of annual data in the NHIS and to partition disability declines into changes in the prevalence of conditions and in the probability of disability given a condition. Second, in order to isolate the contribution of causal conditions, we incorporated additional information on the probability an individual reported a disability and that a particular condition was the cause. In the next two sections, we describe each of these approaches in more detail.

Traditional decomposition using annual data. Kitagawa's (1955) decomposition formula was developed to compare rates across two populations, but the general approach has been extended and adopted for use in analyses of trends (see, e.g., Feyisetan and Casterline 2000; Freedman and Martin 1999; Retherford and Rele 1989; Smith, Morgan, and Koropeckyj-Cox 1996). According to Kitagawa's formula, the contribution of a change in the prevalence of a given condition—say, ever having diabetes—to aggregate changes in disability is a multiple of the proportion of people ever having diabetes (denoted X_{year}) differenced over the two years and the probability of having disability given diabetes (denoted β_{year}) averaged over the two years ($(X_{1997} - X_{2004})\frac{\beta_{1997} + \beta_{2004}}{2}$). The contribution of a change in the probability of having disability given diabetes is a multiple of the difference in diabetes' effects on disability over time and the average proportion ever having diabetes ($(\beta_{1997} - \beta_{2004})\frac{X_{1997} + X_{2004}}{2}$). The sum of the two pieces represents a condition's total contribution to the change in disability.

If only two years of data are available—say, 1997 and 2004—values of β_{year} can be taken from stratified linear regression models that predict disability from the explanatory variables for each of the particular years. In this case, the X_{year} variables represent the prevalence estimates for each covariate in 1997 and in 2004. In the nonlinear case, the expressions are more complex (Das Gupta 1993), but the same logic follows. Firebaugh (1989) suggested a linear regression method that takes advantage of intervening time points to sort out intra-cohort change from cohort-succession effects, although he did not explicitly introduce covariates or allow their effects to vary over time. In this application, we built upon these well-established approaches to take advantage of annual time points in the NHIS.

Instead of obtaining βs from stratified models for 1997 and 2004, we pooled individual data for all years from 1997 to 2004 and estimated a model predicting disability, with year specified as a continuous variable from 0 (= 1997) to 7 (= 2004), demographic and socioeconomic variables, each of the seven condition groups, and interactions between year and each of the other variables. In this model, the simple effects represent βs for 1997. We then calculated βs for 2004 by adding seven times the appropriate interaction term to the 1997 βs.[2] Values of X were obtained in a similar fashion, by regressing each of the demographic and socioeconomic variables individually and each of the seven condition groups individually on year, with the intercepts representing X_{1997} and the intercepts added to seven times the year coefficients representing X_{2004}. We then used these estimated values of βs and Xs in the equations provided by Kitagawa, as shown earlier.[3]

Regression models predicting disability included age (in broad groups), sex, race/ethnicity (white, non-Hispanic and other combined; black, non-Hispanic; and Hispanic), completed education (0–8 years, 9–11 years, 12 years or GED, or 13 or more years), marital

2. Alternatively, we could have reestimated the model with year specified in the reverse from 0 (= 2004) to 7 (= 1997) and with the simple effects and interactions with year. In this second model, which would have provided results identical to those presented here, the simple effects would represent the βs for 2004.

3. Standard errors for βs and Xs were calculated by using STATA's svy: reg command, which adjusts for the complex sample design of the NHIS.

status (married, separated/divorced, widowed, never married), and reports of the seven condition groups described earlier. In a subsequent model that we used to investigate the effects of more-specific conditions, we replaced four of the seven condition groups (heart and circulatory conditions, metabolic conditions, musculoskeletal conditions, and sensory impairments) with indicators of nine more-specific conditions (heart disease, hypertension, stroke, diabetes, obesity, arthritis/joint pain, back or neck pain, vision limitation, and hearing limitation). We also investigated logistic regression models, but the results were essentially identical, and the linear probability models lend themselves more readily to decomposition analysis.

A word about interactions is in order. The majority of respondents reported more than one of the conditions considered here, and 40% of respondents who reported that they had a disability provided more than one cause. Although the model that we described earlier used information on all conditions reported by respondents, it assumed that these conditions operated independently on disability. We therefore explored the usefulness of including interactions between pairs of conditions. We first looked to existing studies and found that when conditions co-occured, they most often did not have synergistic effects on disability (Fried et al. 1999; Verbrugge et al. 1989). We also found in a series of exploratory analyses (not shown) that only a few of the most prevalent pairs were significant predictors of disability (e.g., having both arthritis and heart disease). We ultimately chose to exclude these interactions from the final models because the associations between having these pairs of conditions and reporting disability did not change significantly over time, and no significant change in reporting these pairs of conditions as causes of disability was noted. This exclusion is unlikely to change the substantive conclusions of our analysis.

Decomposition into causal and comorbid components. After we decomposed the change in disability rates into its traditional components, we repartitioned the total contribution of each condition group into components reflecting causal conditions and comorbid conditions. This second decomposition took advantage of information about conditions that were reported to cause disability.

Specifically, we calculated what we refer to as the *causal component* (the contribution of changes in reported causes of disability) by taking the differences in the predicted values of the proportion of the older population reporting disability in a given year *and* that a particular condition caused it. We obtained these predicted values in the same manner described earlier for obtaining predicted X_{year}. Because the probability of disability among those reporting that a particular condition caused their disability in each year is 1.0, this component readily simplified from the expression shown earlier to a simple difference in prevalence. We then obtained the remaining comorbid component by subtracting the causal component from the previously calculated total contribution for the given condition group.[4]

RESULTS

Trends in Disability and Conditions

The percentage of older Americans needing help with ADLs or IADLs declined by 1.45 percentage points from 12.69% in 1997 to 11.24% in 2004 (p = .01). This is equivalent to a decline of 11% over the eight-year period, or an average annual decline of 1.4% per year.

During the same period, reports of many of the potentially debilitating chronic conditions and sensory impairments increased significantly (see the left panel of Table 2). Older Americans were increasingly likely to report that a doctor ever told them that they had

4. In a decomposition framework, the comorbid component can also be considered the sum of the contribution of changes in the prevalence of the comorbid condition and the probability of disability given a comorbid condition. Because these components are not straightforward to interpret, however, we instead focused on the contribution of conditions reported as causes and treated the comorbid component as a residual term.

Table 2. Trends in the Prevalence of Select Chronic Conditions and in Reports of Disability Among Those With Select Chronic Conditions, Population Aged 65 and Older, 1997–2004 (*N* = 48,585)

	% Reporting a Chronic Condition									% Reporting Disability Among Those With a Chronic Condition								
Condition Group	1997	1998	1999	2000	2001	2002	2003	2004	1997–2004 Change	1997	1998	1999	2000	2001	2002	2003	2004	1997–2004 Change
Cancer	19.3	17.8	19.5	20.1	19.6	21.4	19.6	21.3	2.0**	13.7	16.3	14.7	17.1	13.4	13.9	16.5	13.3	–0.4
Heart and Circulatory Conditions	64.5	63.7	62.1	64.0	65.3	65.2	67.0	67.7	3.2**	16.1	16.7	15.2	15.2	14.9	14.1	14.2	13.8	–2.3**
Heart disease	31.5	32.0	28.9	30.2	31.1	30.8	31.1	31.7	0.2	20.4	19.5	19.7	19.2	18.9	18.4	17.6	18.0	–2.4*
Hypertension	51.4	50.8	50.3	52.4	53.4	54.5	56.0	56.4	5.0**	14.9	16.7	14.9	15.1	14.6	13.7	13.8	13.6	–1.2**
Stroke	7.8	8.3	7.8	8.3	8.4	7.8	8.4	8.9	1.1	37.5	31.2	34.4	35.8	31.1	34.9	30.9	30.7	–6.9
Lung Conditions	11.2	11.5	10.2	12.0	11.9	11.1	11.2	12.6	1.4	20.2	22.4	19.8	22.1	17.5	17.8	20.2	18.5	–1.7
Mental Distress	3.4	2.8	2.1	2.6	2.4	1.9	2.2	2.1	–1.3**	49.1	45.2	41.4	39.4	43.7	35.1	37.3	41.8	–7.3*
Metabolic Conditions	25.1	26.0	26.5	28.6	29.1	31.4	29.4	32.1	6.9**	17.7	17.9	15.7	17.3	17.2	15.1	15.0	14.2	–3.6**
Diabetes	13.1	13.2	13.2	14.6	15.2	15.8	15.8	17.1	4.0**	22.3	23.1	19.1	21.3	21.1	17.9	18.2	18.2	–4.1**
Obesity	16.0	16.8	17.7	19.0	19.4	21.1	19.5	21.6	5.6**	15.4	16.3	15.5	16.5	15.4	14.2	13.5	12.6	–2.8**
Musculoskeletal Conditions	57.4	58.7	54.6	55.9	57.8	58.0	59.9	60.7	3.3**	16.5	16.5	15.2	15.8	14.4	14.8	15.1	14.6	–1.9*
Arthritis/joint pain	44.5	45.0	41.8	43.4	43.3	47.3	48.4	50.6	6.1**	17.7	17.4	16.1	16.3	15.0	15.5	16.0	15.0	–2.7**
Pain in back or neck	34.7	36.7	33.4	34.9	36.7	33.7	34.6	34.5	–0.2	17.9	18.6	16.0	16.9	16.3	16.0	17.2	17.1	–0.8
Sensory Impairments	24.6	25.4	23.2	24.6	25.6	24.5	23.1	23.9	–0.7	24.6	25.3	23.6	26.7	23.5	24.0	24.8	22.6	–2.0
Hearing limitation	9.8	10.4	10.1	10.5	10.9	10.5	9.8	10.4	0.6	22.1	24.2	17.1	25.9	19.9	23.2	22.8	23.1	1.0
Vision limitation	18.0	18.0	15.7	17.4	17.4	17.1	15.9	16.3	–1.7**	28.4	28.3	28.6	29.8	28.3	26.6	28.4	25.7	–2.7

*$p < .05$; **$p < .01$

cancer, heart and circulatory conditions (specifically hypertension), metabolic conditions (specifically diabetes and obesity), and musculoskeletal conditions (specifically arthritis/joint pain). Only the prevalence of severe mental distress and vision limitations declined significantly over the period.

Also consistent with prior studies, the probability of disability given a chronic condition was lower in 2004 than in 1997. As shown in the right panel of Table 2, the probability of needing help with personal or routine care activities declined among those with heart and circulatory conditions (specifically heart disease and hypertension), mental distress, metabolic conditions (specifically diabetes and obesity), and musculoskeletal conditions (specifically arthritis/joint pain). A large decline was also evident for stroke (–6.9 percentage points), but this decline was significant only at the .10 level ($p = .08$).

Compositional Changes

Between 1997 and 2004, the composition of the older population changed significantly with respect to age, education, ethnicity, and marital status (see the first two columns of Table 3). Educational increases were particularly noteworthy, with the percentage with eight or fewer years and 9–11 years of completed education both declining and the percentage with 13 or more years (not shown) increasing. Shifts in the prevalence of the seven condition groups considered here mirrored those in Table 2, although they differed slightly because the estimates in Table 3 are predicted values based on information throughout the entire period.

Changes in the Conditional Probability of Disability

The influence on disability of age, sex, and education also changed over this period (see columns 3 and 4 of Table 3). The risk of disability associated with being aged 80–84 declined, as did the risk associated with being female (statistical significance indicated in column labeled *p*+). In addition, relative to having more than 12 years of school, the risk associated with having 8 or fewer years of education increased, as did the risk associated with having 12 years of education.

Of the seven condition groups that we examined, only heart and circulatory conditions became significantly less debilitating over this period. In a model in which we replaced the seven condition groups with all 12 conditions (not shown), none became significantly less debilitating.

Traditional Decomposition of Changes in Disability

The right side of Table 3 decomposes changes in disability into its traditional components: the contribution of changes in prevalence and in the probability of disability given a particular demographic characteristic or condition group. Focusing on the contribution of changes in prevalence (column 5), age, education, and marital status clearly had important influences on disability prevalence. The aging of the population aged 65 and older into the oldest age groups had an upward influence (0.23 percentage points for 80- to 84-year-olds and 0.45 percentage points for those aged 85 years and older); however, shifts away from the lowest education group made significant contributions toward the decline (–0.25 for eight or fewer years of education).

Looking at shifts in the prevalence of condition groups, four of the condition groups that we examined contributed significantly toward increases in disability: cancer (0.05 percentage points), heart and circulatory conditions (0.15), metabolic conditions (0.32), and musculoskeletal conditions (0.12); whereas severe mental distress contributed toward declines (–0.23). Overall, demographic risk factors and condition groups contributed positively to changes in the prevalence of disability (0.27 and 0.38 percentage points, respectively).

Changes in disability associated with shifts in the debilitating effects of demographic factors and condition groups are shown in column 6 of Table 3. Shifts in the probability of having disability among those persons aged 80–84 and women contributed –0.49 and

Table 3. Decomposition of the Estimated Change in Disability Prevalence From 1997 to 2004 Into Demographic and Chronic Condition Components

Variable	Prevalence 1997 (1)	Prevalence 2004 (2)	Prevalence $p+$[a]	Probability of Disability 1997 (3)	Probability of Disability 2004 (4)	Probability of Disability $p+$[a]	Contribution of Change in Prevalence (5)	Contribution of Change in Probability of Disability (6)	Total Contribution (7)
Demographic Risk Factors									
Age 70–74	27.3	24.6	**	0.01	0.01		–0.02	0.12	0.10
Age 75–79	21.9	21.4		0.03**	0.03**		–0.02	–0.09	–0.11
Age 80–84	13.0	15.4	**	0.12**	0.08**	*	0.23**	–0.49*	–0.26
Age 85 or older	8.7	10.6	**	0.25**	0.21**		0.45**	–0.37	0.08
Female	57.8	57.4		0.05**	0.02**	*	–0.01	–1.24*	–1.25*
8 or fewer years of education	18.6	13.4	**	0.03**	0.07**	**	–0.25**	0.68**	0.43
9–11 years of education	16.5	12.9	**	0.01	0.02**		–0.06	0.22	0.17
12 years of education	33.9	34.7		–0.01	0.02**	**	0.00	0.96**	0.96**
Non-Hispanic black	8.1	8.3		0.05**	0.02*		0.01	–0.21	–0.20
Hispanic	5.3	6.3	**	0.02	0.01		0.01	–0.08	–0.07
Widowed	33.3	31.0	**	0.06**	0.06**		–0.14**	–0.16	–0.30
Divorced	7.0	8.4	**	0.06**	0.06**		0.08**	–0.05	0.04
Never married	3.8	3.5		0.06**	0.06**		–0.02	0.01	–0.01

Condition Groups									
Cancer	18.7	21.0	**	0.02*	0.03**		0.05**	0.19	0.24
Heart and circulatory conditions	62.8	67.0	**	0.05**	0.03**	*	0.15**	–1.45*	–1.29*
Lung conditions	11.0	11.9		0.07**	0.05**		0.06	–0.16	–0.10
Mental distress	2.9	1.9	**	0.25**	0.19**		–0.23**	–0.15	–0.38**
Metabolic conditions	25.2	31.9	**	0.05**	0.04**		0.32**	–0.21	0.11
Musculoskeletal conditions	56.1	59.6	**	0.03**	0.03**		0.12**	0.08	0.20
Sensory impairments	24.8	23.9		0.10**	0.11**		–0.10	0.33	0.24
Summary									
Demographic risk factors							0.27	–0.70	–0.43
Chronic conditions groups							0.38	–1.37	–0.99
Residual[b]									–0.02
Total							0.65	–2.07	–1.45

[a]p+ indicates test for the difference between 1997 and 2004; all other tests are for a difference from 0.

[b]Includes intercept and residual due to use of predicted values in decomposition.

*$p < .05$; **$p < .01$

Table 4. Trends in the Prevalence of Disability Caused by Select Chronic Conditions, Population Aged 65 and Older, 1997–2004 (*N* = 48,585)

	% Reporting a Disability Caused by a Condition								
Condition Group	1997	1998	1999	2000	2001	2002	2003	2004	1997–2004 Change
Cancer	0.67	0.74	0.77	0.83	0.89	0.94	0.91	0.70	0.03
Heart and Circulatory Conditions	5.54	6.04	5.06	5.34	5.16	4.65	5.09	4.83	–0.70*
Heart disease	3.24	3.41	2.64	2.98	2.97	2.81	2.94	3.03	–0.21
Hypertension	2.01	2.70	2.05	2.29	2.33	1.90	2.11	1.97	–0.04
Stroke	1.68	1.52	1.72	1.85	1.33	1.61	1.42	1.51	–0.17
Lung Conditions	1.09	1.23	0.99	1.29	0.87	0.98	1.25	0.88	–0.21
Mental Distress	0.17	0.16	0.23	0.31	0.17	0.09	0.11	0.11	–0.06
Metabolic Conditions	2.02	2.16	1.78	2.24	2.30	1.81	1.72	1.89	–0.14
Diabetes	1.92	2.04	1.64	2.11	2.15	1.71	1.57	1.70	–0.21
Obesity	0.15	0.18	0.21	0.18	0.26	0.28	0.27	0.37	0.22*
Musculoskeletal Conditions	4.60	4.83	4.47	4.31	3.67	4.41	4.59	4.82	0.22
Arthritis/joint pain	3.87	4.04	3.82	3.48	3.01	3.57	3.95	4.12	0.26
Pain in back or neck	1.47	1.44	1.24	1.37	1.12	1.59	1.48	1.65	0.17
Sensory Impairments	2.66	2.59	2.09	2.75	2.50	2.29	1.91	2.12	–0.53*
Hearing limitation	0.62	0.83	0.53	0.89	0.81	0.66	0.69	0.71	0.09
Vision limitation	2.25	2.04	1.80	2.16	1.98	1.87	1.36	1.73	–0.52**

*$p < .05$; **$p < .01$

–1.24 percentage points, respectively, toward the decline in disability over this period. At the same time, increases in the disadvantage associated with 8 or fewer years of education and that with 12 years of education almost completely offset these improvements (0.68 and 0.96, respectively).

Of the seven condition groups that we examined, only changes in the debilitating effects of heart and circulatory conditions contributed significantly to the decline, accounting for reductions in disability of 1.45 percentage points—as large as the entire disability decline over this period. Because of this extraordinarily large contribution, on balance, changes in the probability of disability among chronic condition groups had a larger influence on the disability decline than did changes in the probability of disability among demographic groups (–1.37 vs. –0.70 percentage points).

Focusing on the total contributions (see the final column of Table 3), three findings are noteworthy. Changes in heart and circulatory conditions made the largest contribution to the disability decline (–1.29 percentage points), followed by gender (–1.25). Severe mental distress also contributed significantly to the decline (–0.38). Surprisingly, education contributed to increases in disability: 0.96 percentage points were accounted for by changes among those with 12 years of education.

Distinguishing Causal Versus Comorbid Components

Are the declines in disability attributable to heart and circulatory conditions and to mental distress linked to changes in reported causes of disability? As shown in Table 4, the probability of reporting disability caused by heart and circulatory conditions declined from 5.54% to 4.83% ($p < .05$), but the percentage reporting that mental distress caused disability did not change significantly. Also, disability reported to be caused by vision limitations declined by 0.52 percentage points. Disability reported to be caused by obesity doubled over this period (from 0.15% to 0.37%; $p < .05$), although it remained low relative to other causes.

When we used this information to reapportion the contribution of chronic conditions into causal and comorbid components, two condition groups emerged as important contributors to the disability decline: heart and circulatory conditions and sensory impairments (see column 3 of Table 5). Declines in heart and circulatory conditions as reported causes of disability accounted for –0.92 percentage points of the disability decline, whereas declines in sensory impairments accounted for –0.57 percentage points. The contribution of mental distress to the disability decline was mainly the result of significant declines in distress as a comorbid condition. Altogether, changes in the prevalence of these seven condition groups as reported causes of disability accounted for a –1.88 percentage point change in disability prevalence. However, increases of 0.89 percentage points due to shifts in comorbid conditions partially offset these gains.

When we reestimated the model with specific chronic conditions, several additional findings emerged (Table 6). (The results in Table 6 also controlled for demographic factors shown in Table 3, as well as cancer, lung problems, and mental distress; these additional conditions were not shown because they were identical to the findings reported in Table 5.) First, despite extraordinarily large contributions of heart and circulatory conditions to the disability decline, heart disease, hypertension, and stroke did not individually make significant contributions to the disability decline. Second, increases in obesity as a cause of disability increased disability, but only by 0.19 percentage points. Third, declines in vision limitations as a cause of disability accounted for declines in disability of –0.59 percentage points, whereas hearing limitations did not decline as a cause of disability.

Because of the high prevalence of arthritis, its importance in previous studies of disability trends (e.g., Freedman and Martin 2000), and the aforementioned change in

Table 5. Decomposition of the Estimated Change in Disability Prevalence From 1997 to 2004 Into Causal and Comorbid Condition Components[a]

	Prevalence of Causal Condition			Contribution of Change in		
Condition Group	1997 (1)	2004 (2)	p+[b]	Causal Component (3)	Comorbid Component (4)	Total Contribution (5)
Cancer	0.74	0.87		0.13	0.10	0.24
Heart and Circulatory Conditions	5.67	4.76	*	–0.92*	–0.38	–1.29*
Lung Conditions	1.15	1.00		–0.15	0.05	–0.10
Mental Distress	0.22	0.12		–0.10	–0.27*	–0.38**
Metabolic Conditions	2.12	1.86		–0.25	0.36	0.11
Musculoskeletal Conditions	4.48	4.45		–0.02	0.22	0.20
Sensory Impairments	2.65	2.08	*	–0.57*	0.81**	0.24
Total				–1.88	0.89	–0.99

[a]The model controls for demographic factors shown in Table 3.

[b]p+ indicates test for the difference between 1997 and 2004; all other tests are for a difference from 0.

*$p < .05$; **$p < .01$

Table 6. Decomposition of the Estimated Change in Disability Prevalence From 1997 to 2004 Into Causal and Comorbid Condition Components[a] for Select Conditions

	Prevalence of Causal Condition			Contribution of Change in		
Condition Group	1997 (1)	2004 (2)	p+[b]	Causal Component (3)	Comorbid Component (4)	Total Contribution (5)
Heart and Circulatory Conditions						
Heart disease	3.14	2.87		–0.26	0.17	–0.09
Hypertension	2.32	2.01		–0.31	–0.06	–0.37
Stroke	1.68	1.47		–0.21	0.06	–0.15
Metabolic Conditions						
Diabetes	2.01	1.70		–0.30	0.36**	0.06
Obesity	0.14	0.33	*	0.19*	–0.29	–0.10
Musculoskeletal Conditions						
Arthritis/joint pain	3.72	3.75		0.04	–0.17	–0.14
Pain in back or neck	1.32	1.51		0.19	0.02	0.21
Sensory Impairments						
Hearing limitation	0.71	0.72		0.02	0.30*	0.32
Vision limitation	2.19	1.60	**	–0.59**	0.67**	0.08

[a]The model controls for demographic factors shown in Table 3, cancer, lung problems, and mental distress.

[b]Indicates test for the difference between 1997 and 2004; all other tests are for a difference from 0.

*$p < .05$ **$p < .01$

question wording, we probed the finding that musculoskeletal conditions and arthritis in particular did not emerge as significant contributors to the decline in disability prevalence. We found in sensitivity analyses (not shown) that if we had treated inconsistent responses in an alternative manner—accepting cases as having arthritis as a cause of disability even if respondents did not report having arthritis/joint pain as a condition—we would have predicted statistically significant declines in this cause from 4.78% in 1997 to 4.02% in 2004 and in musculoskeletal conditions as causes from 5.54% to 4.77%. Consequently, we cannot rule out the possibility that changes in arthritis also may have contributed to recent declines in late-life disability.

DISCUSSION

Consistent with studies of the late 1980s and early 1990s (Crimmins and Saito 2000; Freedman and Martin 2000), the percentage of older Americans living with disability continued to decline from 1997 to 2004 despite increases in reports of many chronic conditions and impairments. Our analysis suggests that declines in heart and circulatory conditions and vision limitations as reported causes of disability played a major role in these recent declines in late-life disability prevalence. Musculoskeletal conditions—notably arthritis—also may have contributed, although we could not definitively estimate its share because of data limitations. We also found that mental distress declined over the period, but this trend does not appear to be causally linked to the disability decline; and we found that obesity shifted disability prevalence upward, albeit by a relatively small amount. At the same time, shifts in the relationship between gender and disability contributed to declines, but on balance, education did not contribute to disability declines for this period because of increases in the disadvantage associated with fewer years of education.

This study is limited in that consistent information on conditions and reported causes of disability has been available in the NHIS only since its redesign in 1997. This relatively short time period may not reflect longer-term trends. Although pre-1997 data limitations precluded our undertaking a decomposition analysis for that earlier period, in other analyses, we explored trends in reported causes of disability for the period up to 1996 and for 1997 forward (not shown). In those other analyses, we found for both periods significant declines in heart and circulatory, musculoskeletal, and vision conditions as causes of disability, suggesting that our findings in this paper for the 1997–2004 period may indeed reflect longer-term trends.

Unlike prior studies, we minimized variation that can result from analyzing endpoints by modifying the traditional decomposition technique to take advantage of information for the intervening years. Although our approach explicitly relied on assumptions of linearity over the period, the same assumption is implicit in the two-year approach. Moreover, our examination of the data suggested that the linear assumption is reasonable in most cases. Had we limited our analysis to only 1997 and 2004, our results would have been different in two potentially important ways (results not shown). We would have exaggerated the effects of being female, and we would have found significant declines in the probability of disability given a stroke (due to what appears to be an outlier in 2004, rather than a continuation of a trend).

Our findings provide important clues to explain the late-life disability decline. In particular, the substantial decline in heart and circulatory conditions as a reported cause of disability points to the possibility that continued expansion of medical and rehabilitative treatments for these conditions contributed to the decline. Indeed, during the study period, continued expansion of pharmacologic treatment of cardiovascular disease has occurred (e.g., beta blockers, ACE inhibitors, anticholesterol agents, and antihypertensive combinations; Moeller, Miller, and Banthin 2004). Surgical procedures—such as stent insertion to hold open narrowed arteries, first introduced in the early 1990s; and balloon angioplasty—have also increased substantially during the study period (National Center for Health Statistics 2003). Older adults' use of inpatient rehabilitation services and receipt of therapy visits under the Medicare home health benefit also increased over this period (Medicare Payment Advisory Committee 2004). Thus far, attempts to link declines in disability to shifts in cardiovascular treatment have provided limited evidence. For example, a recent study using a different data source and different measures (Cutler, Landrum, and Stewart 2006), which found that cardiovascular disease made significant contributions to declines in late-life disability for the period 1984 to 1999,[5] estimated that area-level use of pharmaceutical treatments and related surgical procedures explained some of the decline in disability among those hospitalized for cardiovascular disease. Studies linking declines in disability prevalence to cardiac and stroke rehabilitation have not been undertaken. Given the salience of heart and circulatory conditions to the declines in disability, further investigation of these linkages—including the role of rehabilitation—is warranted.

We also found large declines in vision as a reported cause of disability. The major causes of vision impairment in late life are age-related macular degeneration, glaucoma, cataracts, and diabetic retinopathy (U.S. Department of Health and Human Services 2000). For one of these conditions—cataracts—outpatient surgery more than doubled between 1984 and 1995 (Desai et al. 2001), and this trend has likely continued. Treatments for glaucoma and for glycemic control of diabetes also expanded during the 1990s, although the extent to which these have contributed to vision improvements has not been explored. Older adults also may be more likely in recent years to accommodate vision impairments

5. That study found that among older adults admitted to the hospital with cardiovascular disease in a prior five-year window, disability declined by 1.4 percentage points, or 22% of the 6.3-percentage-point decline in disability over that period.

with visual devices (such as magnifiers) and adaptive devices (such as large-print materials). Although we found that vision problems were less likely to cause disability, they were only slightly less prevalent in 2004 than in 1997; hence, vision impairment remains an important area for future interventions.

Our results also suggest a possible role for musculoskeletal conditions in recent disability trends. Further research is needed to verify this finding and, if confirmed, to sort out the reasons for such a role. Plausible explanations include increasing diagnosis and recognition of other joint-related conditions (e.g., fibromyalgia), recent changes in treatment (e.g., increases in joint replacement and changes in medication use), increased take-up of health behaviors linked to joint health (e.g., physical activity), and the expansion of assistive technologies that facilitate daily activities.

In addition, we found that severe mental distress declined among older adults. By decomposing trends into causal and comorbid components, however, we demonstrated that this trend did not appear to be driving declines in disability. Although increases in treated mental conditions have been documented among older adults (Crystal et al. 2003; Zuvekas 2001), treatment may not be increasing or improving for the most severe cases of mental distress that cause disability. Moreover, with our data, we were unable to determine whether mental distress declined as a consequence of disability declines. Given the highly debilitating influence of mental health conditions on older adults, further investigation of this complex relationship is needed.

The finding that obesity is increasingly reported as a cause of late-life disability is also notable. The increase in obesity among the near-elderly has received much attention (Lakdawalla, Bhattacharya, and Goldman 2003; Ogden et al. 2006), and extrapolations suggest that increases in late-life obesity could influence disability trends (Sturm, Ringel, and Andreyeva 2004). However, no solid evidence currently exists. In the cross section, older adults who are obese report more limitations (see, e.g., Himes 2000), and Freedman and Martin (2000) found that for the population aged 70 and older, increasing trends in obesity from 1984 to 1995 were associated with increasing trends in lower-body limitations, but the latter study did not investigate ADL and IADL disability. To our knowledge, the current analysis is the first to link trends in obesity as a reported cause of disability to trends in late-life disability prevalence. Nevertheless, such reports remain less common than reports of other conditions that cause disability, even as the prevalence of obesity has increased.

Gender emerged as a key demographic factor in explaining disability trends. The disability gap between men and women declined, which continues a trend identified by Crimmins and Saito (2000) for the mid-1980s to the mid-1990s. Why women are experiencing less disability than they were relative to men is not clear. Perhaps the trend reflects a change in factors not measured in our model—for example, women increasingly may live in more supportive environments relative to men, or the socioeconomic gap between men and women in late life may be closing. Further research should probe reasons for the gender differences in declines by stratifying analyses by gender.

Consistent with earlier predictions of the lessening of education's effects on disability prevalence (Freedman and Martin 1999), we found that education did not, on balance, contribute to declines in disability prevalence for this eight-year period. Although a declining percentage of the older population had fewer than 12 years of education, the disadvantage associated with having less than a college education grew, so that overall shifts in education pushed disability rates up over this period. This finding is also consistent with recent studies that point to growing disparities in disability by education (Schoeni et al. 2005). Perhaps, those in the less-advantaged education groups (that is, those with less than a high school diploma) may be increasingly negatively selected on a variety of factors related to late-life disability. Ross and Wu (1995), for example, suggested three types of mechanisms linking education and health, which are easily extended to apply to disability: economic resources, psychosocial resources, and health behaviors. In addition, those with fewer years of education are less likely to use assistive technology to carry out daily activities, although there is no evidence that these gaps have been increasing (Freedman et al. forthcoming).

Finally, our findings provide insights into the continuing debate on the implications of population aging for the compression or expansion of morbidity. At face value, the general pattern of findings, like earlier studies, appears to be consistent with the dynamic equilibrium perspective of Manton (1982). For instance, diabetes, hypertension, and arthritis all appear to be more prevalent and less debilitating. Upon closer examination, however, we found no changes in the probability of an older individual reporting each of these conditions as causing disability. In the case of diabetes, for example, such a finding could be directly the result of changes in definition because the threshold for diabetes was lowered in 1997 from a fasting, plasma-glucose level of 140 mg/dL to 126 mg/dL (Expert Committee on the Diagnosis and Classification of Diabetes Mellitus 1997). Our analysis underscores the critical importance of distinguishing selection effects—caused by identifying more cases, and particularly, less-severe cases—from changes attributable to shifts in the role of conditions in the disablement process. A fruitful area for future work would be to integrate clinical measures of severity into analyses of disease-disability linkages. Until those data are available, however, using information on reported cause of disability to better understand temporal changes in the chronic disease–disability interplay is a useful starting point.

REFERENCES

Bush, T.L., S.R. Miller, A.L. Golden, and W.E. Hale. 1989. "Self-Report and Medical Record Report Agreement of Selected Medical Conditions in the Elderly." *American Journal of Public Health* 79(11):1554–56.

Crimmins, E.M. 2004. "Trends in the Health of the Elderly." *Annual Review of Public Health* 25(1):79–98.

Crimmins, E.M. and Y. Saito. 2000. "Change in the Prevalence of Diseases Among Older Americans: 1984–1994." *Demographic Research* 3(9). Available online at http://www.demographic-research.org/Volumes/Vol3/9/3-9.pdf

Crimmins, E.M., Y. Saito, and S.L. Reynolds. 1997. "Further Evidence on Recent Trends in the Prevalence and Incidence of Disability Among Older Americans From Two Sources: the LSOA and the NHIS." *Journals of Gerontology* 52(2):S59–S71.

Crystal, S., U. Sambamoorthi, J.T. Walkup, and A. Akincigil. 2003. "Diagnosis and Treatment of Depression in the Elderly Medicare Population: Predictors, Disparities, and Trends." *Journal of the American Geriatrics Society* 51(12):1718–28.

Cutler, D.M. 2001. "Declining Disability Among the Elderly." *Health Affairs* 20(6):11–27.

Cutler, D.M., M.B. Landrum, and K. Stewart. 2006. "Intensive Medical Care and Cardiovascular Disease Disability Reductions." NBER Working Paper Series No. 12184. National Bureau of Economic Research, Cambridge, MA.

Das Gupta, P. 1993. "Standardization and Decomposition of Rates: A User's Manual." *Current Population Reports,* Series P-23(186). Washington, DC: U.S. Bureau of the Census.

Desai, M., L.A. Pratt, H. Lentzner, and K.N. Robinson. 2001. "Trends in Vision and Hearing Among Older Americans." *Aging Trends* (2):1–8.

Ettinger, W.H., Jr., L.P. Fried, T. Harris, L. Shemanski, R. Schulz, and J. Robbins. 1994. "Self-Reported Causes of Physical Disability in Older People: The Cardiovascular Health Study. CHS Collaborative Research Group." *Journal of the American Geriatrics Society* 42(10):1035–44.

Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. 1997. "Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus." *Diabetes Care* 20:1183–97.

Ferraro, K.F. and Y. Su. 2000. Physician-Evaluated and Self-Reported Morbidity for Predicting Disability." *American Journal of Public Health* 90(1):103–108.

Feyisetan, B. and J.B. Casterline. 2000. "Fertility Preferences and Contraceptive Change in Developing Countries." *International Family Planning Perspectives* 26(3):100–109.

Firebaugh, G. 1989. “Methods for Estimating Cohort Replacement Effects.” *Sociological Methodology* 19:243–62.

Freedman, V.A., E. Crimmins, R.F. Schoeni, B.C. Spillman, H. Aykan, E. Kramarow, K. Land, J. Lubitz, K. Manton, L.G. Martin, D. Shinberg, and T. Waidmann. 2004. “Resolving Inconsistencies in Trends in Old-Age Disability: Report From a Technical Working Group.” *Demography* 41:417–41.

Freedman, V.A. and L.G. Martin. 1999. “The Role of Education in Explaining and Forecasting Trends in Functional Limitations Among Older Americans.” *Demography* 36:461–73.

———. 2000. “Contribution of Chronic Conditions to Aggregate Changes in Old-Age Functioning.” *American Journal of Public Health* 90(11):1755–60.

Freedman, V.A., L.G. Martin, J.C. Cornman, E.M. Agree, R.F. Schoeni. Forthcoming. “Trends in Assistance With Daily Activities: Racial/Ethnic and Socioeconomic Disparities in the U.S. Older Population Persist,” In *Health In Older Ages: The Causes and Consequences of Declining Disability Among the Elderly,* edited by D. Cutler and D. Wise. Chicago: University of Chicago Press.

Freedman, V.A., L.G. Martin, and R.F. Schoeni. 2002. “Recent Trends in Disability and Functioning Among Older Adults in the United States: A Systematic Review.” *Journal of the American Medical Association* 288(24):3137–46.

Fried, L.P., K. Bandeen-Roche, J.D. Kasper, and J.M. Guralnik. 1999. “Association of Comorbidity With Disability in Older Women: The Women’s Health and Aging Study.” *Journal of Clinical Epidemiology* 52(1):27–37.

He, W., M. Sengupta, V. Velkoff, and K. DeBarros. 2005. “65+ in the United States: 2005.” *Current Population Reports,* Series P23-209. Washington, DC: U.S. Census Bureau.

Himes, C.L. 2000. “Obesity, Disease, and Functional Limitation in Later Life.” *Demography* 37:73–82.

Institute of Medicine. 1991. *Disability in America: Toward a National Agenda for Prevention*. Washington, DC: National Academy Press.

Kessler, R.C., G. Andrews, L.J. Colpe, E. Hiripi, D.K. Mroczek, S.L. Normand, E.E. Walters, and A.M. Zaslavsky. 2002. “Short Screening Scales to Monitor Population Prevalences and Trends in Non-Specific Psychological Distress.” *Psychology and Medicine* 32:959–76.

Kitigawa, E.M. 1955. “Components of a Difference Between Two Rates.” *Journal of the American Statistical Association* 50(272):1168–94.

Lakdawalla, D., J. Bhattacharya, and D. Goldman. 2003. “Are the Young Becoming More Disabled?” *Health Affairs* 23(1):168–76.

Lawrence, R.C., C.G. Helmick, F.C. Arnett, R.A. Deyo, D.T. Felson, E.H. Giannini, S.P. Heyse, R. Hirsch, M.C. Hochberg, G.G. Hunder, M.H. Liang, S.R. Pillemer, V.D. Steen, and F. Wolfe. 1998. “Estimates of the Prevalence of Arthritis and Selected Musculoskeletal Disorders in the United States.” *Arthritis & Rheumatism* 41:778–99.

Manton, K.G. 1982. “Changing Concepts of Morbidity and Mortality in the Elderly Population.” *Milbank Memorial Fund Quarterly* 60:183–244.

Manton, K.G. and X. Gu. 2001. “Changes in the Prevalence of Chronic Disability in the United States Black and Nonblack Population Above Age 65 From 1982 to 1999.” *Proceedings of the National Academy of Sciences* 98(11):6354–59.

Manton, K.G., X. Gu, and V.L. Lamb. 2006. “Change in Chronic Disability from 1982 to 2004–2005 as Measured by Long-Term Changes in Function and Health in the U.S. Elderly Population.” *Proceedings of the National Academy of Sciences* 103(48):18374–79. Available online at http://www.pnas.org/cgi/doi/10.1073/pnas.0608483103

Medicare Payment Advisory Committee. 2004. *Healthcare Spending and the Medicare Program: A Data Book*. Washington, DC: MEDPAC.

Moeller, J.F., G.E. Miller, and J.S. Banthin. 2004. “Looking Inside the Nation’s Medicine Cabinet: Trends in Outpatient Drug Spending by Medicare Beneficiaries, 1997 and 2001.” *Health Affairs* 23(5):217–25.

National Center for Health Statistics. 2003. "Health Care in America: Trends in Utilization." Hyattsville, MD: National Center for Health Statistics.

Neumann, P.J., S.S. Araki, and E.M. Gutterman. 2000. "The Use of Proxy Respondents in Studies of Older Adults: Lesson, Challenges, and Opportunities." *Journal of the American Geriatric Society* 48:1646–54.

Ogden, C.L., M.D. Carroll, L.R. Curtin, M.A. McDowell, C.J. Tabak, and K.M. Flegal. 2006. "Prevalence of Overweight and Obesity in the United States, 1999–2004." *Journal of the American Medical Association* 295:1549–52.

Retherford, R.D. and J.R. Rele. 1989. "A Decomposition of Recent Fertility Changes in South Asia." *Population and Development Review* 15:739–47.

Ross, C.E. and C. Wu. 1995. "The Links Between Education and Health." *American Sociological Review* 60:719–45.

Schoeni, R.F., L.G. Martin, P. Andreski, and V.A. Freedman. 2005. "Growing Disparities in Trends in Old-Age Disability 1982–2001." *American Journal of Public Health* 95(11):2065–70.

Simpson, C.F., C.M. Boyd, M.C. Carlson, M.E. Griswold, J.M. Guralnik, and L.P. Fried. 2004. "Agreement Between Self-Report of Disease Diagnoses and Medical Record Validation in Disabled Older Women: Factors That Modify Agreement." *Journal of the American Geriatrics Society* 52(1):123–27.

Skinner, K.M., D.R. Miller, E. Lincoln, A. Lee, and L.E. Kazis. 2005. "Concordance Between Respondent Self-Reports and Medical Records for Chronic Conditions: Experience From the Veterans Health Study." *Journal of Ambulatory Care Management* 28(2):102–10.

Smith, H.L., S.P. Morgan, and T. Koropeckyj-Cox. 1996. "A Decomposition of Trends in the Nonmarital Fertility Ratios of Blacks and Whites in the United States, 1960–1992." *Demography* 33:141–51.

Spillman, B.C. 2004. "Changes in Elderly Disability Rates and the Implications for Health Care Utilization and Cost." *The Milbank Quarterly* 82:157–94.

Sturm, R., J.S. Ringel, and T. Andreyeva. 2004. "Increasing Obesity Rates and Disability Trends." *Health Affairs* 23(2):199–205.

U.S. Department of Health and Human Services. 2000. *Healthy People 2010, Understanding and Improving Health,* Vol. II, 2nd ed. Washington, DC: U.S. Government Printing Office.

Verbrugge, L.M., J.M. Lepkowski, and Y. Imanaka. 1989. "Comorbidity and Its Impact on Disability." *Milbank Memorial Fund Quarterly* 67(3–4):450–84.

Wolf, D.A., K. Hunt, and J. Knickman. 2005. "Perspectives on the Recent Decline in Disability at Older Ages." *The Milbank Quarterly* 83:365–95.

World Health Organization (WHO). 2002. "Towards a Common Language for Functioning, Disability, and Health: ICF." Geneva: WHO. Available online at http://www.designfor21st.org/documents/who_icf_2002.pdf

Zuvekas, S.H. 2001. "Trends in Mental Health Services Use and Spending, 1987–1996." *Health Affairs* 20(2):214–24.