Changes in the prevalence of chronic disability in the United States black and nonblack population above age 65 from 1982 to 1999

Kenneth G. Manton* and XiLiang Gu

Center for Demographic Studies, Duke University, Durham, NC 27708

Survey evidence through the early 1990s generally suggests a reduction in disability in the elderly population of the United States. Because the evidence is not fully consistent, several authors have speculated about whether disability declines will continue. This paper reports results from the 1999 National Long-Term Care Survey on disability trends from 1982 through 1999. It is found that disability continued to decline in the 1994 to 1999 period, and that the decline was greater in the 1990s than in the 1980s. The disability decline from 1982 to 1989 was 0.26% per year, from 1989 to 1994 it was 0.38% per year, and from 1994 to 1999 it was 0.56% per year. In addition, disability declined by a greater percentage for blacks than for nonblacks over the 1989 to 1999 period.

Declines in chronic disability over time can have major implications for fiscal stability of Medicare and Social Security programs. Documented chronic disability declines among the U.S. elderly population between 1982 and 1994 led to projections about the positive consequences of continued and even accelerating declines. The purpose of this paper is to use the recently available data from the 1999 round of the National Long-Term Care Survey (NLTCS) to assess whether acceleration in the decline in chronic disability actually occurred. In addition, we assess whether the increase in chronic disability among elderly black Americans observed between 1982 and 1989 has continued, or possibly whether there has, more recently, been a decline in chronic disability within this group as well.

Chronic disability prevalence in the U.S. population aged 65+ declined in the 1982 to 1989 NLTCSs (1). Those declines were scrutinized by a National Academy of Sciences (NAS) panel. That panel concluded that the declines in chronic (i.e., more than 90 days) disability were real but that the 1994 NLTCS would be needed to (*i*) validate evidence of the decline, (*ii*) determine the velocity of the decline, and (*iii*) determine the demographic (i.e., age, gender, race) and disability composition of the decline (2).

The 1994 NLTCS confirmed that the 1982 to 1989 declines in chronic disability continued to 1994 (3). The 1994 NLTCS also showed declines were larger for persons age 85+ and for both serious [i.e., activities of daily living; ADLs (4)] and less serious [i.e., instrumental activities of daily living; IADLs (5)] impairments. Whereas the relative rate of decline 1982 to 1994 was 1.3%, that decline accelerated from 1982 to 1989 (1.0%) to 1989 to 1994 [1.5%; standardized to the 1994 U.S. age distribution (3)].

In addition, a number of other national surveys provided evidence of a disability decline in the elderly U.S. population. Freedman and Martin confirmed the disability decline in the 1984 to 1993 Survey of Income and Program Participation (6). The estimate of the decline (adjusted for population composition) in chronic disability from that survey (from 0.9% to 2.3% per annum for each of four functions) was larger than observed (1.3%) in the 1982 to 1994 NLTCS. As in the NLTCS, rates of decline were most rapid at ages 85+. Other researchers have found a 0.7% per annum decrease in chronic disability (from 21.1% to 19.5%) in the 1982–1993 National Health Interview Survey (NHIS) (7, 8). Waidmann found evidence of the decline of chronic disability in a variety of data sources, including the

NHIS, after correcting for problems in sample design and instrument content (9). Waidmann and Liu (10) found evidence of a decline in disability for persons aged 65+ in the 1993 to 1996 Medicare Current Beneficiary Survey. Freedman and Martin (11) also found evidence of a decline in chronic disability in the 1984 and 1994–1995 Supplements on Aging to the NHIS.

Fogel and Costa, in several studies (12, 13), found long-term declines in chronic morbidity in male Union Civil War veterans aged 65+ (birth cohorts of 1825 to 1844). They compared morbidity recorded during a physician-conducted medical examination in 1910 (required to qualify for a federal pension) with medical conditions reported by male World War II veterans aged 65+ in the 1985 to 1988 NHIS. The 0.6% annual rate of decline in chronic morbidity found by Fogel [which persisted over 75 years (12)] was replicated by Costa for disability (14). Costa found a decline in disability (loss of mobility functions) as reported by the Civil War veterans in 1910 compared with males in the 1990 to 1994 National Health and Nutrition Examination Surveys.

The declines in morbidity and disability observed by Fogel and Costa were attributed to improvements in nutrition and to an increased ability to resist bacterial diseases (12) and possible chronic disease (organ failure) sequelae of those diseases (15–19). A nutritional hypothesis was also promulgated by Perutz (20), who found that British cohorts born after 1840 had a higher rate of survival to ages 100+ than in earlier cohorts. An alternative explanation of these trends is that the improved nutrition of mothers in the U.S. from 1825 to 1844 affected the intrauterine environment in ways that changed diabetes, stroke, and heart disease risks at late ages (21, 22). The fetal environment might also affect cancer risks in adults (23). It may even affect the risk of organic brain syndromes (Zeng Yi, personal communication).

The evidence led Fogel and Costa to posit a model of "techno-physiological" evolution (13). This model argues that improvements in health are too rapid to be caused by evolutionary (genetic) changes. Rather, health changes must be caused by the evolution of the technological environment of the individual—especially in the technologies preserving health. This theory suggests that investment in health care technology and nutrition could preserve human capital in the U.S. economy by allowing workers to continue being productive at increasing ages (24).

The primary question addressed by the new 1999 NLTCS is whether the decline in chronic disability accelerated as suggested by social and economic correlates of the earlier disability declines (25). Singer and Manton (26) found that a continuation of the observed 1.5% relative decline (1989–1994) in disability could preserve, in the long term (to 2070), the fiscal stability of

Medicare and Social Security Programs. These calculations support the tenets of the theory of techno-physiological evolution (13). An acceleration of the decline would be expected from the projected increase of the level of education (years of schooling) in the very elderly U.S. population. Preston (27) projected that the prevalence of persons with 8 years or less of education at ages 85 to 89 would decline from 65% in 1980 to 15% in 2015. Manton and Corder (25) found that the rate of chronic disability decline could be 2.2%, based on the relation of years of school to disability level in the elderly population. Below, we will determine whether the decline in chronic disability accelerated from 1994 to 1999 compared with 1989 to 1994, as well as whether the composition of the distribution of disability changed. We will examine whether the trajectory of change in disability differed for blacks and nonblacks 1982 to 1999. The analysis of black/nonblack differences in the rate of change of disability 1994 to 1999 is of interest in that the 1982 to 1989 NLTCS showed a significant *increase* in chronic disability for elderly black Americans (D. Clark and F. Wolinsky, personal communication; refs. 28 and 29).

Data

The data examined are age-, sex-, and race-specific estimates of the number of persons with chronic disability from the 1982, 1984, 1989, 1994, and 1999 NLTCS. Chronic disability rates were calculated by using as denominators estimates of the size of the population aged 65+ at risk made from sample-weighted counts of persons in each cell. Sample weights were calculated as the inverse of the probability of sample selection. Thus our population estimates, before any poststratification, are based on internally consistent estimates derived only from information in sample responses and the sample design (i.e., the pattern of the probabilities of selection, and their inverses, provide the sample weights to calculate population frequencies; see Census Bureau Source and Accuracy Statement for 1999 NLTCS http://www.cds.duke.edu). This procedure was important for estimating changes in the U.S. institutional population.

Other estimates of changes were made by examining the use of nursing home beds by elderly persons in the 1985 to 1995 National Nursing Home Surveys (NNHS). In the NNHS, reductions in nursing home use occurred for all age groups above 65. They were largest for persons older than 85. For the first time (1995) in the NNHS's history black elderly nursing home use rates (4.52%) were higher than for nonblacks (4.23%). Bishop (30) estimated that rates declined 8.2%. Strahan (31) estimated that use declined 10.8%. In the 1985 and 1995 NNHS there was a large decline in the number of nursing homes (from 19,100 to 16,700) and in their occupancy rate (from 91.8% to 87.4%). Changes were also observed in the size and composition of the nursing home population by using the 1987 to 1996 Medical Expenditures Surveys (MEPS). While the 1985 and 1995 NNHS showed the number of nursing homes declined by 2,400, there was an *increase* in the MEPS of 2,790 institutions (i.e., from 14,050 in 1987 to 16,840 in 1996). This discrepancy occurred even though the NNHS used a *broader* definition of nursing home residence than MEPS, which would increase the estimated number of nursing homes. In MEPS the occupancy rate fell (92.3% in 1987 to 88.8% in 1996). These findings suggest problems in using institutional sample designs based on facility lists. In the NLTCS this problem did not occur because our sampling unit is the individual, and not the facility, so we can use Medicare administrative lists to generate our sample rather than rely on a facility list verification procedure (32). In the NLTCS, we identify, using a person-based list sample, *persons* in facilities by using nursing home beds.

All five NLTCS samples were drawn from Medicare administrative records. This list sample frame maintained near-perfect follow-up of persons across survey years (eliminating bias from loss to follow-up). The sample design for the 1982 NLTCS was drawn,

using reduction sets of 5,000 persons, from 55,000 names drawn from Medicare lists (see Census Bureau Source and Accuracy Statement for 1982–1984 NLTCS located at http://www.cds.duke.edu/RESOURCE.HTML). A reduction set was the predefined number of cases screened until a sufficient number of sets had been processed to identify 6,000 chronically disabled persons to receive detailed community interviews (the number budgeted for). This process required interviewing seven reduction sets—35,000 persons. The reduction set strategy was used because the prevalence of chronic disability in the U.S. elderly community population in 1982 had not been previously estimated. In the 1982 NLTCS persons were only identified as residents in institutions. That is, although the institutional sample component was identified on the 1982 screen, persons were not given detailed interviews. Institutionalized persons did not receive a detailed interview until 1984. After 1982 a sample of roughly 5,000 persons aged 65 to 69 was drawn from Medicare lists to replenish the sample so it would represent the entire U.S. population aged 65+. In each survey year all persons who received a detailed community or (after 1982) institutional interview in a prior survey were given a detailed interview after receiving a shortened screener.

In 1994 and 1999 NLTCS samples were supplemented three ways. First, an over-sample of persons age 95+ was drawn in 1994 (*n* = 540) and 1999 (*n* = 600) to improve the precision of estimates for this extreme elderly population. Second, to improve estimates made of the traits of nondisabled persons the sample receiving a detailed community interview was augmented in 1994 by 1,762 persons designated to receive a community interview even though they would not otherwise have received one based on their screen interview (sample component H). In 1999, 1,262 of these persons ("healthy" in 1994) continued and were given a detailed interview in the institution or community. In addition a sample of 283 healthy (the H sample in 1999) persons was drawn from persons not reporting disability in 1994 to replenish the 1994 healthy sample supplement for mortality 1994 to 1999. The H samples in 1994 and 1999 are designed to improve estimates for nondisabled persons—e.g., improve the precision of estimates of the prevalence of chronic conditions in the nondisabled population.

In each survey year the sample averaged roughly 19,000 cases—a total of 42,000 distinct individuals in all 5 years. In these 5 years, 26,735 detailed community interviews were conducted, along with interviews of more than 7,000 persons in institutions. About 90,000 screens were conducted. The exact age at death of over 22,000 persons was determined for those who died (based on Medicare records) between 1982 and 1999. Another important feature of the NLTCS is its high response rates. The detailed interview response rate in 1999 was the highest yet—97.6%. This high rate has important implications for adjustments made to the survey for poststratification weighting. The smaller the nonresponse rate the less likely bias is to be introduced by poststratification weighting. An area of potential concern is that certain groups, such as blacks, may have higher nonresponse rates. If they have different true disability rates this could lead to bias. The detailed interview response rates for blacks is high (96.7%), which, with the small proportion of the total sample they represent, suggests any bias is small.

The longitudinal sample of persons was linked to a continuous history of Medicare service use from 1982 to 2000 derived from administrative files. These data have become more detailed over time as Medicare file systems were improved (especially in 1990), information on health care services expanded, and the types of Medicare services provided changed. Survey records were, for the first time, linked to the "Denominator" file to identify elderly persons served in Tax Equity and Fiscal Responsibility (TEFRA) risk contracts—i.e., in health maintenance organizations (capitated plans) reimbursed by Medicare a fixed amount per person [using the adjusted average per capita cost (33)] rather than being reimbursed for specific services used by each enrollee.

Table 1. Population distribution (age-standardized to 1999 over-65 population) of disabilities and housing 1982 to 1999

	1982	1984	1989	1994	1999
Distribution by disability, %					
Nondisabled	73.8	73.8	75.6	77.5	80.3
IADL only	5.7	6.2	4.8	4.4	3.2
1 or 2 ADLs	6.9	7.0	6.7	6.1	6.0
3 or 4 ADLs	3.0	3.1	3.7	3.4	3.5
5 or 6 ADLs	3.7	3.4	3.0	3.0	2.9
Institutional	6.8	6.6	6.1	5.7	4.2
Distribution by housing, %					
Housing units	91.9	92.2	93.1	93.3	92.6
Assisted-living community*	0.0	0.0	0.0	0.0	2.3
Nursing home	6.2†	5.9	5.8	5.4	3.4
Others	2.0	1.9	1.1	1.3	1.8
Total disabled, %	26.2	26.2	24.4	22.5	19.7
Year			82–89	89–94	94–99
Standardized decline rate, % per year			0.26	0.38	0.56

*Over 50% report no disability.

†Estimated by 1984 nursing home ratio (only community interviews were conducted in 1982).

An important feature of the survey is that the instrument content on chronic disability was preserved over all waves of the NLTCS. Disability was assessed by using measures of chronic (more than 90 days) disability based on ADLs (4) and IADLs (5). The definition of institutional status was maintained with only a small change made in 1989, and an additional type of residence (i.e., assisted living) was added in 1999.

Results

In Table 1 we present chronic disability prevalence rates for each NLTCS. Rates were standardized to the 1999 U.S. age distribution. They are slightly different from rates in Manton *et al.* (3), which were standardized to the 1994 population.

The prevalence of chronic disability declined 6.5%—26.2% to 19.7%—from 1982 to 1999. This is a relative decline of 25% over 17 years. On a per annum basis the rate of decline in prevalence accelerated from 0.26% 1982 to 1989, to 0.38% 1989 to 1994, to 0.56% 1994 to 1999. The relative rate of disability decline increased from 1.0% 1982 to 1989, to 1.6% 1989 to 1994, to 2.6% 1994 to 1999. The 0.56% per annum decline 1994 to 1999 is consistent with the 0.6% historical annual rate of decline in chronic disability from 1910 to 1985 of ref. 14. The decline of 0.6% per annum is not surprising, given the high level of disability in 1910. It is surprising, given the low level of disability in 1994 (i.e., 22.5%), that the rate of improvement (i.e., the velocity of the decline of chronic disability) accelerated 1994 to 1999 (reaching 19.7%).

Standard errors of estimates were adjusted for design effects. We used the generalized variance function (GVF) methods developed by the U.S. Census Bureau for the 1999 NLTCS (34). These methods have been used in a number of other survey analyses. They, in essence, involve regressing the sizes of populations with a given trait on the variance estimated for that population size. The variance used in the regression function is adjusted for sample design effects (35). Specifically, the standard error of an estimated total Y is predicted as

$$\text{SE}(Y) = (\beta_0 Y^2 + \beta_1 Y)^{1/2}.$$

The SE(Y) is the predicted standard error based on the regression estimates β_0 and β_1. The standard error for a proportion p is

$$S_{(x,p)} = \sqrt{p(1.0 - p) \cdot \beta_1 / x},$$

where β_1 is the regression estimate, x is the weighted population (i.e., sum of sample weights), and p is the proportion for which a standard error, $S_{(x,p)}$ is desired. Estimates of the standard error of a difference in two proportions using the GVF are

$$S_{(x-y)} = \sqrt{S_x^2 + S_y^2 - 2\rho S_x S_y},$$

where ρ is the correlation of the proportions. If ρ is not generally available it can be conservatively assumed to equal zero (36).

Changes in chronic disability prevalence 1982 to 1999 were significant at the 0.05 level or better. The t statistic for the decline in disability was 15.2, which was significantly different from a hypotheses of no change beyond the 0.001 level. t statistics were calculated in several ways (e.g., by using GVF). The sample design effects did not vary enough over individuals to significantly alter the t-statistic computations. When levels of disability are examined, only the prevalence of persons with 3 or 4 ADLs impaired increased 1982 to 1999. All other disability levels decreased significantly. There were large declines 1982 to 1999 of 38.2% (from 6.8% to 4.2%) for persons in institutions and 43.9% (from 5.7% to 3.2%) for persons with IADL impairments. What may underlie these changes is that the proportion of the population with chronic impairments that best respond to instrumentalities (e.g., changes in the built environment—IADL-only impairments and persons in institutions) declined most rapidly.

To interpret these changes we observe that a number of chronic degenerative diseases had a slower rate of progression, or a lower rate of occurrence, 1982 to 1999. Severe dementia, a condition generating significant chronic impairment, declined 33.3% [from 5.7% (age adjusted) in 1982 to 3.8% in 1994 (37)]. If this decline continued to 1999 (a hypothesis to be tested) the prevalence of severe dementia in 1999 would be 2.8%—or a million fewer than expected from the 1982 rates. This would be a reduction of 200,000 persons from what would have occurred if prevalence had remained at 3.4% in 1999 (i.e., 1.2 million persons with severe dementia). Other chronically disabling diseases such as stroke and certain types of heart disease also showed large declines (38). Declines in these conditions suggest declines in nursing home use.

The implications of this decline for the size of the chronically disabled U.S. elderly population in 1982, 1984, 1989, 1994, and 1999 are in Table 2.

The chronically disabled population age 65+, after age standardization, was 7.1 million in 1982. It would have been 9.3 million (+2.3 million; +32.4%) in 1999 if the 1982 age- and disability-specific rates had not declined. The observed number of chronically disabled persons in 1999 was 7.0 million—2.3 million persons less than would have occurred if rates had not changed 1982 to 1999. The size of the disabled elderly population decreased absolutely, from 7.5 million in 1994, to 7.0 million in 1999. The decline of 6.7% in the number of disabled persons 1994 to 1999 can be compared with an increase of 5.5% (+0.39 million) in the number of disabled persons from 1982 to 1994 despite the decline in disability prevalence. There was a large absolute decline (415,000 persons) in the institutional population 1994 to 1999. The NNHS suggested that the institutional population would increase from 1985 to 1995 (33). A decline in nursing home use, after age standardization, both absolutely (22.0%) and relatively (26.3%) was not anticipated. Major new types of institutional residence (i.e., assisted living) emerged.

An important dimension of the chronic disability decline changes among black Americans 1982 to 1999 in Table 3.

There are sizable *increases* in chronic disability prevalence for black Americans 1982 to 1989 (see ref. 29). Chronic disability prevalence *increased* 0.21% per year for black Americans although, because of small samples, the standard error of the increase is large. From 1989 to 1994 disability declined 0.96% per year – with a larger decline of 1.2% in 1994 to 1999. The 1989 to 1994 declines are highly significant. Thus, examination of disability declines from 1982 to

Table 2. Population disability distribution (age-standardized to 1999; prevalence in 1,000s)

	1982	1989	1994	1999
Nondisabled	19,870	23,333	25,677	28,329
% (SE)	73.8 (±0.31)	75.6 (±0.34)	77.5 (±0.32)	80.3 (±0.30)
IADL only	1,539	1,495	1,463	1,130
% (SE)	5.7 (±0.17)	4.8 (±0.17)	4.4 (±0.16)	3.2 (±0.13)
1 or 2 ADLs	1,852	2,077	2,020	2,114
% (SE)	6.9 (±0.18)	6.7 (±0.20)	6.1 (±0.18)	6.0 (±0.18)
3 or 4 ADLs	818	1,155	1,109	1,230
% (SE)	3.0 (±0.12)	3.7 (±0.15)	3.4 (±0.14)	3.5 (±0.14)
5 or 6 ADLs	1,006	915	977	1,009
% (SE)	3.7 (±0.14)	3.0 (±0.13)	3.0 (±0.13)	2.9 (±0.13)
Institutional	1,841	1,896	1,884	1,469
% (SE)	6.8 (±0.18)	6.1 (±0.19)	5.7 (±0.18)	4.2 (±0.15)
Total	26,927	30,874	33,130	35,281
Year		82–89	89–94	94–99
Percent population increase per year between surveys		2.0	1.4	1.3

1994 shows a significant overall decrease in disability because of the improvement of 4.7% from 1989 to 1994. From 1994 to 1999 the estimated decline (5.9%) in disability prevalence was even larger for black Americans than for 1989 to 1994. Declines 1994 to 1999 in chronic disability are likely larger for black than for nonblack Americans, although estimates for blacks have poor precision. Additional factors of concern in interpreting the estimates for blacks is a somewhat lower response rate for blacks and the effects of positive undercounts of blacks in the 1990 Census used to project the 1999 black population estimates.

Despite the faster improvement for black Americans 1989 to 1999, there remains a diminished, but significant, deficit (5.0%) for elderly blacks, i.e., they still have a higher prevalence of disability. In contrast to the 1985–1995 NNHS, blacks in the NLTCS do not have a higher rate of use of nursing homes than nonblacks. Nonblack use of nursing homes declined faster than for blacks.

Temporal trends of education (years of schooling) are in Table 4.

There is a large increase in the number of years of schooling completed by blacks and nonblacks. The proportion with 8 years or less of schooling declined 34.6% for blacks and 27.5% for non-blacks. Thus there is a larger absolute decline in the less educated proportion of the U.S. elderly black, vs. nonblack, population.

The proportion of blacks versus nonblacks with no more than 8 years of schooling increased from 1982 to 1989 (i.e., from 28.9% to 30.8%). From 1989 to 1994 the average education level for blacks improved relative to nonblacks (i.e., from a 30.8% difference in 0 to 8 years of schooling for 1989 to 28.4% for 1994). The relative improvement was faster 1994 to 1999 (i.e., a difference of 28.4% in 1994 declining to 21.8% in 1999).

The educational level reflecting the most improvement was the proportion of blacks with 9 to 12 years of schooling. The deficit decreased from 18.1% in 1989 to 1.8% in 1999. The large differential in the proportion of blacks with less than 8 years of schooling suggests that there is room for further improvement attributable to potential increases in education for blacks.

Black and nonblack disability trends are presented for ages 65–74, 75–84, and 85+ in Table 5.

At ages 65–74, declines in the proportion disabled for blacks show larger declines than for nonblacks. There was more improvement in blacks' disability rates for up to 12 years of education than for nonblacks.

Discussion

Three major findings are (*i*) an acceleration of the decline in chronic disability prevalence from 1994 to 1999 compared with 1989 to 1994, (*ii*) the large relative *and* absolute drop in institutional use, and (*iii*) disability decline for black Americans after 1989.

The rapid decline in chronic disability prevalence is significant for several reasons. First, Singer and Manton (26) showed that a relative rate of improvement of 1.5% per annum in chronic disability could ensure the long-term fiscal solvency of the Medicare and Social Security programs. The Social Security Trustees showed the marginal tax rate increase necessary to maintain Medicare solvency declined to 1.21% (from 1.46% in 1998 (39, 40) and that, for the first time, there was an *actual* (not discounted by inflation) decrease of $2 billion in Medicare spending 1998 to 1999. Income exceeded spending by $21 billion (amended Trustee's Report, April 20, 2000). This estimate of the reduction was too small. The reduction in 1999 was actually $5.1 billion (a 4% decrease) which, with the Supplemental Medical Insurance (SMI; part B) deficit of $1.4 billion, led to a total Medicare savings (Health Insurance and SMI) of $3.7 billion—as reported in the amended Trustees report. A problem in calculating the status of Medicare was caused by a computer programming error that understated the expected rate of interest on Trust fund monies made by the Health Care Financing Administration actuaries of $2.1 billion in 2000. This grows to a $20 billion per annum error after 2015 and a $175 billion cumulative error in 2022. This error represents a shift of 2 years in the date by which Medicare is projected to be insolvent (i.e., in 2026 rather than 2024). This projection does not take into account the effects of reduced disability prevalence discussed above.

The 1999 NLTCS showed that the relative rate of improvement 1994 to 1999 was 2.6%—faster than the 1.5% per annum decrease suggested necessary to preserve Medicare solvency to 2070 (26). If one took the average decline over the 17 years of the NLTCS (standardized to the 1999 U.S. population aged 65+) the relative rate of decline would be 1.7% per annum—more than the 1.5% required to preserve Medicare solvency. The relative decline in nursing home use was larger (3.5% per annum). This finding is important because per annum nursing home costs are much larger than costs for persons not using nursing homes (41). A conservative estimate is that a nursing home stay cost $47,200 per year in 1999. The reduction of nursing home stays by 400,000 between what would have been the use in 1999 calculated from 1994 rates and the observed rates translates into savings of $18.9 billion.

In the NLTCS black disability rates first increased (1982 to 1989) and then decreased (faster than for nonblacks) 1989 to 1999. The source of these changes is likely complex. The analysis showed an interesting association in the relative trajectory of black/nonblack disability and education. The trajectory of education can also be

Table 3. Population disability distribution (age-standardized to 1999) from 1982 to 1999 NLTCS

	1982				1989				1994				1999			
	Blacks	Nonblacks	Difference	t	Blacks	Nonblacks	Difference	t	Blacks	Nonblacks	Difference	t	Blacks	Nonblacks	Difference	t
Nondisabled, %	66.6	74.4	7.8	6.3	65.1	76.3	11.2	7.8	69.8	78.2	8.4	6.0	75.7	80.7	5.0	3.9
(SE)	(±1.20)	(±0.32)	(±1.24)		(±1.39)	(±0.35)	(±1.43)		(±1.37)	(±0.33)	(±1.41)		(±1.24)	(±0.31)	(±1.28)	
IADL only, %	9.0	5.5	−3.5	−4.7	8.6	4.6	−3.0	−3.6	6.7	4.2	−2.5	−3.2	5.4	3.0	−1.4	−2.1
(SE)	(±0.73)	(±0.17)	(±0.75)		(±0.82)	(±0.17)	(±0.83)		(±0.75)	(±0.16)	(±0.77)		(±0.65)	(±0.13)	(±0.66)	
1 or 2 ADLs, %	9.1	6.7	−2.4	−3.2	9.6	6.5	−3.1	−3.5	7.8	5.9	−1.9	−2.3	6.5	5.9	−0.6	−0.8
(SE)	(±0.73)	(±0.19)	(±0.75)		(±0.86)	(±0.20)	(±0.88)		(±0.80)	(±0.19)	(±0.82)		(±0.72)	(±0.18)	(±0.74)	
3 or 4 ADLs	4.6	2.9	−1.7	−3.1	5.9	3.6	−2.3	−3.2	6.1	3.1	−3.0	−4.2	4.1	3.4	−0.7	−1.2
(SE)	(±0.53)	(±0.12)	(±0.54)		(±0.69)	(±0.15)	(±0.71)		(±0.71)	(±0.14)	(±0.72)		(±0.57)	(±0.14)	(±0.58)	
5 or 6 ADLs	6.4	3.5	−2.9	−4.5	6.2	2.7	−3.5	−4.9	5.1	2.8	−2.3	−3.5	4.7	2.7	−2.0	−1.7
(SE)	(±0.62)	(±0.14)	(±0.64)		(±0.71)	(±0.13)	(±0.72)		(±0.65)	(±0.13)	(±0.66)		(±0.61)	(±0.13)	(±0.62)	
Institutional, %	4.3	7.1	2.8	5.2	4.7	6.3	1.6	2.5	4.5	5.8	1.3	2.0	3.6	4.2	0.6	1.1
(SE)	(±0.51)	(±0.19)	(±0.54)		(±0.62)	(±0.20)	(±0.65)		(±0.62)	(±0.19)	(±0.65)		(±0.54)	(±0.16)	(±0.56)	
Year					82–89				89–94				94–99			
Percent decline in disabled population per year	−0.21				0.27				0.38				0.51			

		Grade 0–8	Grade 9–12	College
1982	Black	75.9	18.9	5.3
	Nonblack	47.0	39.5	13.7
	Difference	28.9	−20.6	−8.4
1989	Black	67.5	27.3	5.2
	Nonblack	36.7	45.4	18.0
	Difference	30.8	−18.1	−12.8
1994	Black	54.6	37.1	8.3
	Nonblack	26.2	48.7	25.1
	Difference	28.4	−11.6	−16.8
1999	Black	41.3	46.4	12.3
	Nonblack	19.5	48.2	32.3
	Difference	21.8	−1.8	−20.0
1982–1999 changes	Black	−34.6	27.5	7.0
	Nonblack	−27.5	8.7	18.6

compared with Medicare use. Medicare was in place by 1967. By 1969 the first declines in cardiovascular disease mortality were noted (after static, or increased, mortality 1954 to 1968). Initially, black and white utilization of Medicare appeared (up to 1990) to become more equal with time (42). However, much of the increase in care used by blacks was for hospitalization for "end state" and emergency services. It is only since 1990 that the detailed black/nonblack differentials in Medicare use could be examined because detailed diagnostic and service-specific measures were first recorded in Medicare files in 1990. Analysis of data after 1990 suggests that while per capita use of Medicare increased for blacks, whites (assessed 1990 to 1996) still received more care from specialists and used more high-tech services producing better overall health (42).

Second, the prevalence of institutional residence declined absolutely 1982 to 1999 despite a more than 30% increase in the U.S. population aged 65+. This decline is consistent with analyses of the 1985 and 1995 NNHS (30). Bishop found that the largest consumer of institutional (nursing home) care, persons aged 85+, reduced use of institutions from 219.4 visits per 1,000 to 198.6 visits per 1000—9.5%. If 1985 nursing home use rates (specific to age and sex) are applied to the 1995 population, there would be 250,000 more persons (+12.5%) in institutions than observed in 1995. In that data nursing home use rates reversed themselves for both blacks and nonblacks aged 85+. Nonblack use of nursing homes, 228.7/1000 in 1985, dropped to 200.7/1000 in 1995—12.2%. Black

Table 5. Distribution (%) in age- and education-specific estimates of disability for U.S. elderly blacks and nonblacks

	Black				Nonblack			
Education	1982	1994	1999	Δ82–99	1982	1994	1999	Δ82–99
Age 65–74								
Grade 0–8	22.4	19.7	15.5	−6.9	16.4	15.5	16.1	−0.3
Grade 9–12	33.2	21.6	12.4	−20.8	10.5	10.3	9.0	−1.5
Grade 13+	14.3	31.7*	10.8	−3.5	13.4	8.0	6.7	−6.7
Age 75–84								
Grade 0–8	38.9	38.2	36.2	−2.7	35.8	30.8	30.2	−5.6
Grade 9–12	53.2*	31.0	24.0	−29.0	20.5	23.9	23.3	+2.8
Grade 13+	30.8	25.2	26.1	−4.9	31.3	22.1	18.1	−13.2
Age 85+								
Grade 0–8	81.6	68.1	65.7	−15.9	69.2	57.2	56.6	−12.6
Grade 9–12	33.4*	65.1	48.5	15.1	48.0	61.1	55.8	+7.8
Grade 13+	100.0*	59.4	25.6	−74.4	60.1	57.5	47.2	−12.9

*Small sample size.

rates of nursing home use in the NNHS increased from 141.5/1000 in 1985 to 167.1/1000 in 1995—+18.1%. The difference in nursing home use between blacks and nonblacks at age 85+ declined from 8.7% to 3.4%. In the 1994 to 1999 NLTCS, however, there is a large drop in the black institutional population, consistent with the probable effects of the Balanced Budget Act of 1997 on Medicare and Medicaid reimbursed institution use (43).

Bishop postulated five reasons for the pattern of use observed in 1985 to 1995 NNHS: (*i*) disability prevalence declines, (*ii*) service of only high-need elders, (*iii*) limited bed capacity keeping elders out of homes, (*iv*) more use of home health care, and (*v*) the use of different (and novel) types of residential services (30). The NLTCS indicates there were large declines in disability for blacks and nonblacks. Part of this decline is attributable to a reduction, for both blacks and nonblacks, of nursing home use. Bishop found a decline in nursing home use rates [8.2% from 1985 to 1995; compare to the 10.8% decline found by Strahan (31)—both Bishop and Strahan used the 1995 NNHS] and declines in bed occupancy rates (found in the 1987 to 1996 Medical Expenditures Surveys). This finding suggests that limited capacity (i.e., available beds) is not keeping elders out of homes. The provision of services to only high-need elderly does not explain the trends, because the disability level in the 1984 NLTCS was 4.4 ADLs impaired on average (weighted; 4.7 in 1994) in nursing homes. The rate of disability is so high in nursing homes that the population could not become much frailer. There was a major increase in the use of home health services starting in 1989 (stimulated by changes in the Health Care Financing Administration's reimbursement policy regarding home health reimbursement; HIM-11) and continuing to 1997 (eventually slowed by the Balanced Budget Act of 1997).

What can be uniquely assessed in the 1999 NLTCS is the growth of a new sector of the housing market—assisted-care living facilities. This growth is currently not well understood. The name "assisted living" is, itself, in flux, with Wisconsin relabeling their state regulations to be for "residential-care apartment complexes" (Office of Assistant Secretary for Planning and Evaluation, 2000, located at http://aspe.os.dhhs.gov/). Currently 25% of assisted-living beds are in three states—California (123,238), Florida (66,293), and Pennsylvania (62,241). This represents a national market of 28,000 licensed assisted-living facilities with 612,000 beds. A problem with this housing sector is that persons are frequently forced out of assisted-living residence after developing a disability. Thus, this type of long-term care is developing more as a residential than institutional model. This is bolstered by the 1999 NLTCS

where, of 811,000 persons (estimated) living in assisted-care facilities, over half reported no chronic disability, and of the other half, roughly half were recorded as disabled and living in the community; half were recorded as disabled and meeting the criteria to receive an institutional survey. While we estimated there were 1.2 million persons in nursing homes there were 200,000 persons living in assisted-living facilities who would have been classified as living in institutional residence in 1999—a total of 1.4 million that can be contrasted to the NLTCS estimate that 1.9 million persons would have been designated as in nursing homes in 1994 (based on the standardization of 1994 institutionalization rates to the 1999 U.S. age distribution). Another 200,000 persons in assisted-living facilities were in "community" residence (according to NLTCS criteria) with disability (and are in the community disabled population). If we add the 200,000 disabled receiving a community interview to the institutional population there are still 200,000 fewer in institutions (1.6 million) than in 1994 (1.8 million) despite the growth, 1994 to 1999, of the population aged 65+ (+6.2%).

In summary, the decline in the prevalence of chronically disabled elderly persons of all types observed 1989 to 1994 accelerated 1994 to 1999. The apparent increase in disability observed 1982 to 1989 for blacks reversed from 1989 to 1994 and accelerated 1994 to 1999. This finding is consistent with black and nonblack educational trends. There was a major change in the level, and mix, of institutional use by U.S. elderly persons. This did not cause the population with 5 or 6 ADLs impaired to increase as might be expected if institutional care were being "rationed," forcing persons into community residence. It could be argued that persons who were potential residents in nursing homes, who stayed in the community to receive benefits and services at home, may, in aggregate, not have deteriorated as rapidly as persons who were nursing home residents. This possibility is consistent with concerns over the quality of care in nursing homes—e.g., the residents may have been less likely to remain physically active and receive nutritional benefits.

It will be important to track chronic disability over time because, with the current large size of the U.S. population, increases in birth rates and in-migration cannot be counted upon to replace losses to the stock of human capital available to the U.S. economy. Our only viable strategy is to adopt programs that will preserve human capital and keep it in the labor force, for longer periods of time (24).

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