Summer School 2016
Demography of Health and Education

Health Expectancy Research based on Nihon University Longitudinal Study of Aging

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Outline of talk

- Health expectancy: overview
  - Concept of health expectancy
  - Concept of health
  - Measures of health expectancy
  - Methods of computing health expectancy
- Nihon University Longitudinal Study of Aging
- Prevalence based example
- Prevalence based example with panel data
- Incidence based example
- Incidence based example with more covariates

Health Expectancy: Overview

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The methods and materials of health expectancy

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http://content.iospress.com/articles/statistical-journal-of-the-iaos/sji00840

Health Expectancy in Policy

- EU: EuroStat--Healthy life years as indicator of population health
- EU: Target for a two-year increase in healthy life years at birth from 2010 to 2020
- USA: First appeared in "Healthy People 2000" as one of priorities and continued in "Healthy People 2010" and "Healthy People 2020"
- Japan: First priority to increase health expectancy for the next decades in the health promotion guideline released in 2012 by the Ministry of Health Labour and Wwlfare

Health Expectancy: Definition

Life Expectancy = Healthy Life Expectancy
+ Unhealthy Life Expectancy
(Health Expectancy)

86 Years of Life = 82 Years of Healthy Years
+ 4 Years of Unhealthy Years

- 4 years of unhealthy years do not mean the last 4 consecutive years of life.
- Health states can be more than 2 categories

Definition of Health

- WHO: Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.

- Many measures of health expectancy

Health Related Classifications

- ICD: International Classification of Disease
  - 10th edition
- ICIDH: International Classification of Impairments, Disabilities, and Handicaps
  - Second edition of ICIDH was endorsed at the 54th World Health Assembly with the title International Classification of Functioning, Disability and Health (in short ICF) in May 2001

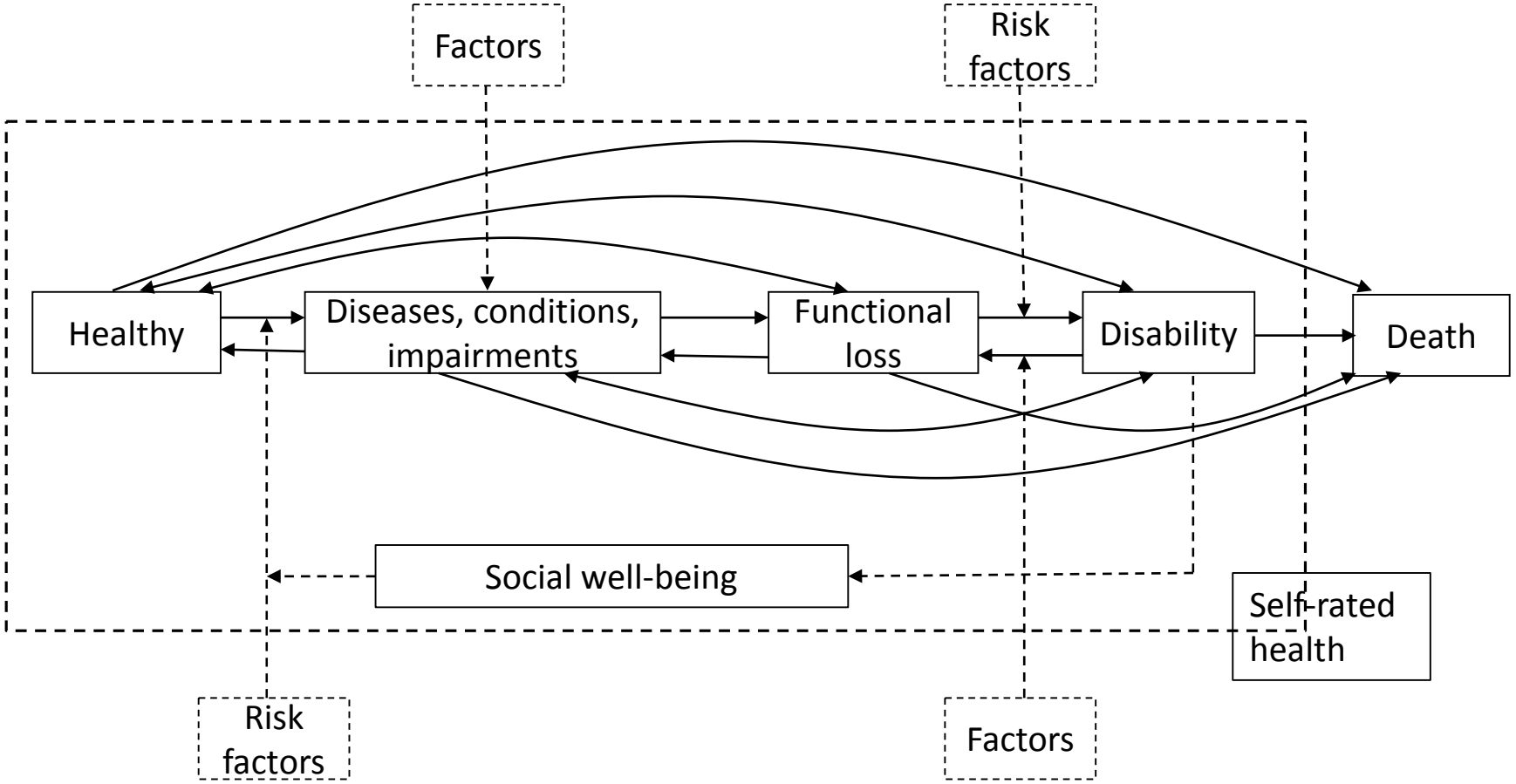
ICF

- The ICF puts the notions of ‘health’ and ‘disability’ in a new light. It acknowledges that every human being can experience a decrement in health and thereby experience some degree of disability. Disability is not something that only happens to a minority of humanity. The ICF thus ‘mainstreams’ the experience of disability and recognizes it as a universal human experience. By shifting the focus from cause to impact it places all health conditions on an equal footing allowing them to be compared using a common metric – the ruler of health and disability. Furthermore ICF takes into account the social aspects of disability and does not see disability only as a 'medical' or 'biological' dysfunction. By including Contextual Factors, in which environmental factors are listed ICF allows to records the impact of the environment on the person's functioning.

5 Dimensions of Physical/Mental Health

- Healthy
- Diseases, Conditions, and Impairments:
  - stroke, dementia, depression, pain, amputated leg
- Functioning loss:
  - walking, hearing, vision
- Disability:
  - ability to perform personal activities, independent living, work
- Death

Health States and Health Transitions



Measures of Health Expectancy

- disease prevalence
- bed-disability
- self-rated health
- Activity of Daily Living (ADL)
- Instrumental Activity of Daily Living (IADL)
- limitation of activities (disability)
- Global Activity Limitation Index (GALI)
- Washington Group's Disability Questions

Self-Rated Health

- self reported subjective measure
- age range: 20+ ?
- Question wording: "Would you say your health in general is"
- "excellent, very good, good, fair or poor" (English speaking countries and Nordic European countries)
- "very good, good, fair, bad or very bad" (EU following WHO recommendation

ADLs and IADLs

- self reported but little more objective
- age range: 50+ ?
- Activities of Daily Living
  - bathing, eating, dressing, walking, toileting
- Instrumental Activities of Daily Living
  - using telephone, managing money, shopping
- response categories: yes/no, some/lot/unable
- Wording: do you have difficulty, can you do, do you need help (vary by culture: eating)

Limitation of Activities

- self reported measure
- age range: ?
- activities can vary by age
  - playing, go to school, work, taking care of oneself
- question used to compute HE in the US and Japan

Global Activity Limitation Index (GALI)

- self reported measure
- based on ICF and measures participation
- age range: 15+ ? (working for younger ages)
- Wording: "For the past 6 months at least, to what extent have you been limited because of a health problem in activities people usually do?"
- Response categories: "not limited" "limited but not severely" "severely limited"

Washington Group's Disability Questions

- self reported measure
- based on ICF and measures functioning
- age range: 5+ ? (working on younger ages)
- short set: 6 questions for census
  - seeing, hearing, walking, cognition, self-care, communication
- long set: for health interview survey, etc.

Health Expectancy & Measures Used

"health states in question"

- self-rated health → healthy life expectancy
- specific disease → stroke-free life expectancy
- impairments → impairments-free life expectancy
- functional limitation→ disability-free life expectancy
- ADL limitation → active life expectancy
- dementia → dementia-free life expectancy

Acronyms of Summary Measure

- Health Expectancy
  - **DFLE**: Disability-Free Life Expectancy
  - **ALE**: Active Life Expectancy
- George W. Torrance (1976, 1987)
  - **QALY**: Quality-Adjusted Life Year
- GBD
  - **DALY**: Disability-Adjusted Life Year
  - **HALE**: Health-Adjusted Life Expectancy
  - **DALE**: Disability-Adjusted Life Expectancy

Data Sources

- Censuses
- Surveys (cross-section, repeated cross-section, panel, longitudinal)
- Surveillance data (INDEPTH)
- Administrative data (Denmark, LTCI in Japan)
- Registration data (Cancer)

Methods of Computing Health Expectancy

- Prevalence-Based (Sullivan) Method (1971)
- Double Decrement Life Table Method (1983)
- Multistate Life Table Method (1989)
- Grade of Membership (GoM) Approach (1993)
- The Global Burden of Disease Approach (1997)
  - DALY, DALE, HALE
- Microsimulation Method (1995)
- Bayesian Approach (2003)

Sullivan Method

Daniel F. Sullivan

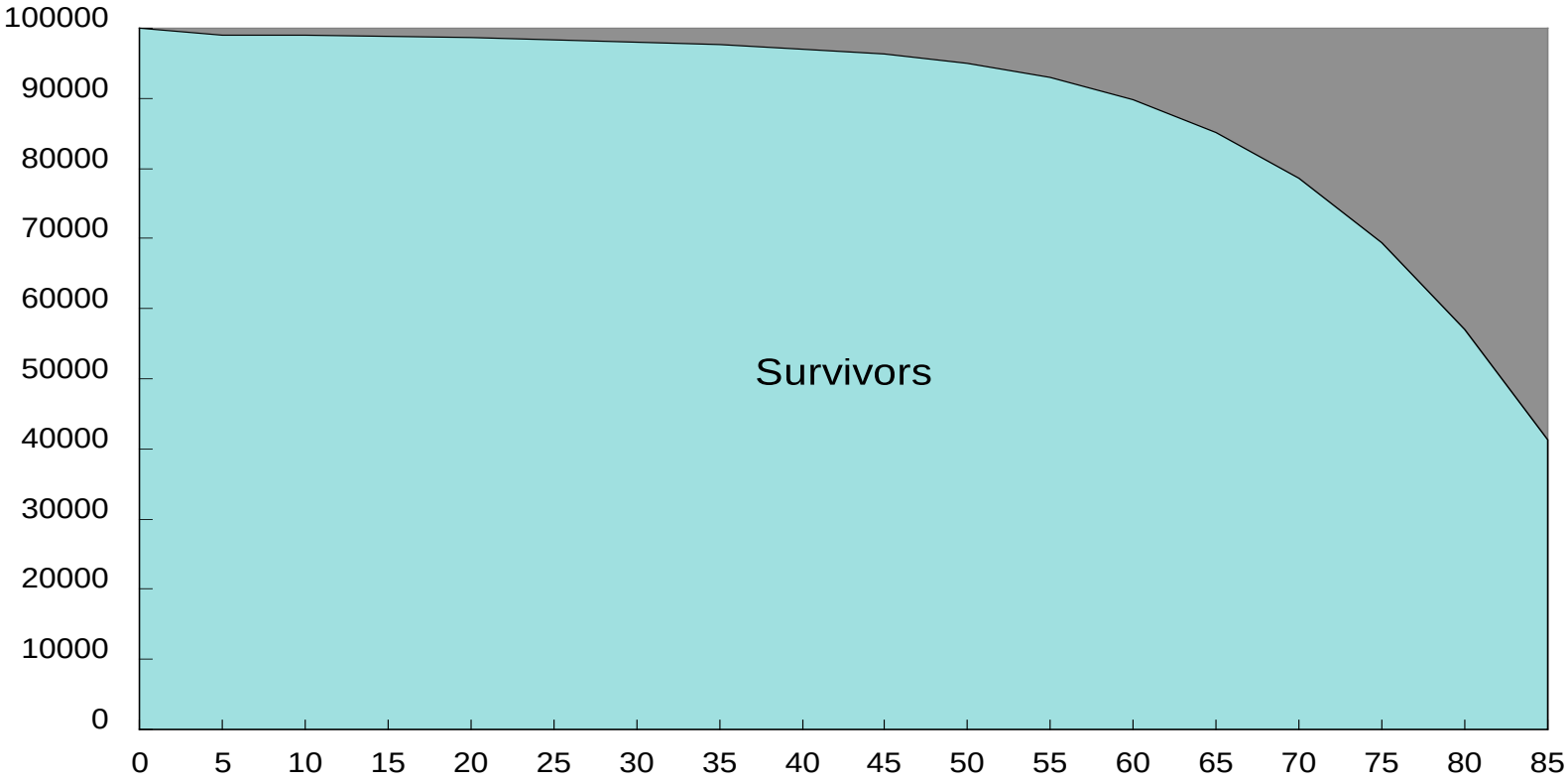
1966: "Conceptual Problems in Developing an Index of Health"

1971: "A Single Index of Mortality and Mobidity"

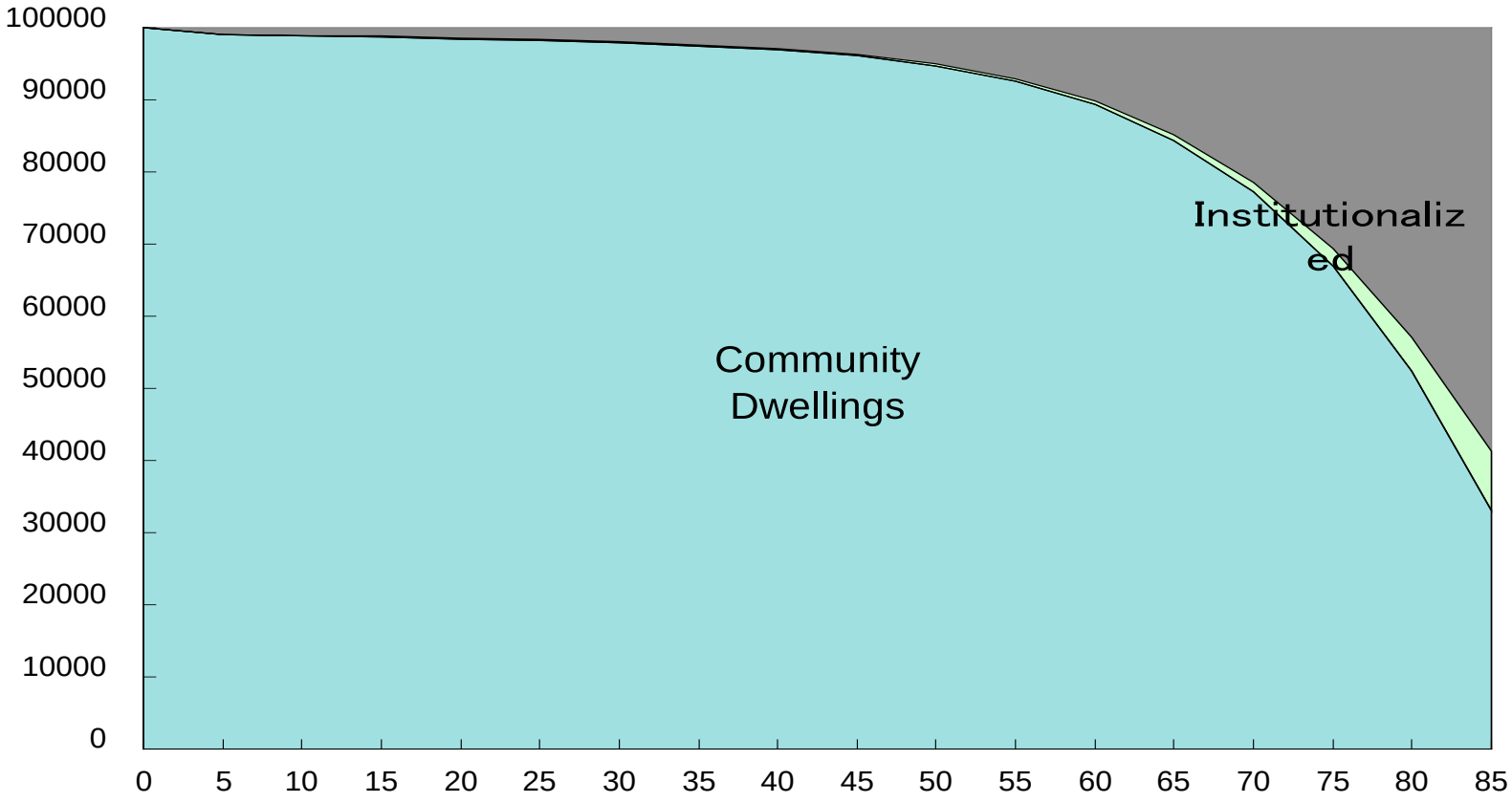
Data: Life Table, Prevalence Rates, Institutionalization Rates

- easy to calculate and collect data
- applied by many countries to compute health expectancy

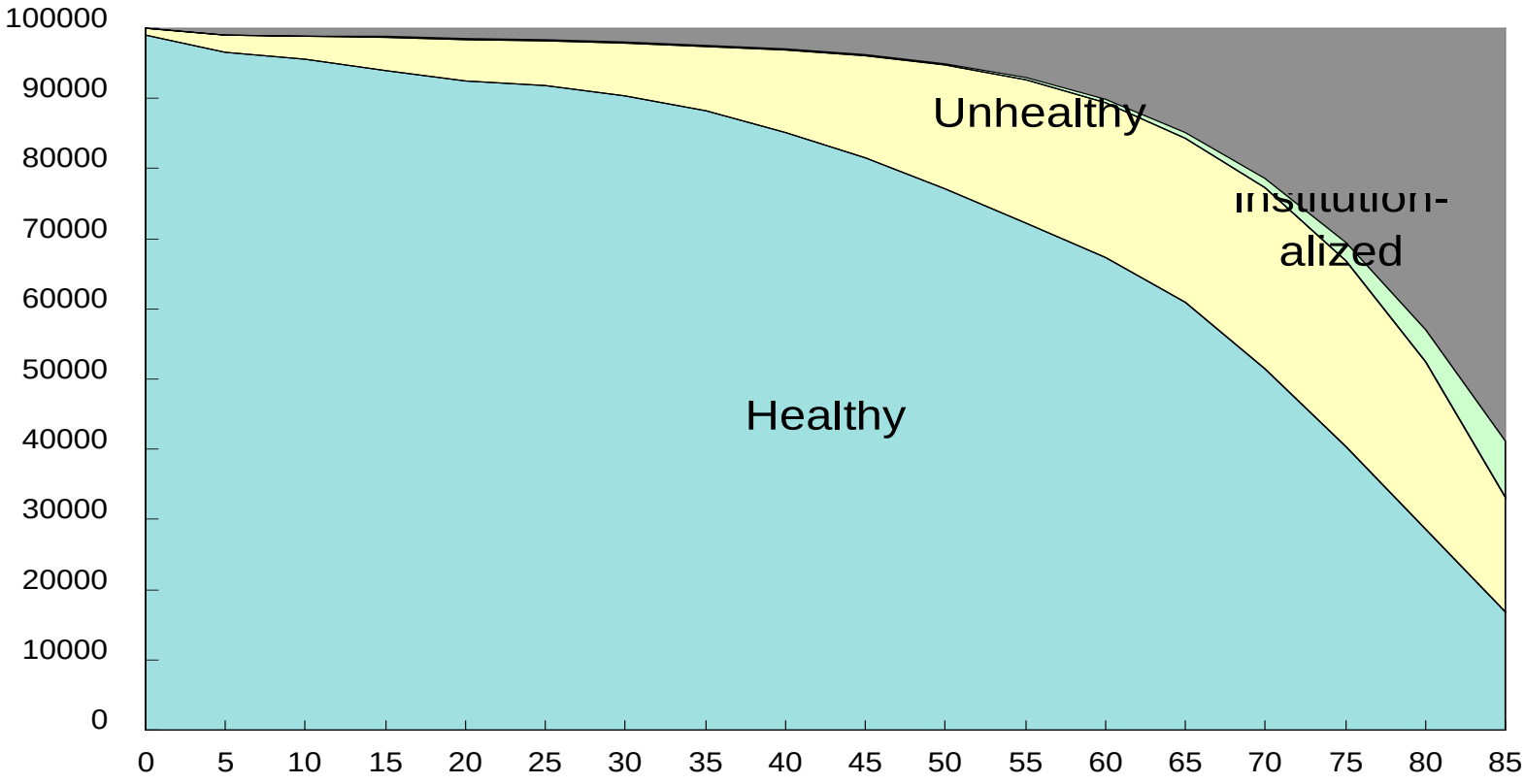
Depiction of Sullivan Method



Depiction of Sullivan Method



Depiction of Sullivan Method



Sullivan Method

e_x (healthy) = T_x (healthy) / l_x

e_x (institutionalized) = T_x (institutionalized) / l_x

e_x (unhealthy) = T_x (unhealthy) / l_x

e_x = e_x (healthy) + e_x (institutionalized)
+ e_x (unhealthy)

Multistate Life Table Method

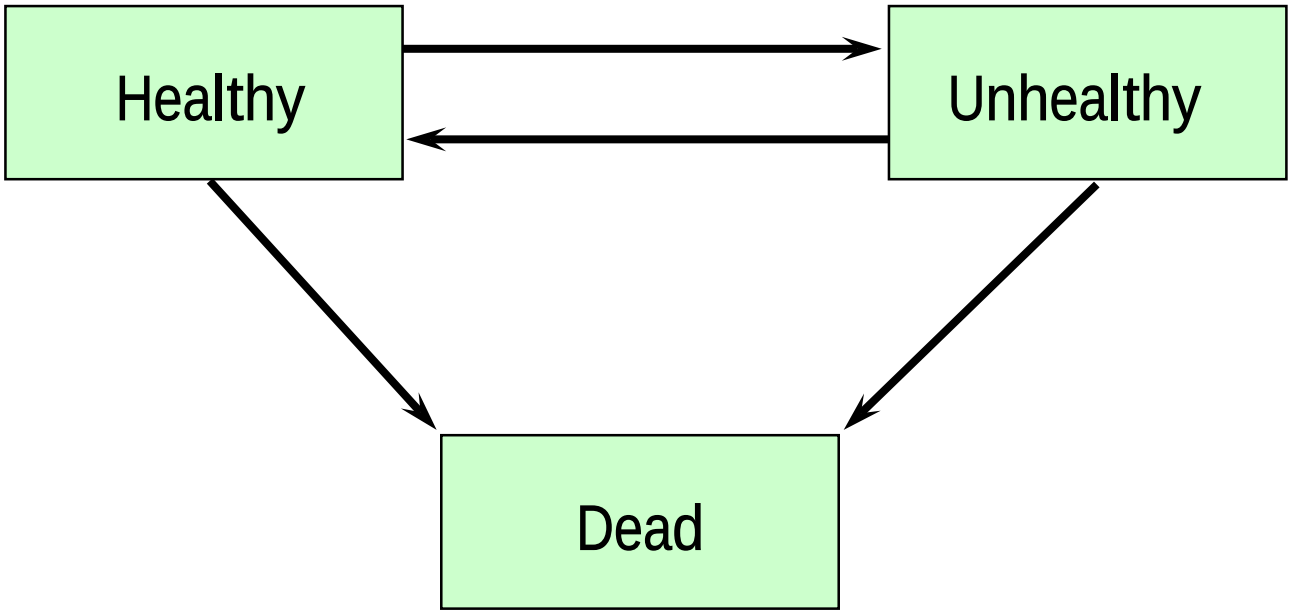
Method existed but applied to Health Expectancy Research by

Rogers A., Rogers R., Branch (1989)

Rogers R., Rogers A., Belanger (1989)

Rogers A., Rogers R., Belanger (1990)

Multistate Life Table Method



Multistate Life Table Method

- Population-Based Method
  - only age is a variable
  - only one radix but need to distribute it by healthy status at the beginning of the age range
- Status-Based Method
  - age and health status are variables
  - can compute life table as many as the number of health status employed

Nihon University Longitudinal Study of Aging

Purpose

- Investigate levels of and changes in health status of Japanese elderly
- Investigate factors affecting health status and changes in health status over time
- Observe effect of long-term care insurance program on attitude toward long-term care
- Collect comparable data to other longitudinal data for cross-national comparisons

NUJLSOA -- Surveys Conducted

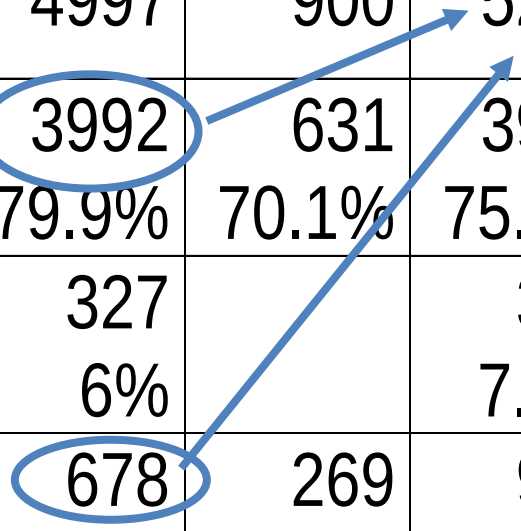
Wave	Main	Follow-up
1	Nov. 1999	Mar. 2000
2	Nov. 2001	Dec. 2001
3	Nov. 2003	Dec. 2003
4	Nov. 2006	Dec. 2006
5	Mar.-Apr 2009	June 2009

Survey Design

- For Wave 1
  - Nationally representative sample of 65 and over
  - Initial sample of 6,700 persons selected by Multi-stage stratified random sampling
  - oversampled those aged 75 and over by factor of 2
  - In-person interview survey using structured survey questionnaire (proxy allowed)
- For later waves
  - Sample refreshing - New sample persons for those age 65 and 66 were added at waves 2 and 3
  - No sample refreshing for waves 4 and 5

Sample Size

	1999	2001 Panel	2001 65-66	2003 Panel	2003 65-66	2006 Panel	2009 Panel
N	6700	4997	900	5242	900	4744	3321
Resp	4997 74.6%	3992 79.9%	631 70.1%	3935 75.1%	572 63.6%	3414 72.0%	2583 77.8%
Dead		327 6%		380 7.2%		477 10.1%	312 9.4%
No Resp	1703 25.4%	678 13.6%	269 29.9%	927 17.7%		853 18.0%	426 12.8%



Question Items in Wave 1

- Demographic attributes
- Family Structure
- Socioeconomic status
- Intergenerational exchange
- Information on Surviving Children's family
- Health behaviors
- Chronic conditions
- Physical functioning (ADL, IADL, NAGI)
- Mental Health
- Vision & Hearing
- Dental Health
- Health Care Utilization
- Housing
- Information Technology
- Living Arrangement

Question Items in Wave 2

Additional Feature

Decedent Interview

- Date of death
- Cause of death
- Place of death
- Medical expenses in the last 6 months prior to death
- Relationship of main caregiver

Additional Questions

- Long-term care insurance system
- CIDI

Question Items in Wave 3

Additional Feature

- survey of survival status of those who did not respond at Wave 1

Additional Questions

- Sleeping disorders
- Restless Leg Syndrome
- Pain
- Stress

Question Items in Wave 4

Additional Feature

- Blood Pressure / Pulse
  - Omron HEM-762
- Anthropometric Measures
  - Waist
  - Leg length
  - Knee height
- Grip strength
  - Tanita

Additional Questions

- Cognitive functioning
  - Immediate word recall
  - Delayed word recall
  - Serial 7
- Anchoring Vignettes
- Health utilization

Question Items in Wave 5

Additional Feature

- Blood Pressure / Pulse
  - Omron HEM-762
- Anthropometric Measures
  - Waist
  - Height
  - Weight
- Grip strength
  - Tanita

Additional Questions

- Cognitive functioning
  - Immediate word recall
  - Delayed word recall
  - Serial 7
- Anchoring Vignettes
- Health utilization

Life expectancy with depression among older adults in Japan & Taiwan: An international comparison

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Chuang-Shen Medical University, Taichung, Taiwan, R.O.C.

Kristen Suthers
U.S. National Institute on Aging

Research Questions

- How does the prevalence of depression among older adults in Japan & Taiwan differ?
- Are there differences in the length of life with depression among older adults in Japan and Taiwan?

Data

- JAPAN: Nihon University Longitudinal Study of Aging (NUJLSOA)
  - Data for this analysis collected: 1999
  - N=4,361
  - % Female= 59%

Data

- TAIWAN: Survey of Health and Living Status of the Middle Aged and the Elderly in Taiwan (SHLSEs) conducted jointly by the Taiwan Provincial Institute of Family Planning (currently the Bureau of Health Promotion, the Executive Yuan, Republic of China) and both Population Studies Center and the Institute of Gerontology at the University of Michigan
  - Data for this analysis collected: 1999
  - N=1,210
  - % Female=54%

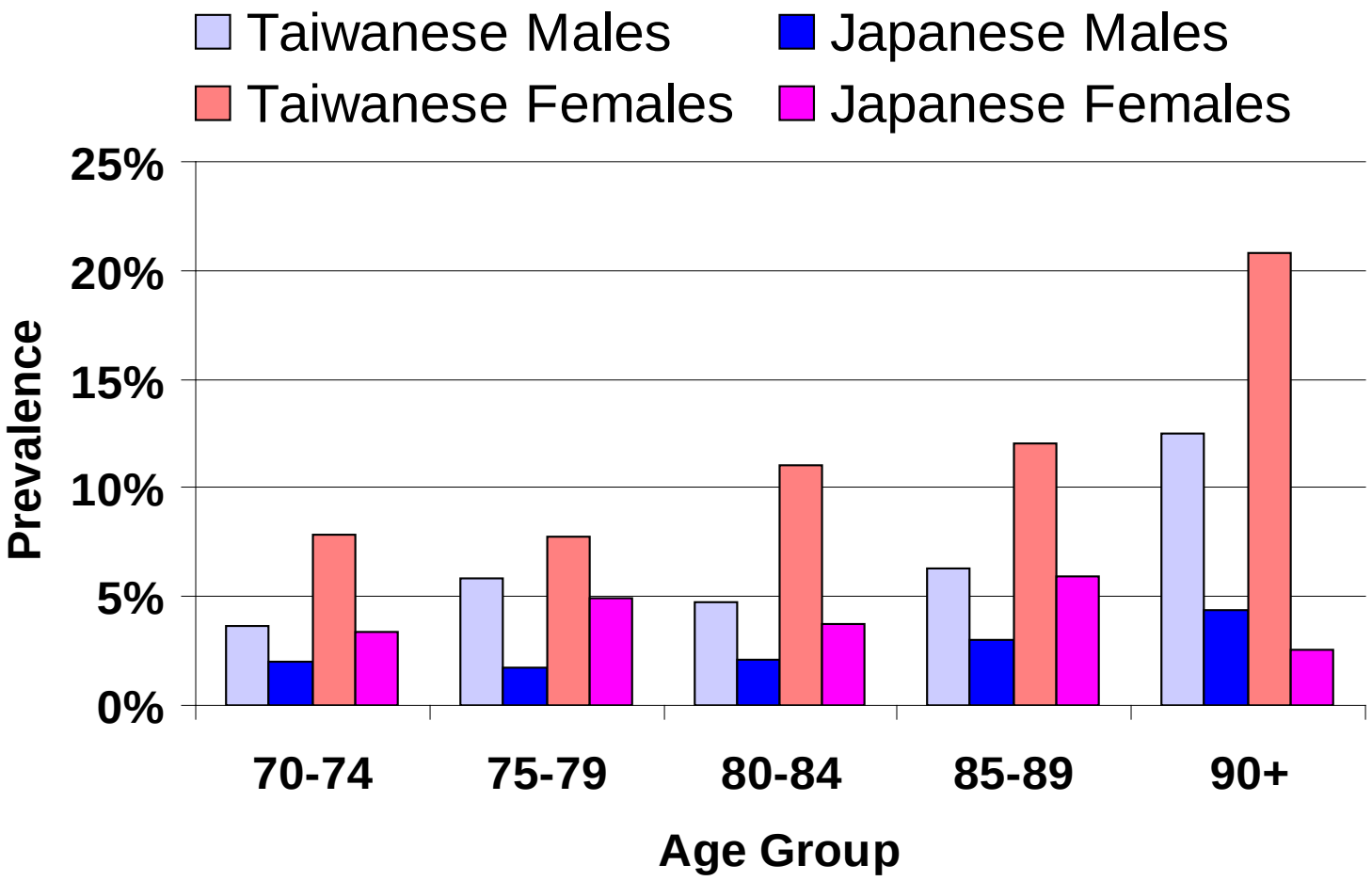
Methods

- To measure depression:
  - CES-D: 10 items common to both surveys
  - A cutoff score of 10 out of a score range of 0-30 was used to define depression in each country.

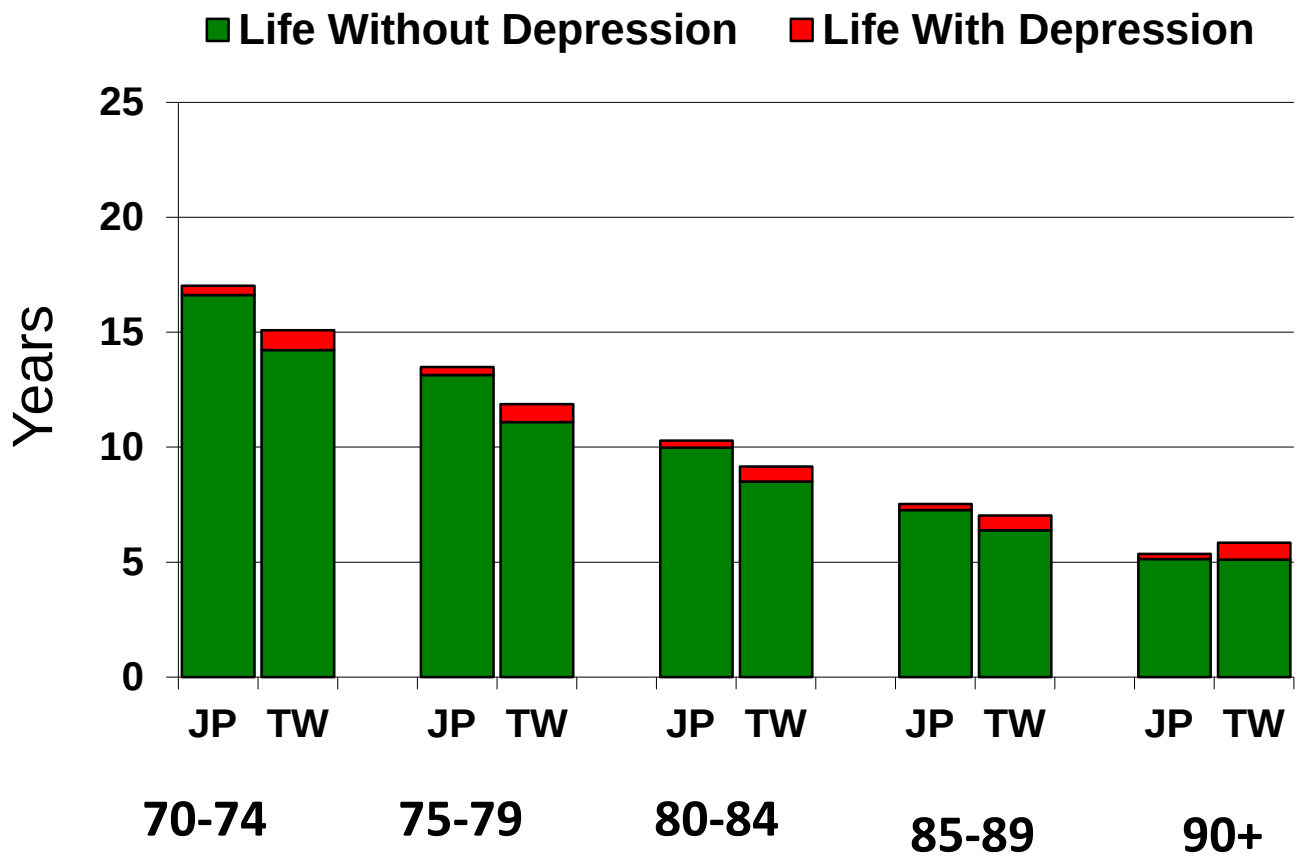
Methods

- Sullivan Method
  - How: Combines the prevalence of cognitive impairment with age-specific mortality rates.
  - Result: Partitions the total life expectancy into years with and without cognitive impairment.

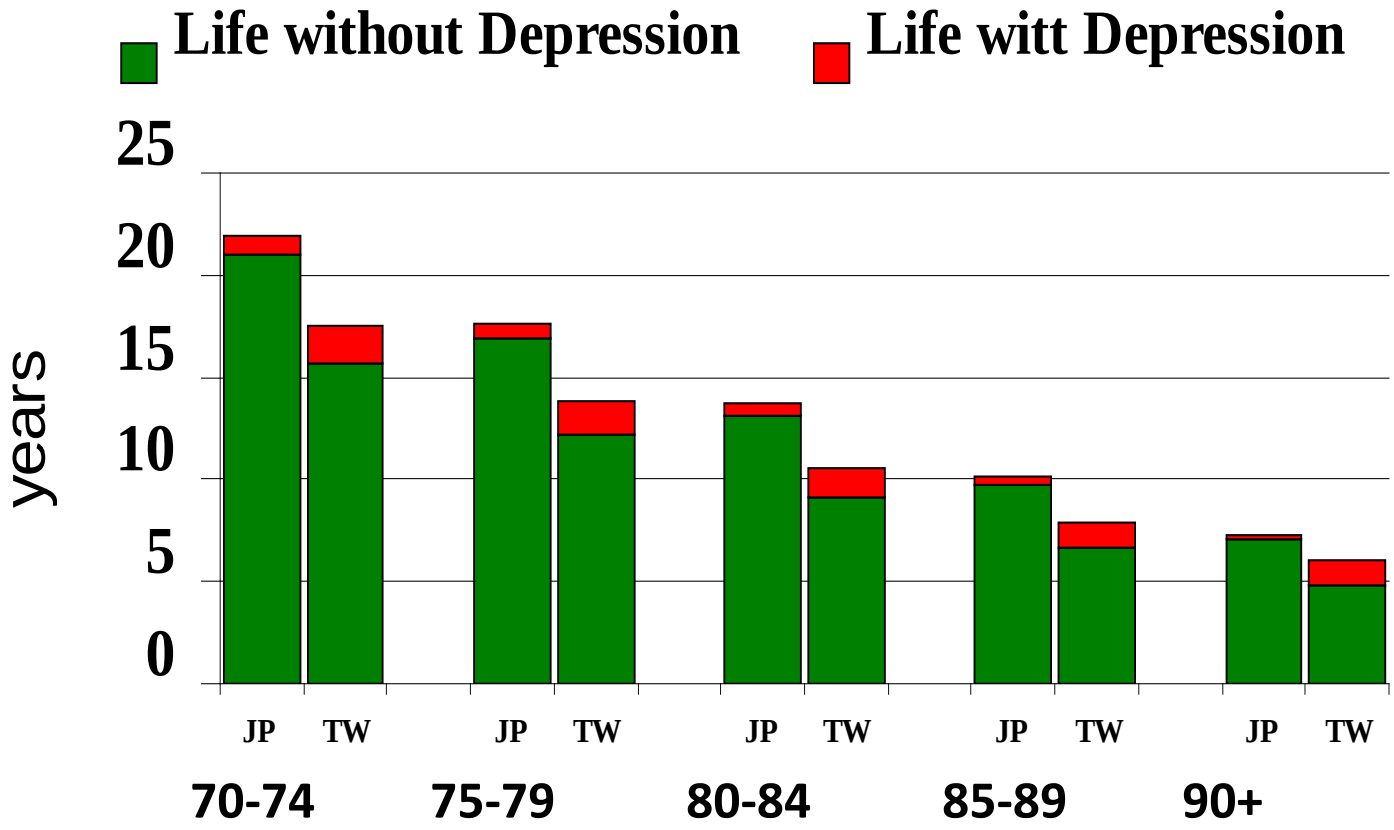
Prevalence of depression in Japan & Taiwan among adults aged 70+ by age & sex.



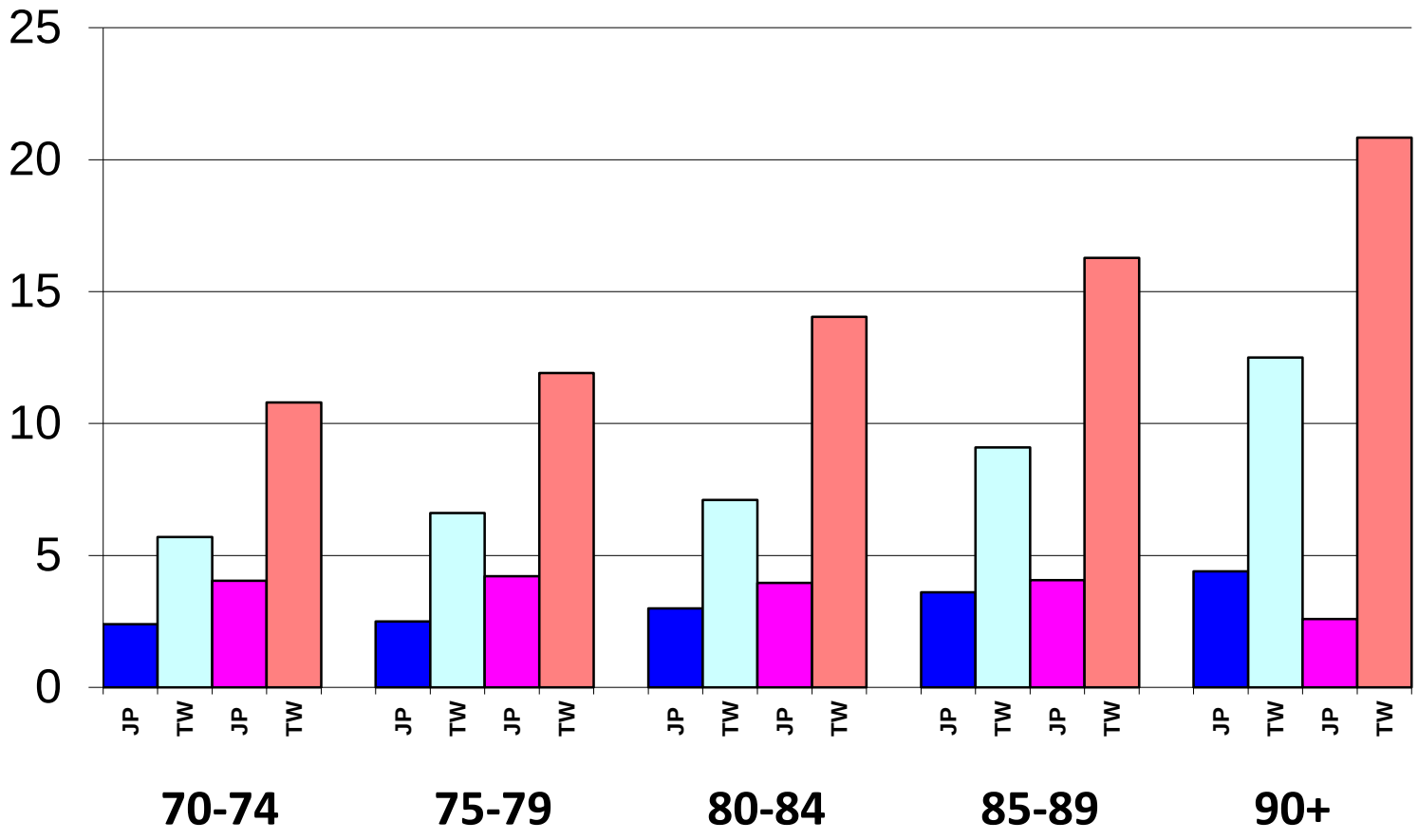
Length of life with and without depression by age group and country: MALES



Length of life with and without depression by age group and country: FEMALES



Proportion of life with depression by age, sex, & country



Summary

- Elderly Japanese have lower plevance of depression for males and females
- In each country, females have higher prevalence of depression except for females 90+
- For females: Life with depresion varies from 0.2-0.4 years for Taiwanese, and 0.6-0.8 in Japanese
- For males: Life with depresion varies from 1.2-2.0 years for Taiwanese, and from 0.2-0.8 years for Japanese
- Taiwanese women have greatest burden ~ length of life with depression relative to total life expectancy is the highest

A Comparison of Educational Differences on Physical Health, Mortality and Healthy Life Expectancy in Japan and the United States

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Mark Hayward, University of Texas at Austin, USA
Yasuhiko Saito, Nihon University, Japan

Journal of Aging and Health, forthcoming

More education is associated with better health

- Compared to groups with low levels of education, well-educated groups have
  - Lower prevalence of most major chronic conditions, impairments, functional problems and disability
  - Lower mortality rates leading to a longer life expectancy
  - Lower disability rates leading to a longer healthy life expectancy

Growing interest in how education is associated with health/mortality

- Conceptually, as education increases, individuals not only have access to more of a particular type of resource that stems from education, but they also have access to more types of resources

- Education thus allows the maximization of life/health chances stemming both from greater levels and numbers of resources

Objectives

- To examine the educational gradient of health and mortality between two wealthy and long-lived populations
  - Japan
    - a wealthy eastern country with the world's leading life expectancy
  - the United States
    - a wealthy western country with a life expectancy that lags behind Japan's

Dataset - JP

- Nihon University Japanese Longitudinal Study of Aging (NUJLSOA)
  - Nationally representative sample of 65+ in Japan
  - N=4,997 (baseline)
  - 1999, 2001, 2003, 2006, 2009 (5 waves)
  - Refreshed in 2001 and 2003 for those aged 65 and 66
  - Oversampled for age 75+
  - Age 65+

Dataset - US

- Health and Retirement Study (HRS)
  - Representative of the U.S. non-institutional population ages 50+ years and their spouses
  - A biennial survey beginning in 1992 (Rand file)
  - The study makes use of 7 waves
    - 1998, 2000, 2002, 2004, 2006, 2008, and 2010
  - Age 65+

Measures

- Mortality
  - NUJLSOA
    - Mortality is identified at follow-up from family members, neighbor, etc.
  - HRS
    - Mortality is identified by
      - NDI (National Death Index), and
      - through tracking of respondents

Measures

- Functional limitation
  - Restrictions in an individual's physiological ability to perform fundamental physical actions
  - Indicate overall abilities of the body to do purposeful work
  - Less sensitive to social roles and environmental demands
  - 6 NAGI items
    - sitting for about two hours; climbing one flight of stairs without resting; stooping, kneeling, or crouching; reaching or extending your arms above shoulder level; lifting or carrying weights over 10 pounds, like a heavy bag of groceries; picking up a dime from a table.

Measures

- Disability
  - Gap between personal capability and environmental demands
    - Disability can be mitigated at either side
  - Outcome of functional limitations and environmental demands in the disablement process
  - Refers to whether a person can live independently or provide self care
  - Measured by difficulties with activities of daily living (ADLs) in this study and ADLs are necessary for survival
  - 6 activities of daily living (ADLs: dressing, bathing, eating, bedding, walking and toileting)

Measures

- Ailments (chronic conditions)
  - Different chronic conditions can impact the disablement process in different ways
  - 5 major chronic conditions
    - Diabetes, heart problems, stroke, cancer, and chronic lung diseases
      - Not include hypertension and arthritis

Measures

- Education
  - Measures in the survey
    - Years of formal schooling
    - Levels of educational attainment
  - Japan: 0-9, 10-11, 12+ years
    - High school graduates and high school dropouts
      - occupations, income, health behaviors, and health.
  - USA: 0-11, 12, 13+ years

Healthy/Unhealthy

- Unhealthy:
  - Have difficulty performing any one of the 6 ADLs
  - Have difficulty performing any one of the 6 NAGI items
  - Ever have any one of the 5 major chronic conditions
- Healthy
  - Have no difficulty performing all 6 ADLs
  - Have no difficulty performing all 6 NAGI items
  - Never have all 5 major chronic conditions

Methods

- All-cause mortality rates
  - Gompertz hazard model
    - Age and education as covariates
    - Stratify by sex for each country

$$\ln m(t, Edu) = \beta_0 + \beta_1 \cdot t + \beta_2 \cdot Edu\_year$$

$$\ln m(t, Edu) = \beta_0 + \beta_1 \cdot t + \beta_2 \cdot Edu\_Middle + \beta_3 \cdot Edu\_High$$

$$m(t, Edu) = \lim_{\Delta t \to 0} \frac{\Pr\left(t \leq T \leq t + \Delta t | T \geq t, Edu\right)}{\Delta t}$$

Methods

- Prevalence probability
  - Logistic regression
    - Age and education as covariates
    - Stratify by sex for each country

$$\ln\left(\frac{\pi}{1-\pi}\right) = \beta_0 + \beta_1 \cdot t + \beta_2 \cdot t^2 + \beta_3 \cdot Edu\_year$$

$$\ln\left(\frac{\pi}{1-\pi}\right) = \beta_0 + \beta_1 \cdot t + \beta_2 \cdot t^2 + \beta_3 \cdot Edu\_Middle + \beta_4 \cdot Edu\_High$$

Methods

- Prevalence-based life tables
  - Sullivan's method
  - Divides total life expectancy into the different health states based on the age-specific prevalence of healthy/unhealthy states
  - Reflects the current health structure of a real population adjusted for age and mortality levels
  - Not using incidence-based life tables

Methods

- Bootstrap technique (n=300)
  - A data resampling method which is used to derive variance estimates when analytic methods are unavailable.
  - Bootstrapping generates repeated calculations of the life table functions by randomly drawing a series of bootstrap samples from the analytic samples.
  - To obtain standard errors for the life table functions.

Sample size

		Men		Women	
Country	Education	n	%	n	%
Japan	Low (0-9)	1,572	55.5	2,290	61.6
	Middle (10-11)	373	13.4	698	20.7
	High (12+)	731	31.0	507	17.7
	Total	2,676	100.0	3,495	100.0
USA	Low (0-11)	2,814	29.5	3,632	29.4
	Middle (12)	2,530	30.0	3,987	37.1
	High (13+)	3,242	40.5	3,483	33.6
	Total	8,586	100.0	11,102	100.0

Regression results – Educ coef

		Mortality		ADL		FL		Ailments	
Sex	Education	Japan	USA	Japan	USA	Japan	USA	Japan	USA
Male	Years	-0.04*	-0.04*	-0.09*	-0.09*	-0.06*	-0.08*	0.01	-0.01*
	(ref=Low)								
	Middle	-0.03	-0.16*	0.13	-0.05*	0.09	0.01	-0.08	0.03
	High	-0.48*	-0.40*	-0.38*	-0.31*	-0.26*	-0.33*	0.10*	-0.09*
Female	Years	-0.01	-0.04*	-0.09*	-0.09*	-0.07*	-0.09*	0.01	-0.05*
	(ref=Low)								
	Middle	-0.17	-0.23*	-0.12*	-0.11*	0.03	-0.05*	-0.01	-0.05*
	High	-0.44*	-0.36*	-0.17*	-0.30*	-0.22*	-0.30*	0.01	-0.19*

Note: intercept and age terms not shown here

Results – Men at 65

	Educ	TLE	ADL			FL			Ailments		
			HLE	ULE	%(hle/tle)	HLE	ULE	%(hle/tle)	HLE	ULE	%(hle/tle)
Japan	Low (0-9)	18.8	16.4	2.4	87.5	11.7	7.1	62.3	9.3	9.5	49.3
		(18.0-19.6)	(15.7-17.2)	(2.1-2.6)	(86.1-88.8)	(11.1-12.3)	(6.6-7.6)	(60.3-64.3)	(8.6-10.0)	(8.9-10.2)	(46.4-52.2)
	Mid (10-11)	19.1	16.9	2.2	88.4	12.1	6.9	63.7	9.5	9.6	49.9
		(17.7-20.5)	(15.6-18.2)	(1.7-2.7)	(85.9-90.9)	(11.0-13.3)	(6.0-7.8)	(59.9-67.5)	(8.3-10.7)	(8.4-10.8)	(44.9-54.8)
	High (12+)	22.8	20.7	2.1	90.7	15.0	7.8	65.9	10.1	12.8	44.1
		(21.1-24.6)	(19.1-22.3)	(1.6-2.6)	(88.7-92.7)	(14.0-16.0)	(6.6-9.0)	(62.5-69.3)	(9.2-11.0)	(11.2-14.3)	(40.5-47.8)
USA	Low (0-11)	15.2	11.5	3.7	75.8	5.3	9.9	34.9	5.2	10.0	34.2
		(14.8-15.6)	(11.2-11.9)	(3.4-3.9)	(74.3-77.3)	(5.0-5.6)	(9.5-10.3)	(33.0-36.8)	(4.9-5.5)	(9.6-10.4)	(32.4-36.0)
	Mid (12)	16.4	13.3	3.1	81.2	6.7	9.7	41.0	5.6	10.8	34.1
		(15.8-17.0)	(12.8-13.8)	(2.9-3.3)	(80.1-82.4)	(6.3-7.1)	(9.2-10.1)	(39.4-42.7)	(5.2-6.0)	(10.2-11.4)	(31.7-36.6)
	High (13+)	18.3	15.4	3.0	83.8	8.9	9.5	48.3	6.6	11.8	35.9
		(17.7-18.9)	(14.8-15.9)	(2.8-3.2)	(82.8-84.7)	(8.5-9.2)	(9.1-9.9)	(47.1-49.6)	(6.2-7.0)	(11.2-12.4)	(33.8-37.9)

Results – Women at 65

			ADL			FL			Ailments		
	Educ	TLE	HLE	ULE	%(hle/tle)	HLE	ULE	%(hle/tle)	HLE	ULE	%(hle/tle)
Japan	Low (0-9)	22.6	18.6	4.0	82.4	9.9	12.7	43.8	12.8	9.8	56.7
		(21.8-23.3)	(18.0-19.3)	(3.6-4.3)	(81.1-83.7)	(9.4-10.4)	(12.0-13.4)	(41.8-45.8)	(12.2-13.4)	(9.1-10.4)	(54.4-58.9)
	Mid (10-11)	24.0	20.6	3.4	85.8	10.9	13.1	45.4	13.3	10.7	55.4
		(22.7-25.3)	(19.5-21.6)	(2.8-4.0)	(83.6-88.0)	(10.2-11.6)	(11.8-14.4)	(42.2-48.6)	(12.3-14.3)	(9.5-11.9)	(51.7-59.1)
	High (12+)	26.4	22.0	4.4	83.3	12.4	14.0	46.9	14.3	12.1	54.2
		(23.4-29.3)	(20.0-23.9)	(2.8-6.0)	(78.8-87.9)	(11.3-13.4)	(11.3-16.7)	(41.8-52.0)	(12.7-15.9)	(9.7-14.4)	(48.9-59.5)
USA	Low (0-11)	18.1	12.0	6.1	66.2	3.9	14.2	21.5	7.2	10.9	39.8
		(17.7-18.5)	(11.6-12.3)	(5.7-6.5)	(64.3-68.0)	(3.6-4.2)	(13.8-14.6)	(19.9-23.1)	(6.8-7.6)	(10.5-11.2)	(38.0-41.6)
	Mid (12)	19.9	14.9	5.0	74.6	5.6	14.3	28.2	9.2	10.8	46.0
		(19.5-20.3)	(14.5-15.2)	(4.8-5.3)	(73.6-75.7)	(5.3-5.9)	(13.9-14.7)	(26.7-29.6)	(8.8-9.5)	(10.5-11.0)	(44.7-47.2)
	High (13+)	21.0	16.0	4.9	76.5	6.7	14.2	32.2	10.3	10.7	49.1
		(20.4-21.5)	(15.6-16.4)	(4.6-5.2)	(75.3-77.7)	(6.4-7.1)	(13.8-14.6)	(30.9-33.5)	(9.8-10.8)	(10.2-11.1)	(47.5-50.8)

Summary

- Education coefficients are similar for both Japan and USA populations
  - It would be very interesting to compare how education can access health related resources and translate them to health and mortality outcomes in Japan and USA.

- Older Japanese have superior mortality and health profiles
  - Older Japanese in the lowest education group have similar(better) TLE to older Americans in the highest education group.
  - Older Japanese in the lowest education group even have better HLE, ULE, %(HLE/TLE) profiles than those of older Americans in terms of ADL, functional limitation and major chronic conditions.

Yong, V., & Saito, Y. (2012). Are there education differentials in disability and mortality transitions and active life expectancy among Japanese older adults? Findings from a 10-year prospective cohort study. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences, 67(3)*, 343–353, doi:10.1093/geronb/gbs029. Advance Access published on March 15, 2012

Are There Education Differentials in Disability and Mortality Transitions and Active Life Expectancy Among Japanese Older Adults? Findings From a 10-Year Prospective Cohort Study

Vanessa Yong and Yasuhiko Saito

Previous Research

- Mainly in Western countries
  - Consistent evidence for a strong association between education and health and mortality
  - Better educated people have:
    - better health; fewer disabilities
    - less likely to transit to worse health; more likely to recover
    - longer lives; more years of active life
  - Regardless of data sets, health measures, analytical methods used; time periods, age groups studied

Few Studies on Asia

- Unclear or mixed findings
  - Japan (Liu et al. 1995)
  - Taiwan (Zimmer et al. 1998)
  - China (Gu & Zeng 2004; Liang et al. 2001)
  - Indonesia (Hidajat et al. 2006; Kaneda & Zimmer 2007)
  - the Philippines (Cruz et al. 2007)
- Mostly did not compute ALE by educational levels

Asian Studies

Educational effects on transition from:	Active-Inactive	Active-Dead	Inactive-Active	Inactive-Dead
Japan	*	*	ns	ns
Taiwan	*	ns	ns	ns
China	ns	ns	*/ns	ns
Indonesia	*/ns	*/ns	ns	ns
Philippines	ns	ns	ns	ns

* significantly different
ns not significantly different

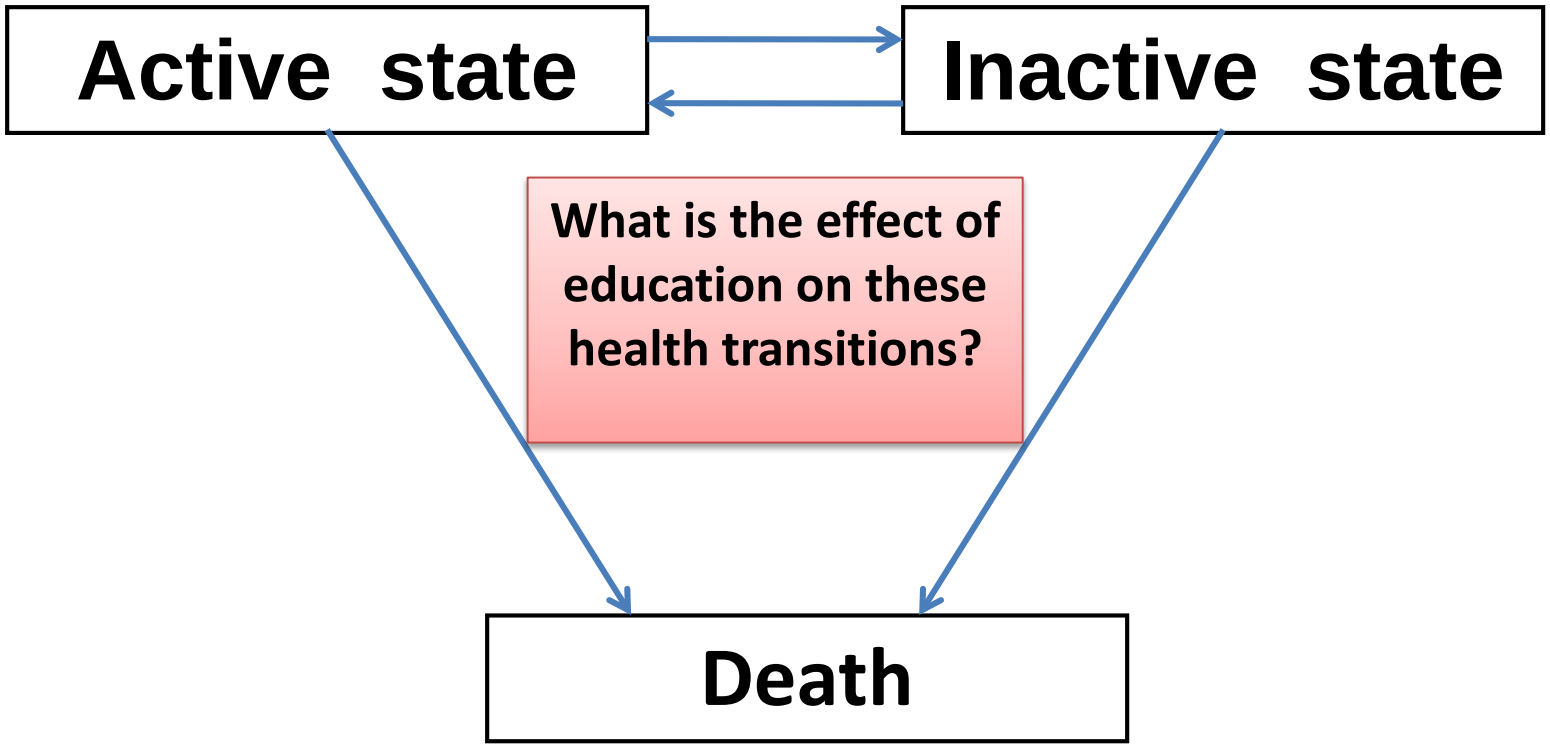
Aims of Study

- To examine the effects of education on disability and mortality transitions; and
- To compute active life expectancy by education for older Japanese men and women

Some Causal Pathways

- Behavioral-related Factors
  - Smoking, dietary habits, physical activities, knowledge of and access to health information
- Material-related Factors
  - Housing conditions, employment status, occupation, income, access to health care
- Life course effects; cohort effects

Conceptual Framework



Data

- Nihon University Japanese Longitudinal Study of Aging (NUJLSOA)
- 5 waves of panel data: 1999, 2001, 2003, 2006, and 2009
- Nationally representative sample of age 65+ in 1999
- Oversampled for age 75+

Data (cont.)

Waves Year	W1 1999	W2 2001	W3 2003	W4 2006	W5 2009
Sample size*	4997	3992	3418	2520	1861
Deaths	--	327	370	450	287
Response rate	74.6%	86.4%	82.1%	82.3%	85.2%

* For panel data only. Refreshed samples in 2001 and 2003 were omitted from the analyses. About 10% at each wave is by proxy-interviews with family members.

**Response rate includes deaths and some of those who didn't answer previous interviews.

Data (cont.)

- Sample size for analyses (n=4,968)
  - Men= 2,107 - Women= 2,861
- Excluded:
  - Missing education variable (24 cases)
  - Missing initial functioning state (5 cases)
- Date of death (DOD) were obtained from family members and municipal records
- Missing DOD were coded as at mid-point of the survey interval (40 cases)

Health Measure

- **Inactive**: difficulty performing at least one of 7 ADLs or 7 IADLs

- **Active**: otherwise

  - 7 ADLs: bathing, dressing, eating, getting in/out of bed, walking, going outside, toileting

  - 7 IADLs: preparing for own meal, shopping, managing money, making phone calls, doing light housework, using transportation, taking medication

Education Measure

- Dichotomized by level of education based on observed distribution
  - **Less than High School** (≤ 9 years of schooling) *
  - **High School and above** (10+ years of schooling)

* less than 1% had < 6 years of schooling

Sample distribution by education and sex

	Less than HS	**HS and above**	Total
Men	1325 (60.2%)	782 (39.8%)	2107 (44.0%)
Women	1966 (65.5%)	895 (34.5%)	2861 (56.0%)
Total	3291 (63.2%)	1677 (36.8%)	4968 (100.0%)

Proportions shown are for the weighted sample

Method

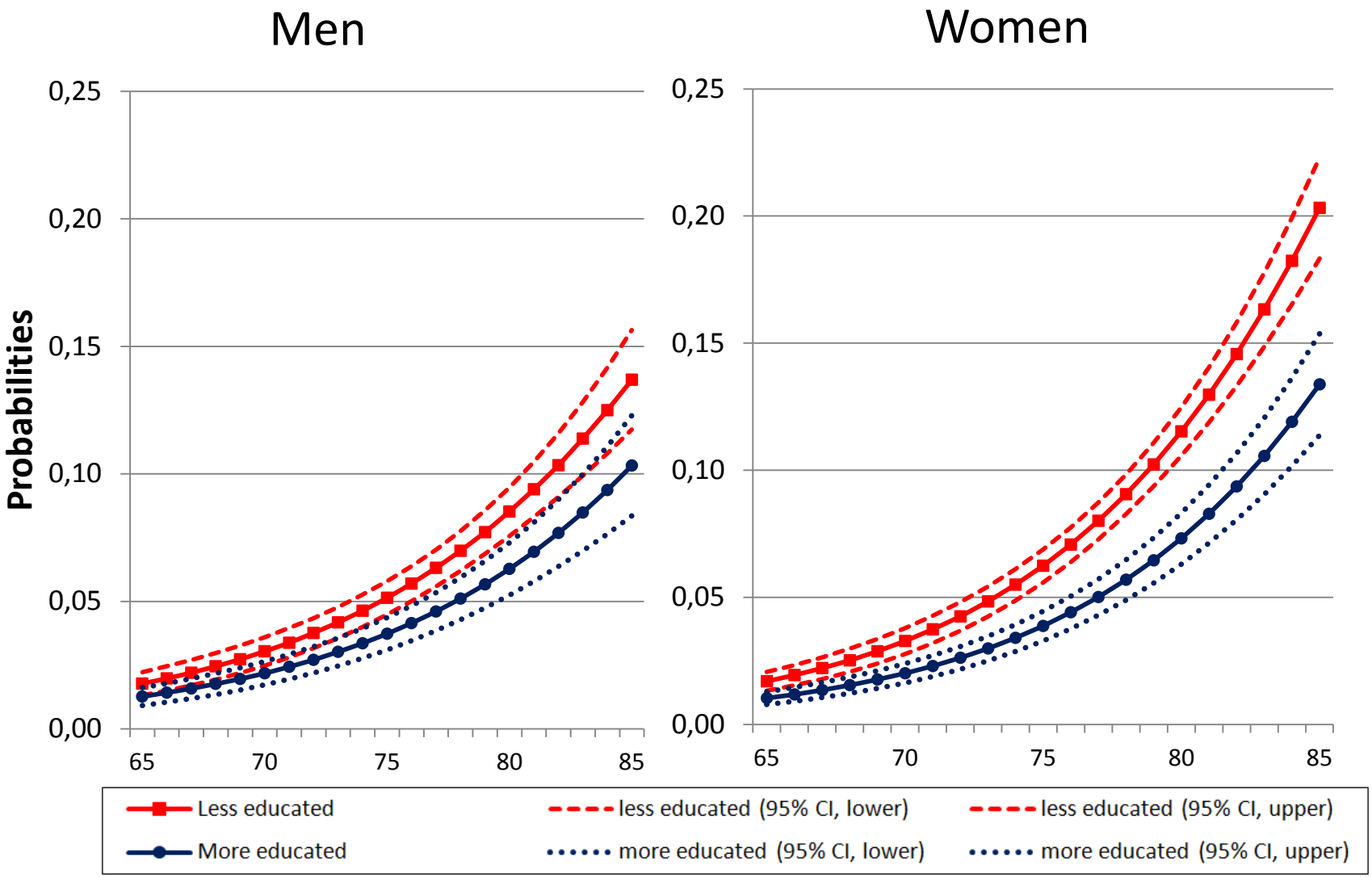
- Multi-state life table (MSLT) method by sex
  - Population-based and Status-based estimates by educational level
- IMaCh used to obtain transition probabilities and compute active life expectancies
  - To handle different interval lengths between surveys (1999, 2001, 2003, 2006, 2009)
  - Annual probabilities were estimated (stepm=12)

RESULTS

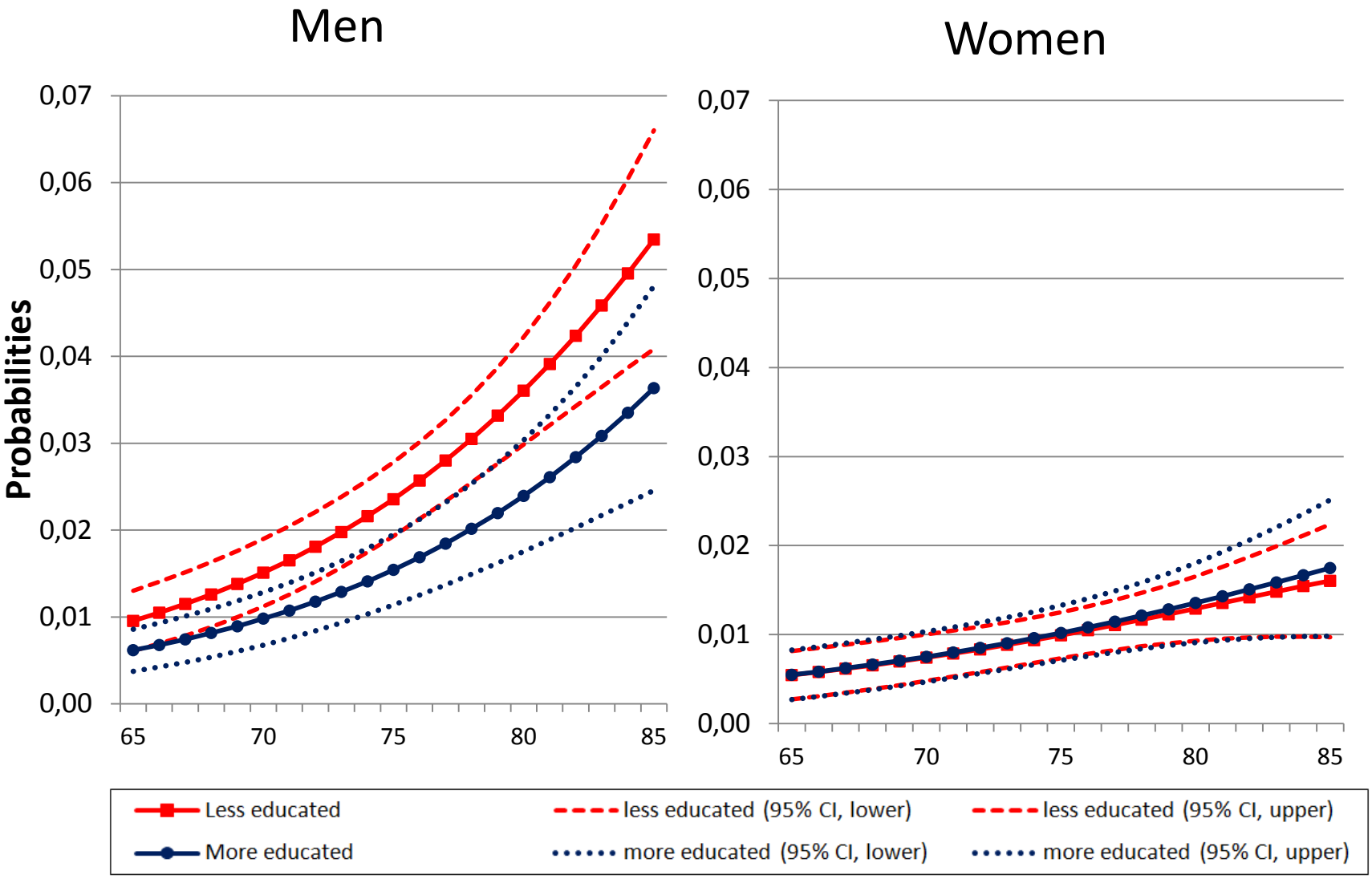
Distribution of health transitions

	End state			
	Active	Inactive	Dead	Total
Initial state	**Less than high school**			
Active	4751	1011	391	6153
Inactive	415	1415	652	2482
Total	5166	2426	1043	8635
	High school and above			
Active	3125	390	181	3696
Inactive	164	452	195	811
Total	3289	842	376	4507

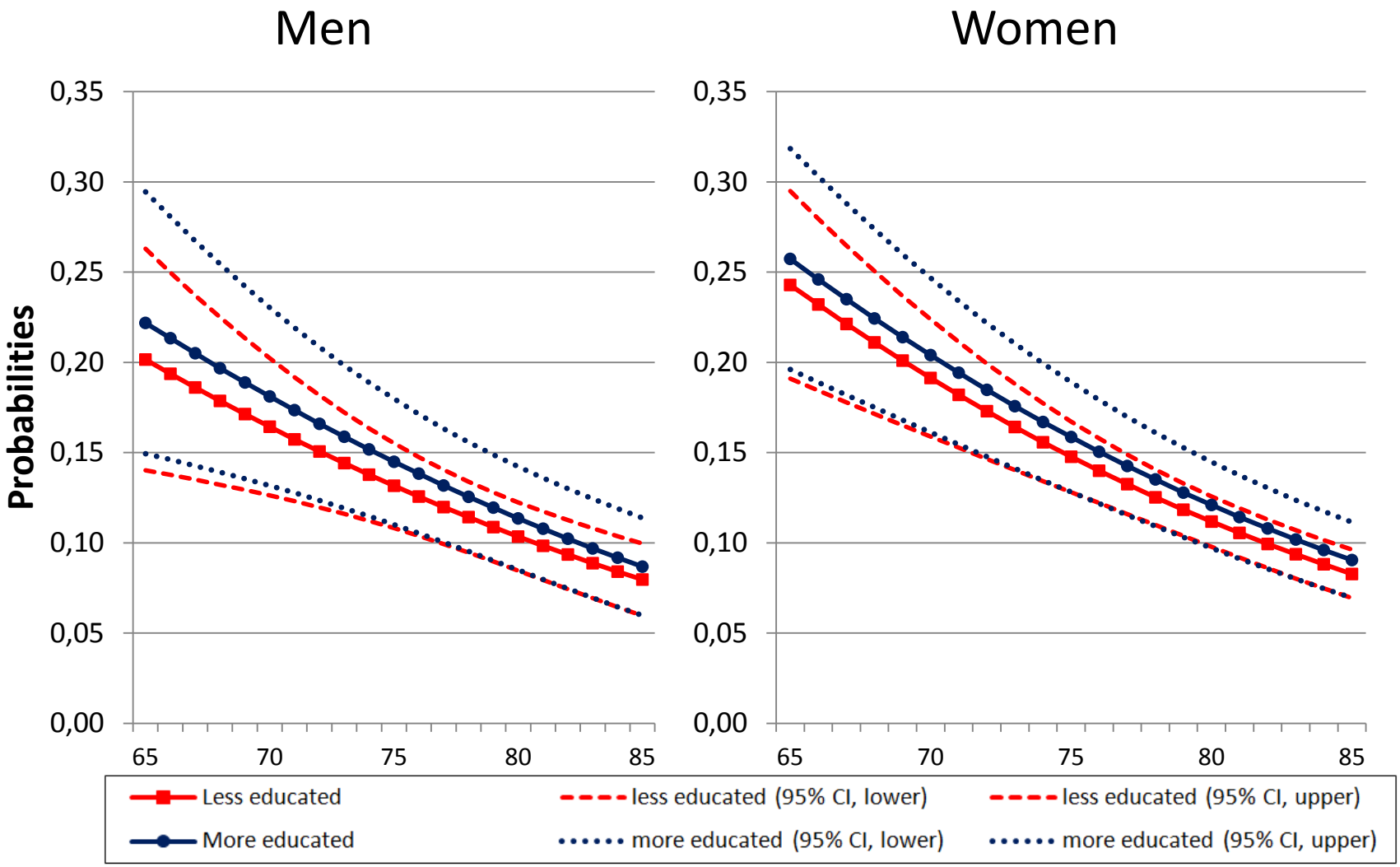
Active to Inactive (worsening health)



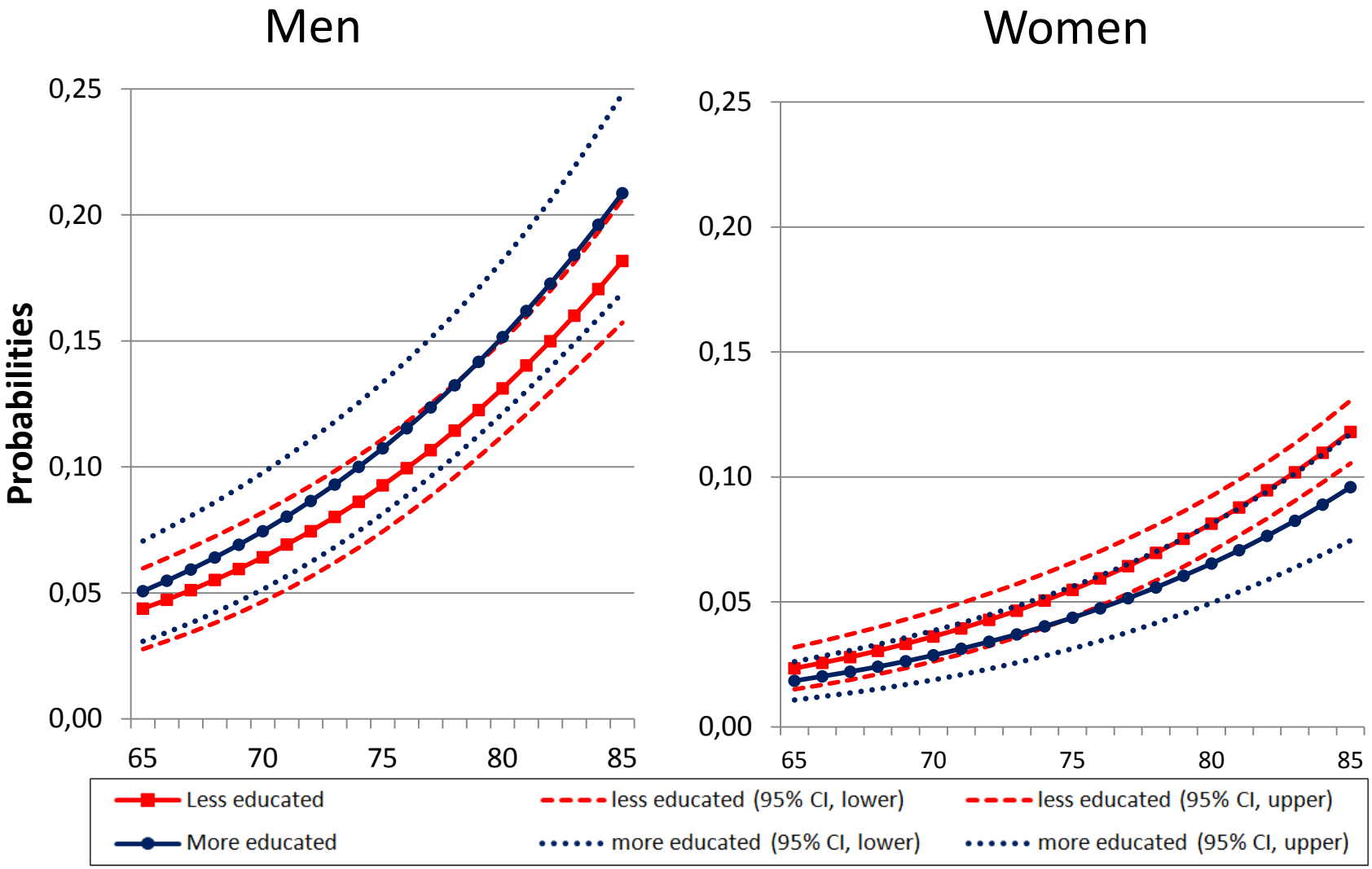
Active to Dead (mortality)



Inactive to Active (improving health)



Inactive to Dead (mortality)



Population-based estimates

	Age	TLE	95% CI	ALE	95% CI	IALE	95% CI	ALE/TLE(%)
Men								
less than high school	65	**18.4**	(17.6-19.2)	**14.7**	(14.0-15.4)	**3.7**	(3.3-4.1)	80.0
	85	**5.9**	(5.3-6.4)	**2.9**	(2.5-3.3)	**3.0**	(2.5-3.4)	49.5
high school & above	65	**20.5**	(19.4-21.5)	**17.3**	(16.3-18.2)	**3.2**	(2.7-3.6)	84.6
	85	**6.6**	(5.9-7.4)	**4.1**	(3.5-4.8)	**2.5**	(2.0-3.0)	61.9
Women								
less than high school	65	**22.3**	(21.6-23.1)	**15.9**	(15.3-16.5)	**6.4**	(5.9-6.9)	71.2
	85	**7.4**	(6.8-8.0)	**2.4**	(2.1-2.7)	**5.0**	(4.5-5.5)	32.4
high school & above	65	**24.5**	(23.2-25.8)	**18.4**	(17.6-19.3)	**6.1**	(5.1-7.0)	75.3
	85	**9.1**	(8.0-10.1)	**3.7**	(3.2-4.3)	**5.3**	(4.4-6.3)	41.2

Totals may not add up exactly due to rounding

Status-based estimates: Active at age 65

	TLE	95% CI	ALE	95% CI	IALE	95% CI	ALE/TLE(%)
Men							
< HS	**18.5**	(17.8-19.3)	**15.0**	(14.3-15.6)	**3.6**	(3.2-4.0)	80.8
HS+	**20.6**	(19.5-21.6)	**17.5**	(16.6-18.4)	**3.1**	(2.6-3.6)	85.0
Women							
< HS	**22.4**	(21.6-23.1)	**16.1**	(15.5-16.6)	**6.3**	(5.8-6.8)	71.7
HS+	**24.5**	(23.2-25.8)	**18.5**	(17.7-19.4)	**6.0**	(5.1-6.9)	75.6

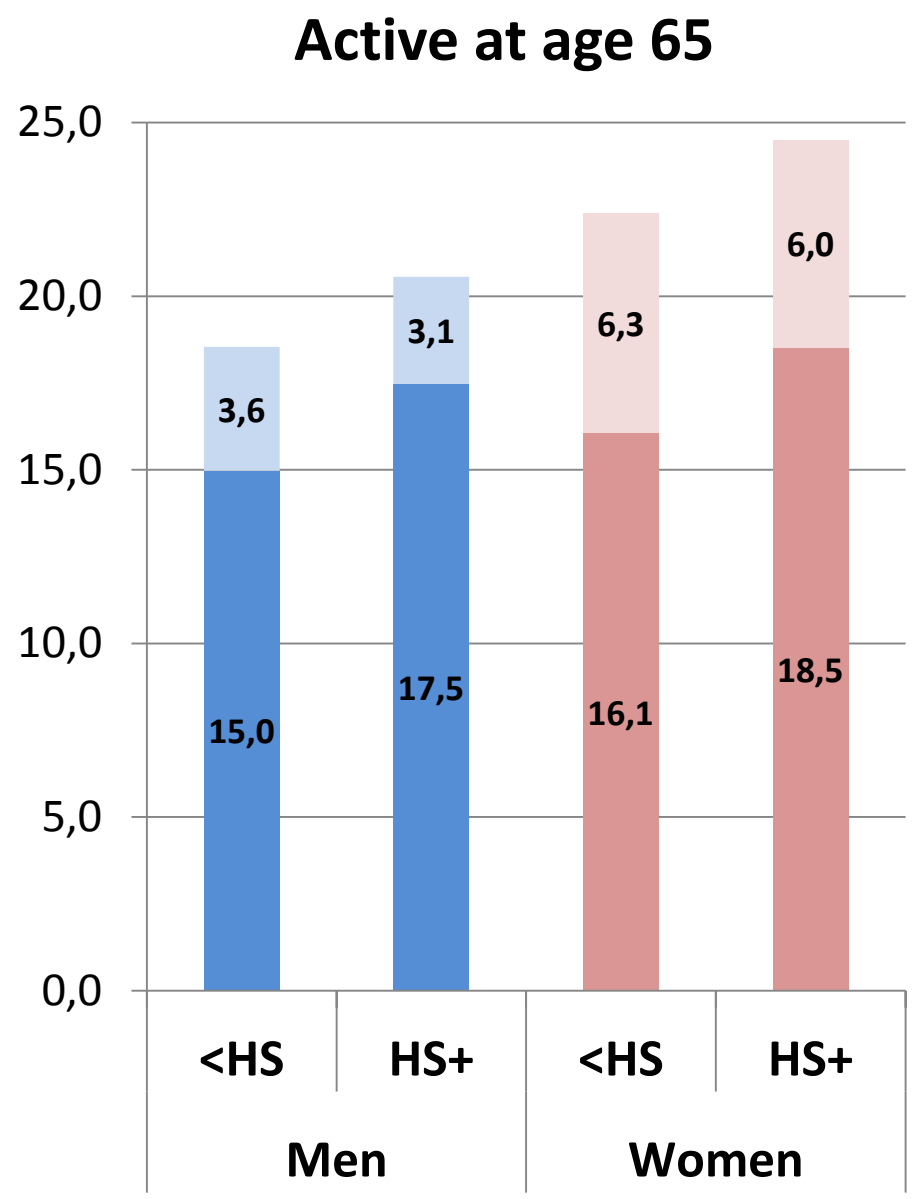
Totals may not add up exactly due to rounding

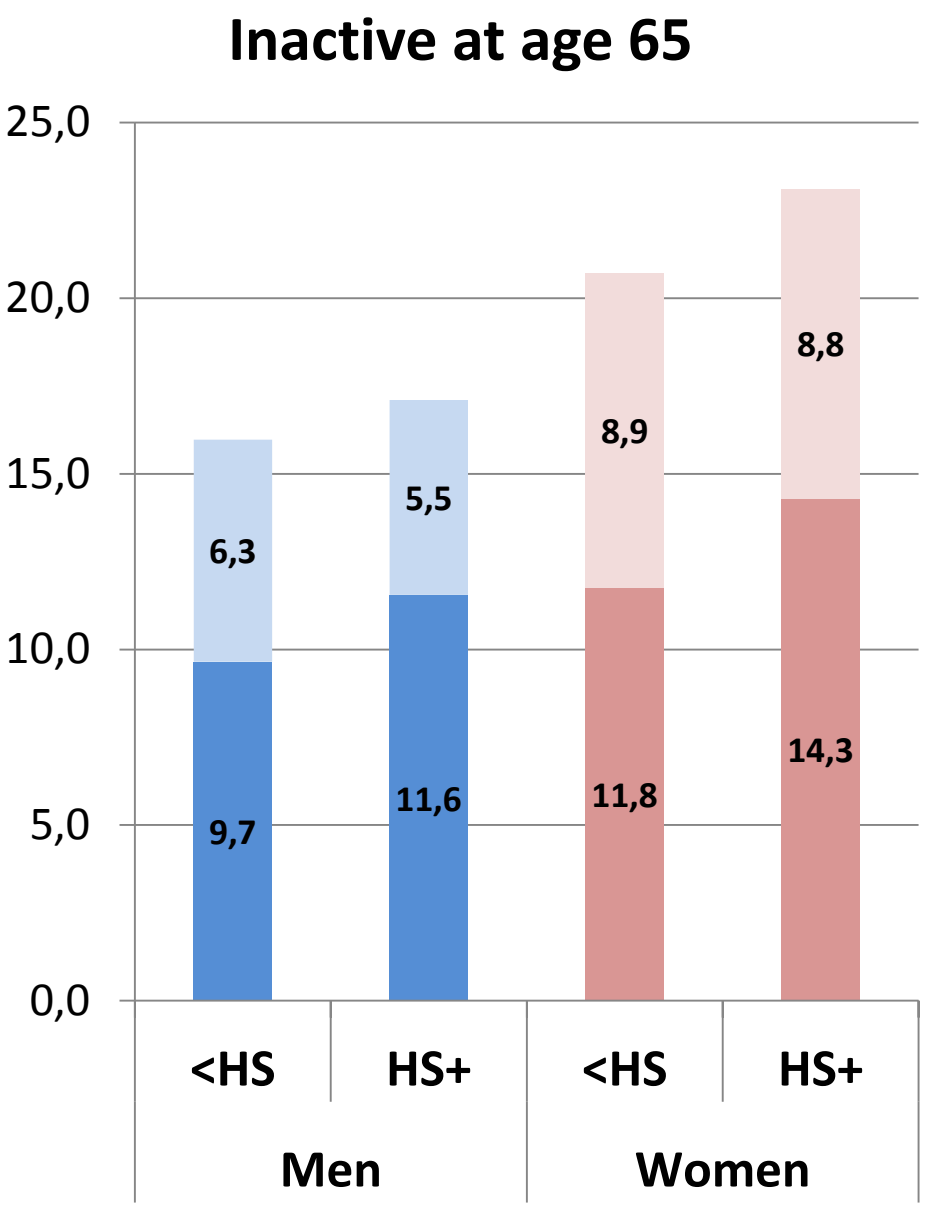
Status-based estimates: Inactive at age 65

	TLE	95% CI	ALE	95% CI	IALE	95% CI	ALE/TLE(%)
Men							
< HS	**16.0**	(14.7-17.3)	**9.7**	(8.2-11.1)	**6.3**	(5.5-7.1)	60.4
HS+	**17.1**	(15.3-18.9)	**11.6**	(9.6-13.5)	**5.5**	(4.7-6.4)	67.6
Women							
< HS	**20.7**	(19.7-21.7)	**11.8**	(10.7-12.8)	**8.9**	(8.2-9.7)	56.8
HS+	**23.1**	(21.6-24.6)	**14.3**	(12.9-15.7)	**8.8**	(7.6-10.0)	61.9

Totals may not add up exactly due to rounding

Comparison of status-based estimates





Summary: Transition Probabilities

Education Differentials in Health and Mortality Transitions	Men	Women
Active to Inactive (worsened health)	*/ns	*
Active to Dead (transit to death)	ns	ns
Inactive to Active (improved health)	ns	ns
Inactive to Dead (transit to death)	ns	ns

* p<0.05 ns: not significant

Summary: ALE at age 65

Education differentials in:	Men	Women
Population-based		
TLE	*	*
ALE	*	*
IALE	ns	ns
Status-based (initial active state)		
TLE	*	*
ALE	*	*
IALE	ns	ns
Status-based (initial inactive state)		
TLE	ns	ns
ALE	ns	*
IALE	ns	ns

Discussion

- Generally, little effect of education
- Possible reasons:
  - Universal access to health care in Japan
  - High health literacy and concern among Japanese regardless of educational levels
  - Annual health exams required by all …
  - Negligible migrant population; mostly homogeneous
  - Generally, lower inequality among this study population; emphasize on egalitarianism and cooperation
  - Diet and nutritional intake less differentiated

Limitations/Areas for further study

- unable to adjust for clustering of observations
- Attrition
- Missing values
- Definition of health
- Introduction of other covariates

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Gender Differentials in Disability and Mortality Transitions: The Case of Older Adults in Japan

Angelique Chan, PhD[1], Zachary Zimmer, PhD[2], and Yasuhiko Saito, PhD[3]

Introduction

* This paper focuses on gender differentials in ‘disability-free’ or ‘active’ life expectancy among older Japanese

* Active life expectancy divides total life expectancy into states of health, e.g. with or without disability

* Active life expectancy estimates derived from multi-state life tables

* Probabilities for the multi-state life tables derived from hazard rate parameters describing a set of transitions

Data

- * Nihon University Japanese Longitudinal Study of Aging
- * Nationally representative sample aged 65+
- * Data collected in 1999, 2001 and 2003

Data

Episodic data is stacked

Baseline 1999 → Follow-up 2001

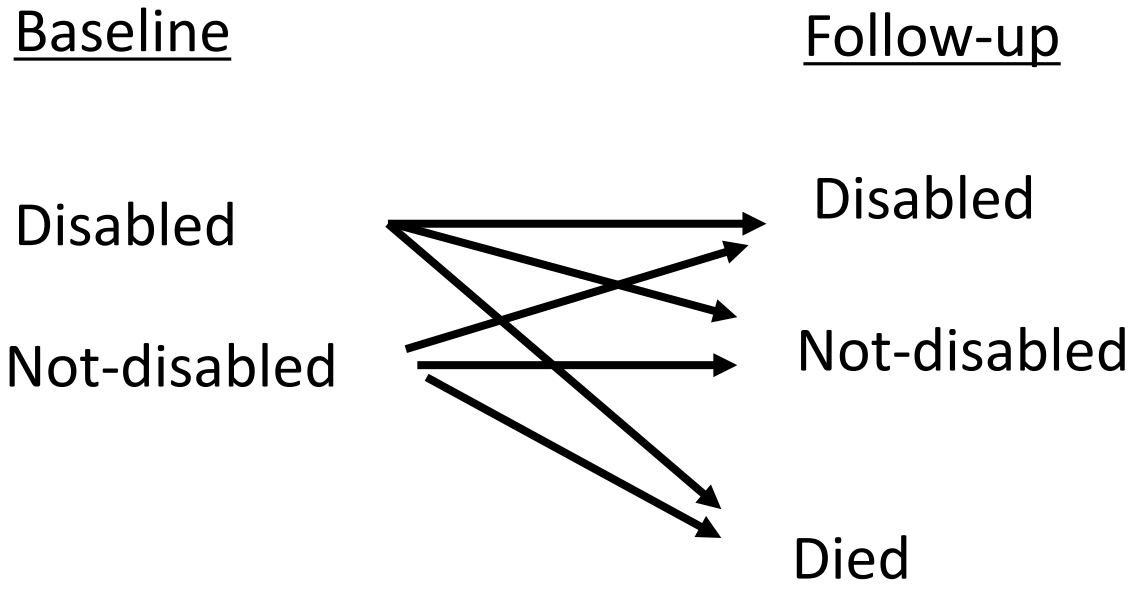
Baseline 2001 → Follow-up 2003

Total N ~ 8,400

Measures

A person is considered ‘disabled’ if they cannot perform at least one of the following ADLs independently

1. Bathing
2. Dressing
3. Eating
4. Rising
5. Walking
6. Leaving house
7. Using toilet



LE, DFLE and DLE

Table 5. Estimates of Life, Disability, and Disability-Free Life Expectancy Estimates for Men and Women Across Several Covariate Scenarios and Select Ages

		Men			Women		
Scenarios	Age	Years without disability	Years with disability	Total life expectancy	Years without disability	Years with disability	Total life expectancy
Medium level	65	16.76	1.69	18.45	19.20	3.20	22.40
Top level	65	24.28	1.45	25.73	29.89	3.01	32.89
Bottom level	65	11.46	1.80	13.26	12.99	3.29	16.29

Factors considered in the study are: age, sex education (high/low) occupation (while/others), income (high/low), life threatening diseases (yes/no), debilitating diseases (yes/no)

Source: Chan, Zimmer and Saito, 2010, *Journal of Aging and Health*