Educational Differences in the Prevalence of Dementia and Life Expectancy with Dementia: Changes from 2000 to 2010

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ABSTRACT

Dementia prevalence appears to be on the decline in the United States and some Western European Countries. Life expectancy increase in the United States has continued at a modest pace in recent decades. This paper provides the first life tables of educational differences for the U.S. population in life expectancy with dementia, with cognitive impairment but without dementia and cognitively healthy life. After age 70, persons with less than high school education are about four times more likely to have dementia than those with college education. There is little significant change by education in cognitive status over 2000 to 2010 decade. Because life expectancy has increased over the last decade, however, there has been an increase in the length of life with good cognition for most sex-education groups and a decrease in the length of life with dementia for some, generally those with more education.

INTRODUCTION

Dementia appears to be on the decline in the United States and some Western European Countries. Life expectancy increase in the United States has continued at a modest pace in recent decades. However, neither levels nor trends in dementia and life expectancy are equal across educational groups in the U.S. There are strong differentials by education in cognitive functioning and dementia with poorer functioning and more dementia among those with lower education (Langa et al. 2008; Lievre et al. 2008; Stern et al. 1999). In addition, life expectancy of those with less education is shorter than that of those with more education (Hummer and Lariscy 2011) and in recent years life expectancy differentials between higher and lower education groups have been increasing (Meara et al. 2008; Montez et al.2011; Olshansky et al. 2012; Sasson 2016).

Increasing levels of education are one of the factors to which decreases in dementia are attributed; however, levels and trends within education groups of a nationally representative sample of Americans have not been clarified nor have changes in cognitively healthy life expectancy by education been estimated. This paper examines change over ten years in cognitive functioning and life expectancy in cognitive states by education for people 65 and over in the United States. We produce the first life tables of educational differences for the U.S. population in life expectancy with dementia, with cognitive impairment but without dementia (CIND) and cognitively healthy life. In addition, we examine the effect of changes in cognitive state, as well as changes in mortality, from 2000 to 2010 within educational groups on changes in cognitive life expectancy.

DATA AND METHODS

Data

Cognitive State

Data on cognitive ability in the population come from the 2000 and 2010 Health and Retirement Study (HRS) for those 65+. The HRS is a nationally representative sample of persons 50 years of age and over who are interviewed every 2 years beginning in 1992. The data included 10,383 participants in 2000 and 10,002 in 2010 who were age 65 or older and included both community-dwelling and nursing home residents, as well as self- and proxy respondents. Because results for cognitive status are imputed if some tests are missing only 9 cases do not have a dementia status in 2000 and 1 case is missing education in 2010. The average age of the sample at both dates was about 75 years, of whom about 59% in 2000 and 57% in 2010 were females.

Cognitive status is determined through responses to a series of tests for individuals who are self-respondents and to a set of questions to proxies and interviewer observations for those who are not self-respondents. Because poor cognitive functioning is one of the reasons people do not respond for themselves, it is particularly important to include these people in assessment of the prevalence of cognitive state. Categorizing people as having good cognition, dementia, or CIND is based on the concordance of HRS cognitive functioning scores and diagnosis of dementia and CIND in a subset of HRS respondents who had neuropsychological assessment in the Aging, Demographics, and Memory Study (ADAMS) (Langa et al., 2005; Crimmins et al., 2011).

Self-respondents' cognitive scores can range from 0 to 27 and are based on tests of immediate recall of 10 words, delayed recall of the same 10 words, 5 trials of Serial 7s, and

Backward counting (score 0-2). If a respondent does not complete all the tests, the missing measures are imputed (Fisher et al. 2015). Respondents with scores from 12-27 are classified as having good cognitive functioning; 0-6 is dementia; and 7 to 11 is CIND.

For individuals whose information is provided by proxies the classification is based on an direct assessment of memory (0 excellent, 1 very good, 2 good, 3 fair, 4 poor); an assessment of limitations in 5 instrumental activities of daily living (IADLs) (managing money, taking medication, preparing hot meals, using phones and doing groceries) (0-5); and the interviewer assessment of difficulty completing the interview because of cognitive limitation (score 0-2 indicating, none, some, prevents completion). These scores are summed and those with a score of 0-2 are classified as cognitively healthy; 3-5 as CIND; and 6-11 as having dementia.

Education

Reported years of educational attainment are used to divide people into 4 categories: college or more (16 years or more), some college (13-15), high school completion (12 years), less than high school (less than or equal to 11 years of schooling). In 2000, about 34% of males had educational level of less than high school, 28% with high school completion, 16% with some college, and 22% with college or more. In 2010, the percent changed to 21% for less than high school, 31% for high school completion, 19% with some college, and 29% with college or more. Among women, the distribution in 2000 is 32% with less than high school, 37% with a high school degree, 18% with some college and 13% completing college; in 2010 the percentages were 22%, 39%, 22% and 17%. Because this is a longitudinal survey, people report their education at the initial wave, generally long before the onset of dementia.

Mortality Data

Mortality data for 2000 and 2010 for this analysis are from the U.S. National Vital Statistics. Life tables for educational groups were developed from mortality rates estimated by Sasson (2016) based on novel methods of imputing education. They were developed using data from the black and white populations of the U.S. for 2000 and 2010. Data for deaths come from the U.S. Multiple Cause of Death Public Use Files (Centers for Disease Control and Prevention 2013); population denominators come from the 5% Integrated Public Use File (Ruggles et al. 2012).

Methods

First we examine the prevalence of cognitive state currently and then change over time for education groups. Significant change is defined by non-overlapping confidence intervals. Life expectancy by cognitive by education is determined by combining measures of the prevalence of the population prevalence of dementia, CIND, and good cognition by educational group with education specific mortality. We use the Sullivan method for computing the length of expected life with dementia, CIND, and good cognitive functioning (Jagger et al., 2007; Saito et al., 2014). The lifetable years lived in each age group are divided into these three states using the prevalence of the cognitive states at each age. Years lived with dementia, CIND, and good cognition are summed at all ages after the specified age and divided by the number of people alive at that age to get life expectancy with dementia and CIND. Cognitively healthy life expectancy reflects the average number of years at a specified age a person can expect to live with good cognitive skills given current mortality and prevalence of cognitive problems. Standard errors for the estimated values were computed using the approach provided by Jagger et al. (2007).

RESULTS

Educational Differences in the Prevalence of Good Cognition, CIND, and Dementia

Good cognition characterizes the majority of people with at least a college education into their 90s; for people with less than a high school education the majority have good cognitive functioning only up to age 75 (Table 1 and Supplementary Tables S1 and S2).

Change in the Prevalence of Good Cognition, CIND, and Dementia

The description above is for the year 2010. Between 2000 and 2010, these is no significant change in the prevalence of dementia for most age-sex-education groups; only 1 out of 48 shows a significant decline (Figure 2 and Supplementary Tables S1 and S2). It is also true that there is little significant change in the percent in good cognitive condition with only 3 out of the 48 groups experiencing a significant increase (Figure 3 and Supplementary Tables S1 and S2).

Change in Life Expectancy

Life expectancy at age 65 increased for men and women in every educational group over the ten year period. Increases for both men and women are greatest among the most education (2.33 for men and 1.45 for women who have completed college); and lowest for those with the least education (.68 for men and .66 for women) (Figure 1 and Table 2). Note that the improvement for men with a college education is substantially greater than that for women.

At age 85, there are also increases in life expectancy for every educational group. They do not differ systematically by educational level; however, again males with the highest education have the greatest increase (1.18 years).

Educational Differences in Life Expectancy by Cognitive State

At age 65, life expectancy with good cognition increases substantially as education increases. In 2010, it is from 7.50 for men and 8.76 for women with less than a high school education; for those who graduated from college it is more than twice as long, 16.77 for men and 17.92 for women. On the other hand, years with dementia are much longer among those with low education. Among those with a college education years with dementia in 2010 were 0.77 for men and 1.57 for women; for those with less than a high school education years spent with dementia is about 3 times as long, 2.57 years for men and 4.12 for women.

This means that is you have graduated from high school on average you spend at least 70 percent of your years after age 65 with good cognition; if you graduate from college on average you spend at least 80 years with good cognition. But if you have less than a high school education, you spend less than 50 percent of your years on average with good cognition. Conversely, people who have graduated with college spend a small percent of life on average with dementia (3.8 for men and 16.6 for women); and those with the lowest education spend a substantially greater portion of life with dementia (7.0 and 21.8).

At age 85, there are similar differences in life expectancy by cognitive state. Life expectancy with good cognitive health is higher for those with higher education (3.85 for men and 3.52 for women with college education and 1.29 and 1.38 for men and women with less that a high school degree). For people with some college education or more, about 50 percent of life at age 80 is expected to be in good cognitive health; for those with less than a high school education this is only about 20%.

Expected years with dementia are two to three times larger at age 85 for those with the lowest level of education (2.16 for men and 3.50 for women) than for those with a college degree

(0.65 for men and 1.48 for women). For those in the three highest categories of education, life expectancy at age 85 with dementia is quite similar to that at age 85 (e.g. 0.65 and 0.77 for men and 1.48 and 1.57 for women with college education) meaning most dementia occurs after age 85. For those with the lowest levels of education life expectancy with dementia at age 65 exceeds expected life with dementia at age 85, indicating younger dementia in this age group.

Change in Life Expectancy by Cognitive State

Every education group for men and all but the lowest education group for women experienced a significant increase between 2000 and 2010 in expected life with good cognition at age 65 (Table 1 and Figure 4). The increase is greatest among those with the highest education (1.51 for men and 1.79 for women) and lowest for those with the least education (0.66 for men and 0.27 for women).

Among women there was a significant decline in expected years with dementia at age 65 for college graduates (-0.55) and for those who attended college (-0.24); for those with less education, there was no significant change. For men at age 65, two education groups experienced small but significant increases in life with dementia (0.12 for college graduates and 0.18 for high school graduates). In the other groups, years with dementia decreased significantly (-0.31 for those with some college and -0.37 for those with less than 12 years of schooling). These changes resulted in very little change and unsystematic change, in the proportion of life in each of the three states.

At age 85, life expectancy with good cognition increased significantly for women in each of the four education groups. In no educational group for males at age 85 was there a significant change in life expectancy with good cognition. Life with dementia decreased at age 85 for

women in two educational groups and increased in one group; for men one group decreased and one group increased.

One way to see the relative effect of changes in the prevalence of cognitive states and mortality on the overall change in life expectancy by cognitive state and education is to assume only one component changes and hold the other constant. For instance if the prevalence of cognition changes as it did and mortality stayed constant, for most groups there would have been little increase in life expectancy with good cognition. For example, the improvement for women with a college education would have been about a year less; while the improvement for men would have been about 1.5 years less. On the other hand, the decrease in years with dementia would have been somewhat greater than observed. If mortality changed but the prevalence of cognitive states stayed constant, length of life in all states would have increased and the improvement in life expectancy in good cognition would have been similar to what was observed. This implies that most of the improvement was due to lengthening life and the differentials by education in improvement were due to differences in life expectancy change.

CONCLUSION

There are large differences in cognitive status by educational attainment in the older population. Persons with lower levels of education have significantly more dementia. However, there is little significant change by education in cognitive status over recent years. There are also large differences in the length and proportion of life spent with dementia by educational status; again with those with less education spending longer and a greater proportion of their lives with dementia. Because life expectancy has increased over the last decade, however, there has been an increase in the length of life with good cognition for most sex-education groups and a decrease in the length of life with dementia for some, generally those with more education.

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Figure 1: Life Expectancy at age 65 by Education: 2000, 2010
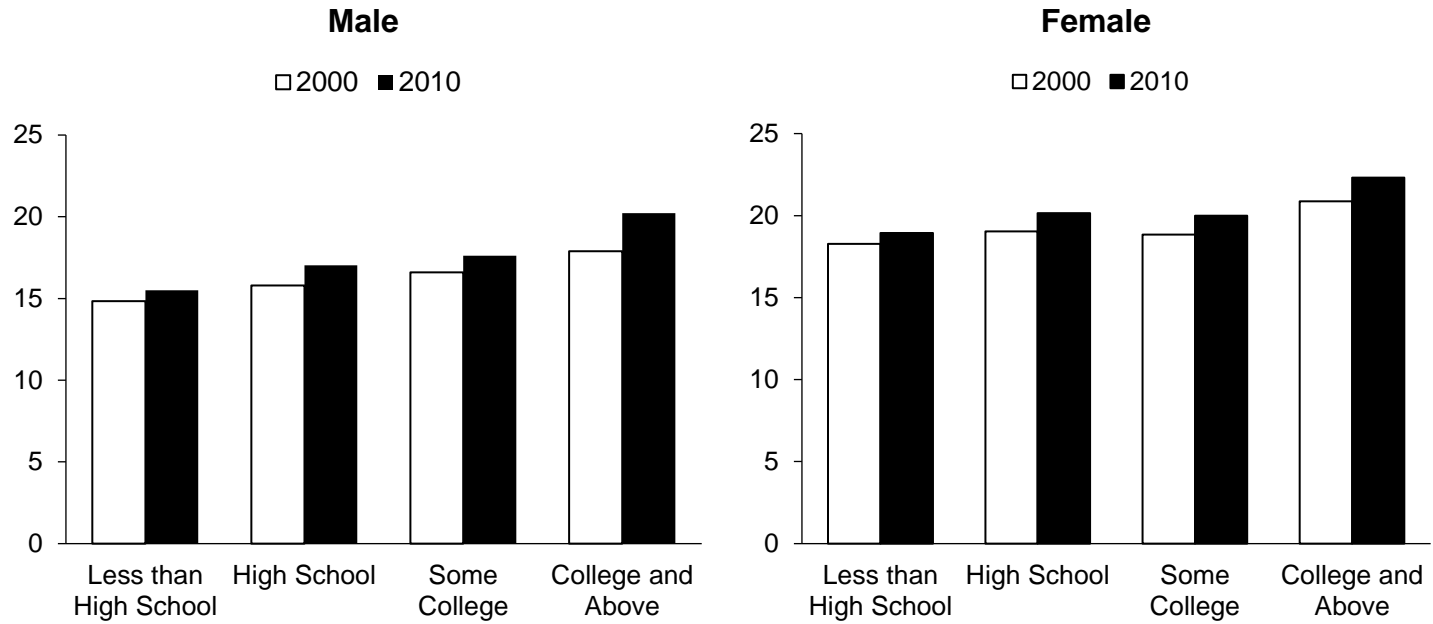
Figure 2: Proportion with Dementia, 2000 and 2010, by Education Group

Males

0.8	

Chart: X-axis age groups 65-69, 70-74, 75-79, 80-84, 85-89, 90+; Y-axis 0 to 0.8

Females

Chart: X-axis age groups 65-69, 70-74, 75-79, 80-84, 85-89, 90+; Y-axis 0 to 0.8

Legend:
- - - 2000 Less Than High School
— · — 2000 High School
— — — 2010 Less Than High School
— · — 2010 High School
·········· 2000 Some College
——— 2000 College and Above
·········· 2010 Some College
——— 2010 College and Above
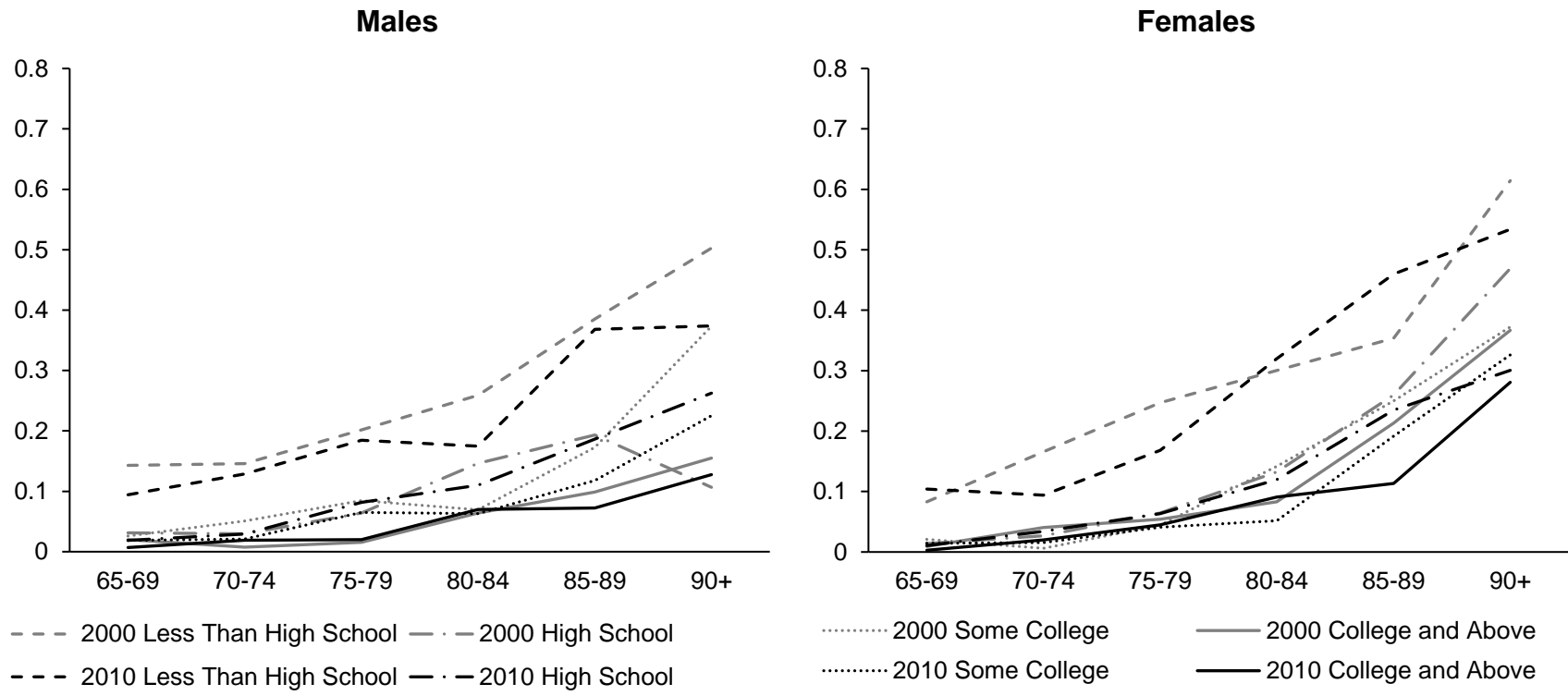
Figure 3: Proportion in Good Cognitive Health by Education in 2000 and 2010

Males

Females

- - - 2000 less than high school	- · - 2000 High School
- - - 2010 less than high school	- · - 2010 High School
········ 2000 Some College	—— 2000 College and Above
········ 2010 Some College	—— 2010 College and Above
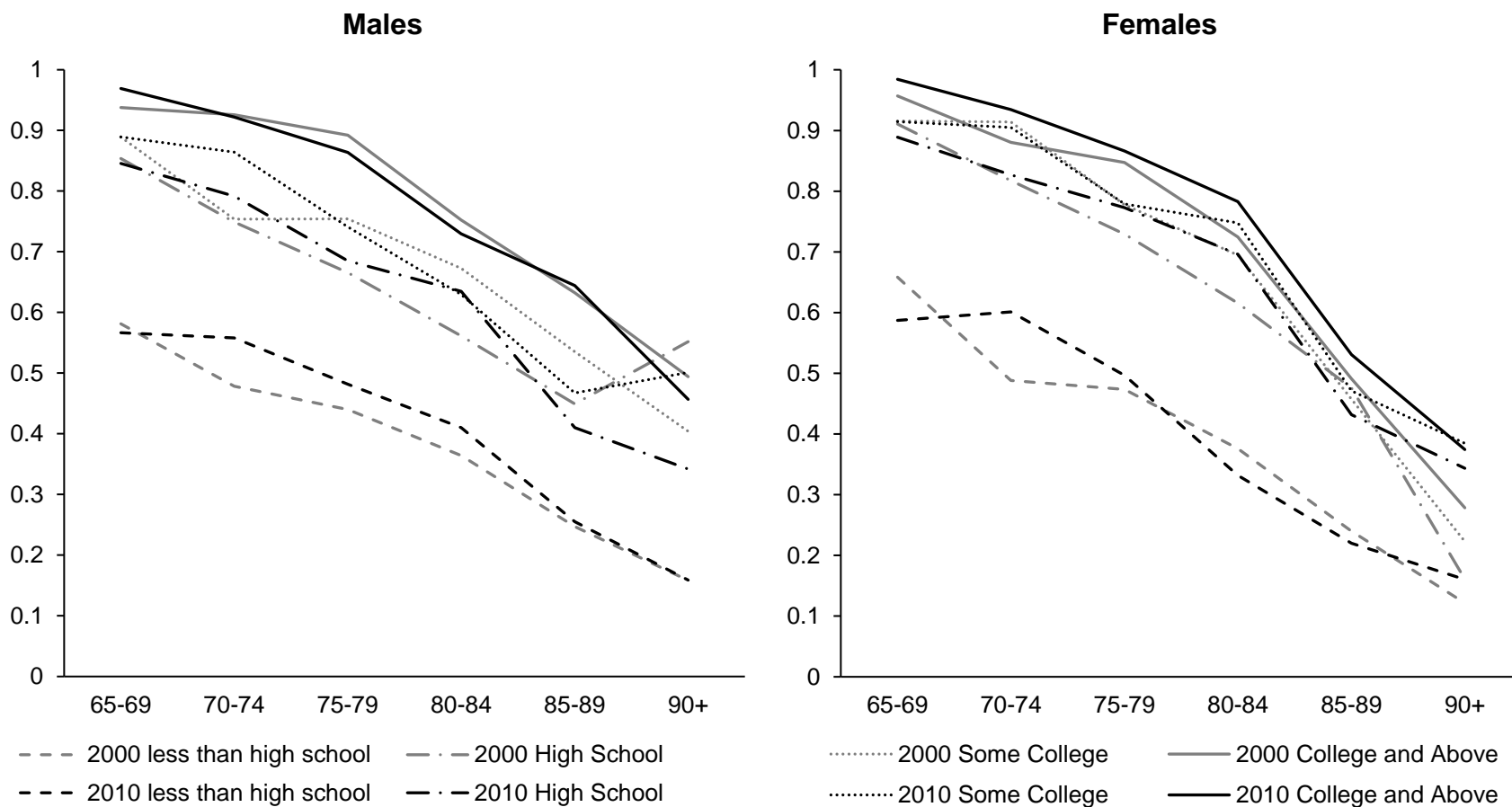
Figure 4: Change from 2000 to 2010 at age 65 in Expectation of life by cognitive state by Education
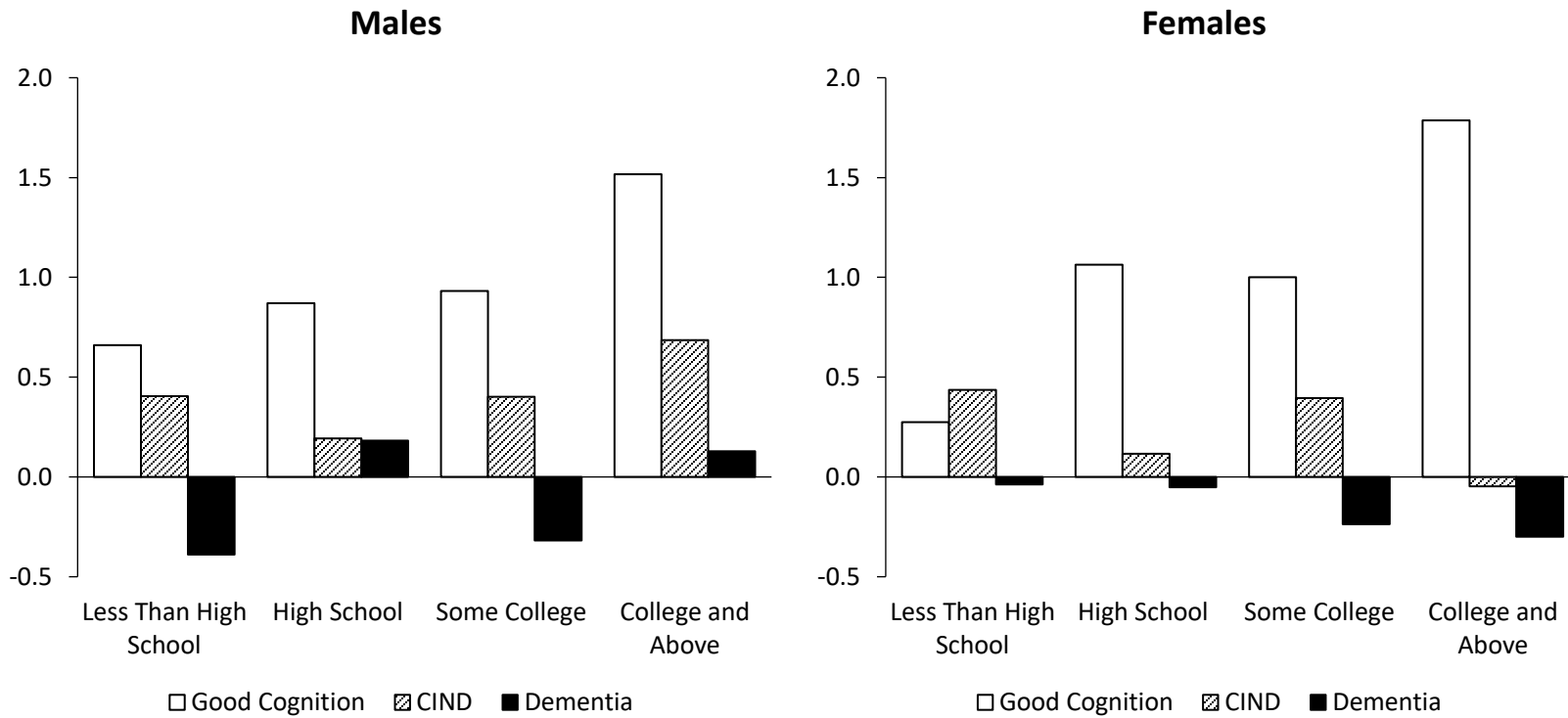
Figure 5. Change from 2000 to 2010 in expectation of life at age 65 by cognitive state by Education

Panel A. Prevalence of cognitive states changed; mortality stayed constant
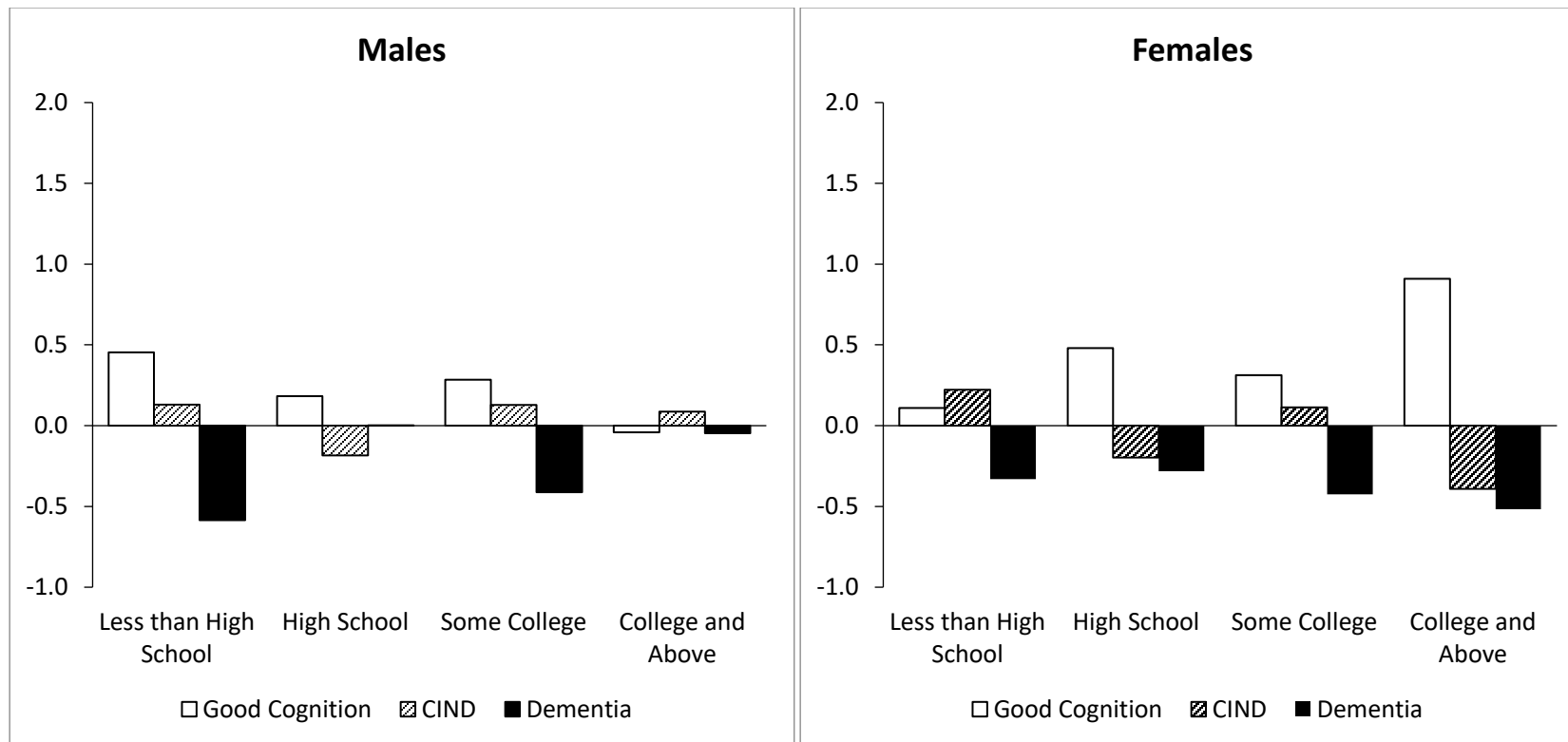
Panel B. Mortality changed; prevalence stayed constant

Males

2.0
1.5
1.0
0.5
0.0

Less than High School | High School | Some College | College and Above

☐ Good Cognition   ☒ CIND   ■ Dementia

Females

2.0
1.5
1.0
0.5
0.0

Less than High School | High School | Some College | College and Above

☐ Good Cognition   ☒ CIND   ■ Dementia
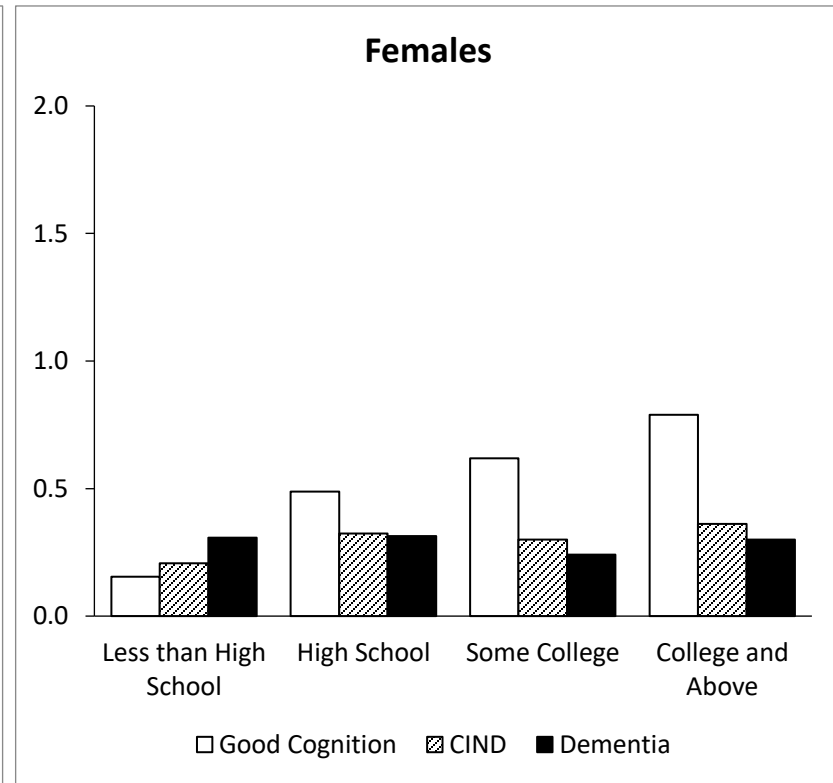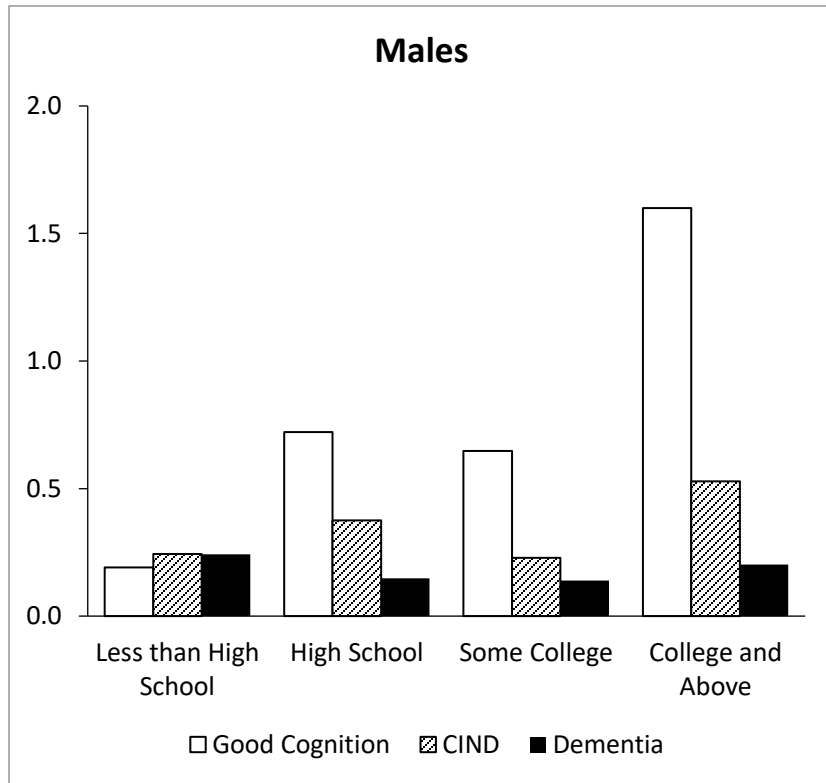
Table 1. Percent with Dementia, CIND, and Good Cognition by Education, 2010

	Females					Males				
	edu: 0-11	edu: 12	edu: 13-15	edu: 16	ratio: 0-11 to 16+	edu: 0-11	edu: 12	edu: 13-15	edu: 16	ratio: 0-11 to 16+
Percent with Good Cognition										
65-69	58.7	88.9	91.5	98.4		56.7	84.6	88.9	96.9	
70-74	60.1	82.7	90.5	93.4		55.8	79.2	86.4	92.2	
75-79	49.7	77.3	77.9	86.6		48.2	68.5	74.1	86.4	
80-84	33.2	69.6	74.8	78.3		41.0	63.5	62.9	73.0	
85-89	22.0	43.2	47.1	53.1		25.5	41.0	46.7	64.4	
90+	16.0	34.4	38.5	37.4		15.9	34.2	50.1	45.7	
Percent with CIND										
65-69	30.9	10.1	7.1	1.3		33.9	13.6	9.2	2.4	
70-74	30.5	13.9	7.9	4.6		31.3	17.9	11.5	5.9	
75-79	33.5	16.4	18.0	8.9		33.4	23.3	19.4	11.6	
80-84	34.8	18.4	20.1	12.7		41.6	25.5	30.8	20.0	
85-89	32.0	33.3	33.7	35.6		37.7	40.4	41.5	28.3	
90+	30.6	35.6	29.0	34.5		46.7	39.6	27.4	41.6	
Percent with Dementia										
65-69	10.4	1.1	1.4	0.3	34.7	9.4	1.9	2.0	0.7	6.7
70-74	9.4	3.4	1.6	2.0	4.7	12.9	2.9	0.8	1.9	6.8
75-79	16.8	6.4	4.1	4.5	3.7	18.5	8.2	1.6	2.0	9.2
80-84	32.0	12.0	5.2	9.1	3.6	17.5	11.0	6.4	7.0	2.5
85-89	46.0	23.5	19.2	11.3	4.1	36.8	18.7	9.9	7.2	5.1
90+	53.4	30.1	32.6	28.1	1.9	37.4	26.3	15.5	12.8	2.9

Table 2: Life Expectancy in 2000 and 2010 at age 65 and 85, Total and by Cognitive State: 4 Educational Groups

	Males						Females				
	2000	2010	Percent 2000	Percent 2010	Change yrs 2000-2010		2000	2010	Percent 2000	Percent 2010	Change yrs 2000-2010
College +											
At age 65											
Total	17.89	20.22			2.33		20.87	22.32			1.45	
Good Cognition	15.20	16.71	85.00	82.60	1.51	*	16.13	17.92	77.30	80.30	1.79	*
CIND	2.04	2.73	11.40	13.50	0.69	*	2.88	2.83	13.80	12.70	-0.05	
Dementia	0.65	0.77	3.60	3.80	0.12	*	1.87	1.57	9.00	7.00	-0.30	*
Some College -											
At age 65											
Total	16.60	17.62			1.02		18.84	20.00			1.16	
Good Cognition	12.44	13.37	74.90	75.90	0.93	*	14.49	15.49	76.90	77.40	1.00	*
CIND	2.90	3.31	17.50	18.80	0.41	*	2.78	3.17	14.60	15.80	0.39	*
Dementia	1.26	0.95	7.60	5.40	-0.31	*	1.57	1.33	8.30	6.60	-0.24	*
High School -											
At age 65											
Total	15.79	17.03			1.24		19.03	20.16			1.13	
Good Cognition	11.17	12.04	70.70	70.70	0.87	*	13.60	14.66	71.40	72.70	1.06	*
CIND	3.54	3.73	22.40	21.90	0.19		3.53	3.65	18.50	18.10	0.12	
Dementia	1.08	1.26	11.40	7.40	0.18	*	1.90	1.85	10.00	12.60	-0.05	
<=11 yrs -											
At age 65											
Total	14.83	15.51			0.68		18.28	18.94			0.66	
Good Cognition	6.84	7.50	46.10	48.40	0.66	*	8.49	8.76	46.40	46.30	0.27	
CIND	5.04	5.44	34.00	35.10	0.40	*	5.62	6.06	30.70	32.00	0.44	*
Dementia	2.96	2.57	20.00	16.60	-0.39	*	4.16	4.12	22.80	21.80	-0.04	

	Males						Females					
	2000	2010	Percent 2000	Percent 2010	Change yrs 2000-2010		2000	2010	Percent 2000	Percent 2010	Change yrs 2000-2010	
College +												
At age 85												
Total	5.64	6.82			1.18		7.11	7.70			0.59	
Good Cognition	3.30	3.85	58.50	56.50	0.55		2.84	3.52	39.90	45.70	0.68	*
CIND	1.67	2.32	29.60	34.00	0.65	*	2.28	2.70	32.10	35.10	0.42	
Dementia	0.66	0.65	11.70	9.50	-0.01		1.99	1.48	28.00	19.20	-0.51	*
Some College -												
At age 85												
Total	5.50	5.68			0.18		6.00	6.47			0.47	
Good Cognition	2.71	2.72	49.30	47.90	0.01		2.24	2.83	37.30	43.70	0.59	*
CIND	1.48	2.08	26.90	36.60	0.60	*	2.00	2.06	33.30	31.80	0.06	
Dementia	1.31	0.88	23.80	15.50	-0.43	*	1.76	1.58	29.30	24.40	-0.18	
High School -												
At age 85												
Total	5.48	5.93			0.45		6.50	7.22			0.72	
Good Cognition	2.65	2.28	48.40	38.40	-0.37		2.28	2.83	35.10	39.20	0.55	*
CIND	1.93	2.38	35.20	40.10	0.45	*	1.99	2.48	30.60	34.30	0.49	*
Dementia	0.90	1.27	16.40	21.40	0.37	*	2.23	1.91	34.30	26.50	-0.32	*
<=11 yrs -												
At age 85												
Total	5.26	5.84			0.58		6.52	7.10			0.58	
Good Cognition	1.15	1.29	21.90	22.10	0.14		1.26	1.38	19.30	19.40	0.12	*
CIND	1.89	2.39	35.90	40.90	0.50	*	2.28	2.23	35.00	31.40	-0.05	
Dementia	2.22	2.16	42.20	37.00	-0.06		2.98	3.50	45.70	49.30	0.52	*

Table S1: Distribution of Cognitive State in 2000 and 2010: Health and Retirement Study, Male 65+

% demented (Male 65+)

	edu 0-11 yrs				edu 12 yrs				edu 13-15 yrs				edu 16+ yrs			
	2000		2010		2000		2010		2000		2010		2000		2010	
Age	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)
65-69	14.3	(11 , 17.6)	9.4	(4.8 , 14)	3.1	(1.5 , 4.7)	1.9	(0.3 , 3.5)	2.6	(0.6 , 4.6)	1.9	(-0.1 , 3.9)	2.0	(0.5 , 3.5)	0.7	(-0.4 , 1.7)
70-74	14.6	(11.1 , 18.1)	12.9	(9 , 16.8)	3.0	(1.1 , 4.9)	2.9	(1.3 , 4.6)	5.1	(1.8 , 8.4)	2.1	(0.2 , 4)	0.8	(-0.3 , 1.8)	1.9	(0.3 , 3.5)
75-79	20.2	(15.9 , 24.4)	18.5	(13.7 , 23.2)	6.4	(3.4 , 9.4)	8.2	(5.1 , 11.2)	8.5	(4.1 , 12.8)	6.5	(2.5 , 10.5)	1.6	(-0.2 , 3.3)	2.0	(0.1 , 3.9)
80-84	25.9	(20.1 , 31.7)	17.5	(11.5 , 23.4)	14.6	(9.4 , 19.9)	11.0	(6.3 , 15.7)	6.9	(1.6 , 12.3)	6.3	(1.5 , 11)	6.4	(1.2 , 11.5)	7.0	(3.2 , 10.8)
85-89	38.5	(30.6 , 46.5)	36.8	(27.6 , 46)	19.3	(10.3 , 28.3)	18.7	(10.4 , 26.9)	17.3	(6 , 28.6)	11.8	(4.1 , 19.5)	9.9	(1.4 , 18.4)	7.2	(2 , 12.5)
90+	50.3	(37.5 , 63)	37.4	(24.9 , 49.8)	10.7	(-1 , 22.3)	26.3	(10.2 , 42.3)	37.3	(7.4 , 67.3)	22.5	(6.5 , 38.6)	15.5	(0 , 31)	12.8	(2 , 23.5)

%CIND (Male 65+)

	edu 0-11 yrs				edu 12 yrs				edu 13-15 yrs				edu 16+ yrs			
	2000		2010		2000		2010		2000		2010		2000		2010	
Age	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)
65-69	27.6	(23.4 , 31.8)	33.9	(26.4 , 41.4)	11.5	(8.5 , 14.5)	13.6	(9.5 , 17.7)	8.5	(4.9 , 12.1)	9.2	(4.9 , 13.5)	4.2	(2.1 , 6.4)	2.4	(0.5 , 4.3)
70-74	37.6	(32.8 , 42.4)	31.3	(25.9 , 36.7)	22.2	(17.5 , 26.8)	17.9	(14.2 , 21.6)	19.5	(13.6 , 25.5)	11.5	(7.2 , 15.7)	6.7	(3.6 , 9.8)	5.9	(3.2 , 8.6)
75-79	35.8	(30.7 , 40.9)	33.4	(27.6 , 39.1)	27.0	(21.5 , 32.5)	23.3	(18.6 , 28)	16.1	(10.3 , 22)	19.4	(13 , 25.8)	9.2	(5.1 , 13.3)	11.6	(7.4 , 15.9)
80-84	37.7	(31.3 , 44.1)	41.6	(33.8 , 49.3)	29.3	(22.5 , 36)	25.5	(18.9 , 32.1)	25.8	(16.6 , 35)	30.8	(21.7 , 39.8)	18.4	(10.2 , 26.5)	20.0	(14.1 , 25.9)
85-89	36.8	(28.9 , 44.6)	37.7	(28.4 , 46.9)	35.8	(24.8 , 46.7)	40.4	(30 , 50.7)	29.2	(15.6 , 42.8)	41.5	(29.8 , 53.2)	26.9	(14.2 , 39.5)	28.3	(19.2 , 37.4)
90+	33.9	(21.8 , 46)	46.7	(33.9 , 59.6)	34.2	(16.3 , 52)	39.6	(21.8 , 57.4)	22.3	(-3.5 , 48)	27.4	(10.2 , 44.5)	35.0	(14.6 , 55.4)	41.6	(25.7 , 57.4)

% in Good Condition (Male 65+)

	edu 0-11 yrs				edu 12 yrs				edu 13-15 yrs				edu 16+ yrs			
	2000		2010		2000		2010		2000		2010		2000		2010	
Age	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)
65-69	58.1	(53.5 , 62.8)	56.7	(48.8 , 64.5)	85.4	(82.1 , 88.7)	84.6	(80.2 , 88.9)	88.9	(84.9 , 92.9)	88.9	(84.3 , 93.6)	93.8	(91.2 , 96.4)	96.9	(94.7 , 99.1)
70-74	47.8	(42.9 , 52.8)	55.8	(50 , 61.6)	74.9	(70 , 79.8)	79.2	(75.2 , 83.1)	75.4	(68.9 , 81.8)	86.4	(81.9 , 91)	92.6	(89.3 , 95.8)	92.2	(89.1 , 95.3)
75-79	44.0	(38.7 , 49.3)	48.2	(42.1 , 54.3)	66.6	(60.7 , 72.4)	68.5	(63.3 , 73.7)	75.4	(68.6 , 82.2)	74.1	(67 , 81.2)	89.2	(84.8 , 93.6)	86.4	(81.8 , 90.9)
80-84	36.4	(30 , 42.8)	41.0	(33.3 , 48.7)	56.1	(48.7 , 63.5)	63.5	(56.2 , 70.8)	67.3	(57.4 , 77.1)	62.9	(53.5 , 72.4)	75.2	(66.2 , 84.3)	73.0	(66.4 , 79.5)
85-89	24.7	(17.6 , 31.7)	25.5	(17.2 , 33.9)	44.9	(33.6 , 56.3)	41.0	(30.6 , 51.4)	53.5	(38.6 , 68.4)	46.7	(34.9 , 58.6)	63.3	(49.5 , 77)	64.4	(54.8 , 74.1)
90+	15.8	(6.5 , 25.2)	15.9	(6.5 , 25.3)	55.2	(36.4 , 73.9)	34.2	(16.9 , 51.5)	40.4	(10 , 70.8)	50.1	(30.9 , 69.3)	49.4	(28 , 70.8)	45.7	(29.6 , 61.7)

Table S2: Distribution of Cognitive State in 2000 and 2010: Health and Retirement Study, Female 65+

% demented (Female 65+)

| | edu 0-11 yrs | | | | edu 12 yrs | | | | edu 13-15 yrs | | | | edu 16+ yrs | | | |
| | 2000 | | 2010 | | 2000 | | 2010 | | 2000 | | 2010 | | 2000 | | 2010 | |
Age	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)
65-69	8.3	(5.9, 10.7)	10.4	(6.8, 14.1)	1.4	(0.5, 2.3)	1.1	(0.1, 2)	2.1	(0.5, 3.7)	1.4	(0.1, 2.8)	0.9	(-0.2, 2.1)	0.3	(-0.4, 1)
70-74	16.6	(12.9, 20.3)	9.4	(6.5, 12.3)	2.7	(1.3, 4)	3.4	(2, 4.9)	0.6	(-0.4, 1.6)	1.6	(0.2, 2.9)	4.0	(1.1, 7)	2.0	(0.3, 3.8)
75-79	24.7	(20.5, 28.9)	16.8	(12.6, 21)	6.4	(4.2, 8.6)	6.4	(4.2, 8.5)	4.5	(1.8, 7.1)	4.1	(1.6, 6.6)	5.4	(1.6, 9.2)	4.5	(1.6, 7.4)
80-84	30.1	(25.4, 34.7)	32.0	(25.7, 38.3)	13.2	(9.6, 16.8)	12.0	(8.5, 15.5)	14.2	(8.7, 19.7)	5.2	(1.8, 8.6)	8.3	(2.8, 13.9)	9.1	(3.9, 14.3)
85-89	35.4	(29.8, 40.9)	46.0	(38.5, 53.5)	26.0	(19.4, 32.6)	23.5	(17.9, 29.1)	25.0	(15.7, 34.3)	19.2	(12.1, 26.3)	21.3	(9.8, 32.8)	11.3	(4.1, 18.6)
90+	61.4	(53.9, 69.0)	53.4	(45.2, 61.6)	46.9	(34.2, 59.6)	30.1	(22.2, 37.9)	37.2	(24.7, 49.8)	32.6	(22.1, 43.1)	36.7	(20.7, 52.6)	28.1	(13.6, 42.6)

%CIND (Female 65+)

| | edu 0-11 yrs | | | | edu 12 yrs | | | | edu 13-15 yrs | | | | edu 16+ yrs | | | |
| | 2000 | | 2010 | | 2000 | | 2010 | | 2000 | | 2010 | | 2000 | | 2010 | |
Age	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)
65-69	25.9	(22.1, 29.7)	30.9	(25.4, 36.4)	7.5	(5.5, 9.6)	10.1	(7.3, 12.8)	6.3	(3.7, 9)	7.1	(4.2, 10)	3.4	(1.2, 5.6)	1.3	(-0.1, 2.7)
70-74	34.6	(29.9, 39.4)	30.5	(25.9, 35.1)	15.6	(12.5, 18.7)	13.9	(11.2, 16.7)	8.0	(4.5, 11.5)	7.9	(5, 10.9)	7.9	(3.9, 11.9)	4.6	(1.9, 7.2)
75-79	28.0	(23.6, 32.3)	33.5	(28.2, 38.8)	20.7	(17, 24.3)	16.4	(13.1, 19.7)	17.8	(12.8, 22.8)	18.0	(13.2, 22.8)	9.9	(4.9, 14.9)	8.9	(4.9, 12.8)
80-84	32.4	(27.6, 37.1)	34.8	(28.4, 41.3)	25.2	(20.6, 29.8)	18.4	(14.2, 22.6)	16.4	(10.5, 22.2)	20.1	(13.9, 26.2)	19.2	(11.3, 27.2)	12.7	(6.7, 18.6)
85-89	40.6	(34.9, 46.4)	32.0	(24.9, 39)	26.5	(19.8, 33.1)	33.3	(27.1, 39.6)	29.3	(19.5, 39)	33.7	(25.2, 42.2)	29.6	(16.8, 42.4)	35.6	(24.7, 46.5)
90+	26.4	(19.6, 33.3)	30.6	(23, 38.1)	37.0	(24.7, 49.3)	35.6	(27.4, 43.8)	40.5	(27.7, 53.2)	29.0	(18.8, 39.1)	35.5	(19.6, 51.3)	34.5	(19.2, 49.8)

% in Good Condition (Female 65+)

| | edu 0-11 yrs | | | | edu 12 yrs | | | | edu 13-15 yrs | | | | edu 16+ yrs | | | |
| | 2000 | | 2010 | | 2000 | | 2010 | | 2000 | | 2010 | | 2000 | | 2010 | |
Age	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)
65-69	65.8	(61.7, 69.9)	58.7	(52.8, 64.6)	91.1	(88.9, 93.2)	88.9	(86, 91.7)	91.6	(88.5, 94.6)	91.5	(88.3, 94.6)	95.7	(93.2, 98.2)	98.4	(96.9, 100)
70-74	48.8	(43.8, 53.8)	60.1	(55.3, 65)	81.8	(78.5, 85.1)	82.7	(79.7, 85.7)	91.4	(87.8, 95.1)	90.5	(87.3, 93.7)	88.0	(83.2, 92.9)	93.4	(90.3, 96.5)
75-79	47.4	(42.5, 52.2)	49.7	(44.1, 55.3)	72.9	(68.9, 76.9)	77.3	(73.5, 81)	77.8	(72.4, 83.1)	77.9	(72.8, 83)	84.7	(78.7, 90.8)	86.6	(81.9, 91.4)
80-84	37.6	(32.7, 42.5)	33.2	(26.8, 39.5)	61.6	(56.4, 66.7)	69.6	(64.7, 74.6)	69.5	(62.2, 76.7)	74.8	(68.1, 81.4)	72.5	(63.5, 81.4)	78.3	(70.8, 85.7)
85-89	24.0	(19.0, 29.0)	22.0	(15.7, 28.3)	47.6	(40.1, 55.1)	43.2	(36.6, 49.8)	45.7	(35, 56.5)	47.1	(38.1, 56.1)	49.1	(35.1, 63.1)	53.1	(41.7, 64.4)
90+	12.2	(7.1, 17.2)	16.0	(10, 22.1)	16.1	(6.7, 25.5)	34.4	(26.2, 42.5)	22.3	(11.5, 33.1)	38.5	(27.6, 49.3)	27.8	(13, 42.7)	37.4	(21.8, 53)