The Role of Health and Health Behaviors in Determining Survivorship among the U.S. Oldest Old

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REVES-Conference

Havana, Cuba

May 20, 2010

Background

- Moderate and high levels of non-occupational physical activity associate with reduced incidence of disability, increased likelihood of recovery from disability, and greater gains in disability-free years (Nusselder el at. 2008).

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- High levels of physical activity associate with gains in total and CVD-free life expectancy (Nusselder el at. 2009, Franco et al. 2005).

- Moderate and high levels of physical activity increased life expectancy without diabetes and decreased length of time with the disease (Jonker el at. 2006).

Purpose

- In this paper we examine how socioeconomic status, demographic characteristics, and health behaviors are associated with oldest-old mortality and survivorship among people who have survived to old age in the U.S.

Data

- National Health Interview Survey (NHIS).
    - Health Promotion and Disease Prevention Supplement in 1990-1991.
    - 16,521 adults aged 65 years and older.

- Mortality follow-up through Dec. 2002.
    - 8,522 deaths.

Measures

- "Activity Limitation:" Coded yes if unable to perform or limited in major activity, and if limited in other activities.

- "Exercise:" Coded yes if engaged in any of the following activities in the prior two weeks: walk, jog, golf, play tennis, garden, aerobics, bowl, bike, or swim.

- Education (3 categories): less than high school (less than 12 years), high school (12 years), and college or more (13+ years).

Methods

- Step 1: Characterize the health and health behavior profiles of individuals by age.

- Step 2: Use a Poisson log-linear model (proportional hazard model) to estimate the hazard of death.

- Step 3: Construct life tables by socioeconomic and demographic variables.

Sample Distribution of Activity Limitation and Exercise Status by Age and Sex: NHIS

Age	Women No Limitation	Limitation	Total	Men No Limitation	Limitation	Total
			Exercisers			
65-69	1304	569	1873	955	475	1430
70-74	1282	392	1674	858	306	1164
75-79	818	275	1093	448	177	625
80-84	430	202	632	253	123	376
85-89	142	112	254	71	50	121
90-94	26	19	45	23	10	33
95-+	2	2	4	1	5	6
Total	4004	1571	5575	2609	1146	3755
			Non-Exercisers			
65-69	648	543	1191	315	285	600
70-74	593	517	1110	298	251	549
75-79	627	566	1193	262	217	479
80-84	383	508	891	172	158	330
85-89	222	277	499	68	54	122
90-94	47	113	160	10	18	28
95-+	8	24	32	3	4	7
Total	2528	2548	5076	1128	987	2115

Activity Limitation among Exercisers and Non-Exercisers by Age and Sex
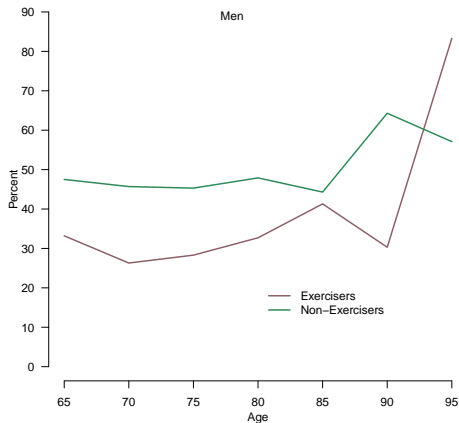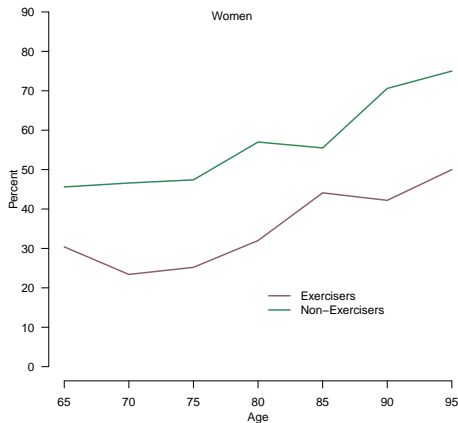
Deaths and Person-Years by Sex

		Women			Men	
Age	Deaths	Person-yrs	Death rate	Deaths	Person-yrs	Deaths
65-69	152	9065	16.8	159	6042	26.3
70-74	553	22210	24.9	540	13559	39.8
75-79	1073	27449	39.1	872	14771	59.0
80-84	1210	20867	57.9	843	9488	88.8
85-89	1148	12272	93.5	614	4381	140.1
90-94	711	4963	143.2	268	1331	201.3
95-+	282	1443	195.4	56	299	186.9

Estimated hazard of death from a Poisson model

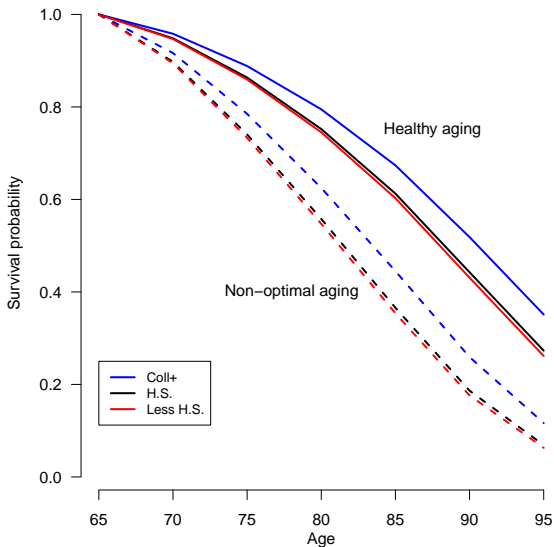| Covariate	Hazard rate
Age (ref=65-69)	
70-74	1.77***
75-79	2.60***
80-84	3.85***
85-89	6.08***
90-94	8.85***
95-+	10.83***
Sex (ref=women)	1.60***
Education (ref=less HS)	
High school	0.97
College+	0.78***
Activity limitation	1.61***
Exercise	0.79***

Estimated Life Expectancy by Level of Education for Women
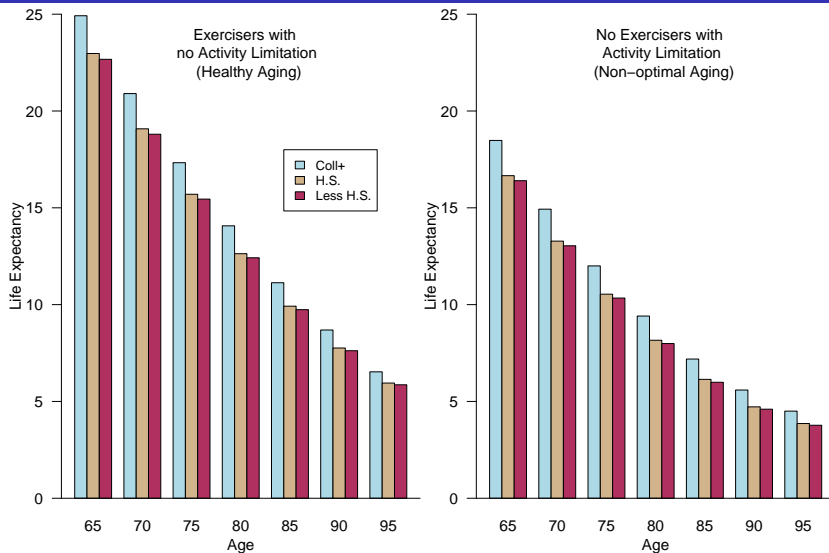
Estimated Life Expectancy by Level of Education for Men
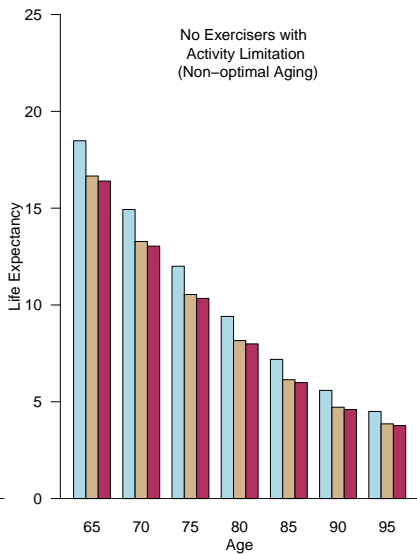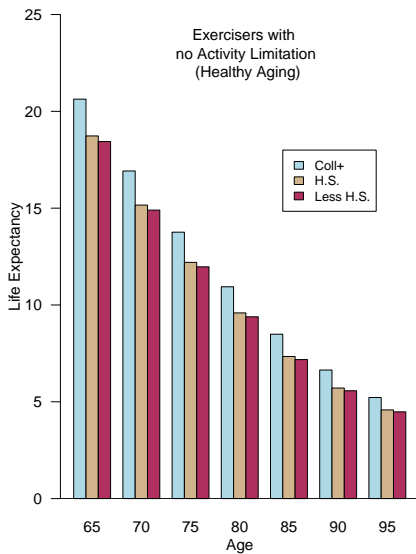
Estimated Survival Curves by Level of Education for Women
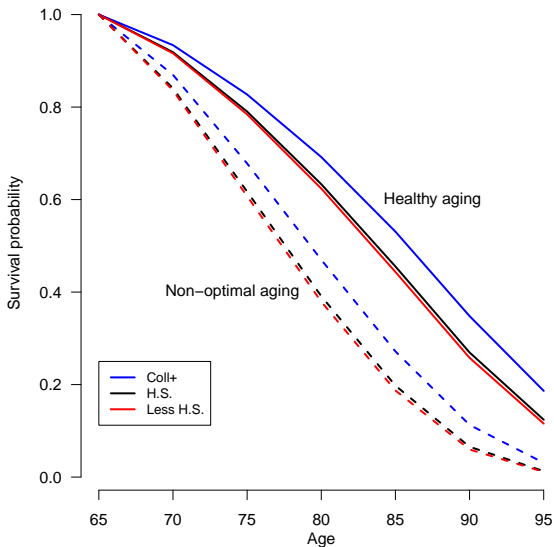
Conclusion

- Activity limitation and exercising status play an important role in survival to old age.

- Having an activity limitation and not exercising reduces life expectancy regardless of level of education: a difference of about 6 years in life expectancy between exercisers with no limitation and non-exercisers with limitation for each level of education.

Conclusion

- Remaining active and engaging in physical activity increases the likelihood of survival into old age for all levels of education: about 50% of a hypothetical cohort of exercisers with no limitation aged 65 will survive to at least age 84 regardless of level of education.

Future direction

- This analysis only considers the prevalence of activity limitation and exercise, future work will include the study of incidence to assess changes in status by age.

- Current analysis uses large nationally representative U.S. health survey, but time varying information on health and health behaviors not available, longitudinal national data are needed.