Major Declines in Severe Cognitive Impairment in the U.S. Elderly Population: New Estimates from the 1984 and 2004 National Long Term Care Survey

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ABSTRACT

Purpose: To estimate age-standardized 20-year changes in severe cognitive impairment (SCI) among the U.S. elderly using the HIPAA CI trigger.

Methods: SCI-1 was defined as 3+ SPMSQ errors, caregiver report of Alzheimer's disease/dementia, or similar problems, with concurrent substantial supervision; SCI-2 and SCI-3 were defined similarly, with SPMSQ cut-points = 4+ and 5+ errors, respectively.

Results: Overall prevalence rates were 9.2% and 6.7% for SCI-1 in 1984 and 2004, respectively. Age-standardized rates of decline were 2.74%/yr. for SCI-1 (t = 15.53), 2.66%/yr. for SCI-2 (t = 13.45), and 2.58%/yr. for SCI-3 (t = 12.16). Sex differences in prevalence were large: 4.7% (Male) v. 8.1% (Female) (SCI-1, 2004); but the rates of decline were similar: 2.85%/yr. (Male; t = 8.15) v. 2.59%/yr. (Female; t = 12.75) (SCI-1).

Conclusions: Severe cognitive impairment exhibited substantively important and highly statistically significant declines among the U.S. elderly during the 20-year period 1984–2004.

BACKGROUND

Accurate characterization of temporal changes in severe cognitive impairment (SCI) is a major challenge for population scientists seeking to understand the pathways between health and mortality and to forecast the future need for long-term services and supports for the SCI population.

Existing studies of SCI (or CI) changes have not presented sufficiently compelling evidence to form a consensus about the long-term trends in the U.S. elderly population (e.g., Freedman et al., 2001; Rodgers et al., 2003; Langa et al., 2008; and Sheffield and Peek, 2011).

Manton et al. (2005) reported that the age-standardized SCI prevalence rates declined from 5.7% in 1982 to 2.9% in 1999, based on community data from the NLTCS with supplemental calculations for the institutional population based on the NNHS, where SCI was defined as the inability to answer any SPMSQ or MMSE questions; and with a rapid drop in prevalence from 5.7% in 1982 to 4.8% in 1984, implying that the annualized relative rate of decline was 3.3% per year ($t \approx 9.78$) for the 15-year period 1984–1999, just below Sheffield and Peek's (2011) estimate of 3.4% per year for the 10-year period 1993–2004 in the HRS, but with much higher precision.

In this poster, we use the 1984 and 2004 NLTCS to accurately estimate the change in prevalence of SCI among aged Medicare enrollees using the CI disability trigger defined by the Health Insurance Portability and Accountability Act of 1996 (Public Law 104–191) (HIPAA; see Internal Revenue Service, 1997).

METHODS

National Long Term Care Survey (NLTCS)

Purpose: To measure disability and use of LTC among the U.S. elderly (age 65+) at multiple points in time from 1982 to 2004. Cumulative N ≈ 49,000, each wave ≈ 16,000–21,000, with ≈ 6,000–7,500 detailed interviews for persons meeting various screening criteria. "Disability" included ADL and IADL limitations (3+ months), CI, and institutionalization.

HIPAA CI Trigger

The individual requires "substantial supervision" to protect him/herself from threats to health and safety due to "severe cognitive impairment," defined as:

> A loss or deterioration in intellectual capacity that is comparable to (and includes) Alzheimer's disease and similar forms of irreversible dementia, and measured by clinical evidence and standardized tests that reliably measure impairment in the individual's (i) short-term or long-term memory, (ii) orientation as to people, places, or time, and (iii) deductive or abstract reasoning.

Severe Cognitive Impairment in the NLTCS

Short Portable Mental Status Questionnaire (SPMSQ) Choice of 3+, 4+, or 5+ errors out of 10 questions; **Or** Caregiver report of Alzheimer's Disease, dementia, or other cognition problems preventing SPMSQ completion with a passing score of 0–2, 0–3, or 0–4 errors.

NLTCS Survey Weights

Standard errors of weighted binomial estimators were based on Potthoff et al. (1992). Sensitivity to the Duke/PNAS weighting protocol was assessed using alternative protocols based on Cox and Wolters (2008).

Disabled Life Expectancy (DLE) Beyond Age x in Year y

$$e_{D\,x,y} = \int_0^\infty {}_t p_{x,y}\ \pi_{x+t,y}\ dt$$

where ${}_t p_{x,y} = l_{x+t,y}/l_{x,y}$

and $\pi_{x+t,y}$ = disability prevalence at age $x+t$.

Change from Year y_0 to y in DLE at Age x

$$e_{Dx,y} - e_{Dx,y_0}$$

$$= \int_0^\infty \left({}_t p_{x,y}\ \pi_{x+t,y} - {}_t p_{x,y_0}\ \pi_{x+t,y_0} \right) dt$$

$$= \int_0^\infty \left({}_t p_{x,y}\ \pi_{x+t,y} - {}_t p_{x,y_0}\ \pi_{x+t,y_0} + 0 \right) dt$$

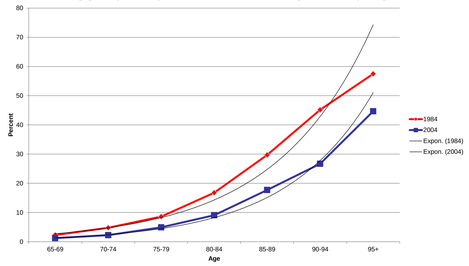
$$= \int_0^\infty \left({}_t p_{x,y}\ \pi_{x+t,y} - {}_t p_{x,y_0}\ \pi_{x+t,y_0} + {}_t p_{x,y}\ \pi_{x+t,y_0} - {}_t p_{x,y}\ \pi_{x+t,y_0} \right) dt$$

$$= \int_0^\infty \left({}_t p_{x,y} - {}_t p_{x,y_0} \right) \pi_{x+t,y_0}\ dt \qquad \text{Survival Increment } (3-2)$$

$$- \int_0^\infty {}_t p_{x,y} \left(\pi_{x+t,y_0} - \pi_{x+t,y} \right) dt \quad \text{Morbidity Decrement } (4-1).$$

RESULTS: SCI Prevalence Rates by Year, Sex, and Age

Percent of U.S. Population Meeting HIPAA CI Trigger (SCI-1), 1984 and 2004, Age 65+ by Age



Percent of U.S. Population Meeting HIPAA CI Trigger (SCI-1), 1984 and 2004, Age 65+ with 2 Modes of Age Standardization

Age	1984	2004	Change	% Change	Annual Rate of Decline; 20 yr.
65-69	2.31	1.22	-1.09	-47.1	3.13%
70-74	4.78	2.26	-2.52	-52.7	3.67%
75-79	8.60	4.93	-3.67	-42.6	2.74%
80-84	16.77	9.07	-7.70	-45.9	3.03%
85-89	29.70	17.70	-12.00	-40.4	2.55%
90-94	45.16	26.69	-18.48	-40.9	2.60%
95+	57.48	44.67	-12.81	-22.3	1.25%
Total	9.24	6.69	-2.56	-27.7	1.61%
1984 ASDR	9.24	5.21	-4.03	-43.6	2.82%
2004 ASDR	11.65	6.69	-4.96	-42.6	2.74%
Standard Error					
Total	0.20	0.21	0.28		
1984 ASDR	0.20	0.17	0.26		
2004 ASDR	0.25	0.21	0.32		
t-statistic					
Total	46.75	32.62	-8.98		
1984 ASDR	46.75	30.79	-15.49		
2004 ASDR	47.52	32.62	-15.53		

NOTE: ASDR denotes age-standardized disability rate; the 1984 ASDR and 2004 ASDR results were age-standardized, respectively, to the 1984 and 2004 NLTCS weighted unisex population. The CI trigger used 3+ errors on the SPMSQ.

Source: Authors' calculations based on the 1984 and 2004 NLTCS.

Annual Rate of Decline in the Percent of U.S. Population Meeting HIPAA CI Trigger (SCI-1), 1984 and 2004, Age 65+ with Two Modes of Age Standardization – Tabulated Using Three Alternative Weighting Protocols

	Annual Rate of Decline (%)			t-statistic	
Age	Duke/PNAS Weight	Unadjusted Cox Weight	Adjusted Cox Weight	Unadjusted	Adjusted
65-69	3.13	2.50	2.50		
70-74	3.67	3.38	3.48		
75-79	2.74	2.39	2.57		
80-84	3.03	2.68	2.84		
85-89	2.55	2.07	2.24		
90-94	2.60	2.28	2.31		
95+	1.25	1.11	1.16		
Total	1.61	1.44	1.56	0.93	0.24
1984 ASDR	2.82	2.44	2.57	2.08	1.39
2004 ASDR	2.74	2.37	2.49	2.10	1.38
Standard Error					
Total	0.18	0.17	0.18		
1984 ASDR	0.18	0.18	0.18		
2004 ASDR	0.18	0.17	0.17		
t-statistic					
Total	8.98	8.26	8.93		
1984 ASDR	15.49	13.74	14.36		
2004 ASDR	15.53	13.75	14.39		

NOTE: ASDR denotes age-standardized disability rate; the 1984 ASDR and 2004 ASDR results were age-standardized, respectively, to the 1984 and 2004 NLTCS weighted unisex population. The CI trigger used 3+ errors on the SPMSQ.

Source: Authors' calculations based on the 1984 and 2004 NLTCS.

Percent of U.S. Population Meeting 3 Alternative HIPAA CI Triggers, 1984 and 2004, Age 65+ with 2 Modes of Age Standardization

Item	1984	2004	Change	% Change	Annual Rate of Decline; 20 yr.
SCI-1					
1984 ASDR	9.24	5.21	-4.03	-43.6	2.82%
2004 ASDR	11.65	6.69	-4.96	-42.6	2.74%
t (1984 ASDR)	46.75	30.79	-15.49		
t (2004 ASDR)	47.52	32.62	-15.53		
SCI-2					
1984 ASDR	7.44	4.31	-3.13	-42.1	2.70%
2004 ASDR	9.56	5.58	-3.98	-41.6	2.66%
t (1984 ASDR)	41.48	27.95	-13.25		
t (2004 ASDR)	42.04	29.47	-13.45		
SCI-3					
1984 ASDR	6.51	3.84	-2.66	-40.9	2.60%
2004 ASDR	8.44	5.01	-3.43	-40.7	2.58%
t (1984 ASDR)	38.46	26.41	-11.93		
t (2004 ASDR)	38.84	27.77	-12.16		

NOTE: ASDR denotes age-standardized disability rate; the 1984 ASDR and 2004 ASDR results were age-standardized, respectively, to the 1984 and 2004 NLTCS weighted unisex population.

Source: Authors' calculations based on the 1984 and 2004 NLTCS.

Percent of U.S. Male and Females Meeting HIPAA CI Trigger (SCI-1), 1984 and 2004, Age 65+ with 2 Modes of Age Standardization

Item	1984	2004	Change	% Change	Annual Rate of Decline; 20 yr.
Males					
1984 ASDR	6.57	3.68	-2.88	-43.9	2.85%
2004 ASDR	8.34	4.68	-3.66	-43.9	2.85%
t (1984 ASDR)	23.63	16.01	-7.99		
t (2004 ASDR)	23.45	17.01	-8.15		
Females					
1984 ASDR	10.98	6.33	-4.65	-42.4	2.72%
2004 ASDR	13.76	8.14	-5.63	-40.9	2.59%
t (1984 ASDR)	40.53	26.39	-12.85		
t (2004 ASDR)	41.46	27.99	-12.75		

NOTE: ASDR denotes age-standardized disability rate; the 1984 ASDR and 2004 ASDR results were age-standardized, respectively, to the 1984 and 2004 NLTCS weighted sex-specific population.

Source: Authors' calculations based on the 1984 and 2004 NLTCS.

SCI Life Expectancy by Year and Sex

Components of Change in Unisex and Sex-Specific Life Expectancy and HIPAA CI Expectancy (SCI-1, in Years at Age 65), United States 1984 and 2004

	Year				
At Age 65	1984	2004	Change	Survival Increment	Morbidity Decrement
Unisex					
Life Expectancy	16.64	18.11	1.48	1.48	–
HIPAA CI Expectancy	1.81	1.20	-0.61	0.27	0.88
Standard Error	0.04	0.04	0.05	0.01	0.06
t-statistic	47.79	32.78	-11.61	43.76	15.47
Males					
Life Expectancy	14.41	16.67	2.26	2.26	–
HIPAA CI Expectancy	1.09	0.79	-0.30	0.31	0.62
Standard Error	0.05	0.05	0.07	0.02	0.08
t-statistic	23.69	17.02	-4.63	20.01	8.10
Females					
Life Expectancy	18.66	19.50	0.84	0.84	–
HIPAA CI Expectancy	2.43	1.55	-0.88	0.18	1.06
Standard Error	0.06	0.06	0.08	0.00	0.08
t-statistic	41.63	28.13	-10.91	37.91	12.69

Source: Authors' calculations based on the 1984 and 2004 NLTCS.

DISCUSSION/CONCLUSIONS

SCI exhibited substantively important and highly statistically significant declines among the U.S. elderly during the 20-year period 1984–2004.

Our estimated declines were smaller than Manton et al.'s (2005) estimated 3.3%/yr. during 1984–1999, but were consistent with recent reports from Denmark during 1998–2010 (Christensen et al., 2013) and the U.K during 1991–2011 (Matthews et al., 2013). Our 2.58%/yr. decline for SCI-3 was similar to the statistically highly significant 2.55%/yr. decline (t = 3.44) for SCI from Christensen et al. (2013, Table 2). Our estimate of the age- and sex-adjusted odds ratio based on SCI-1 was 0.55 (not shown; see Stallard and Yashin, 2014), just below the lower bound (0.6) of Matthews' 95% CI.

Our results provide the confirmation sought by Dallas W. Anderson at the NIA Dementias of Aging Branch (*The New York Times*, July 16, 2013) that the trends in the U.S. were comparable to those reported for the U.K. and Denmark.

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