

# Active Life Expectancy and Functional Limitations among Older Singaporeans: Gender, Educational and Ethnic Differences

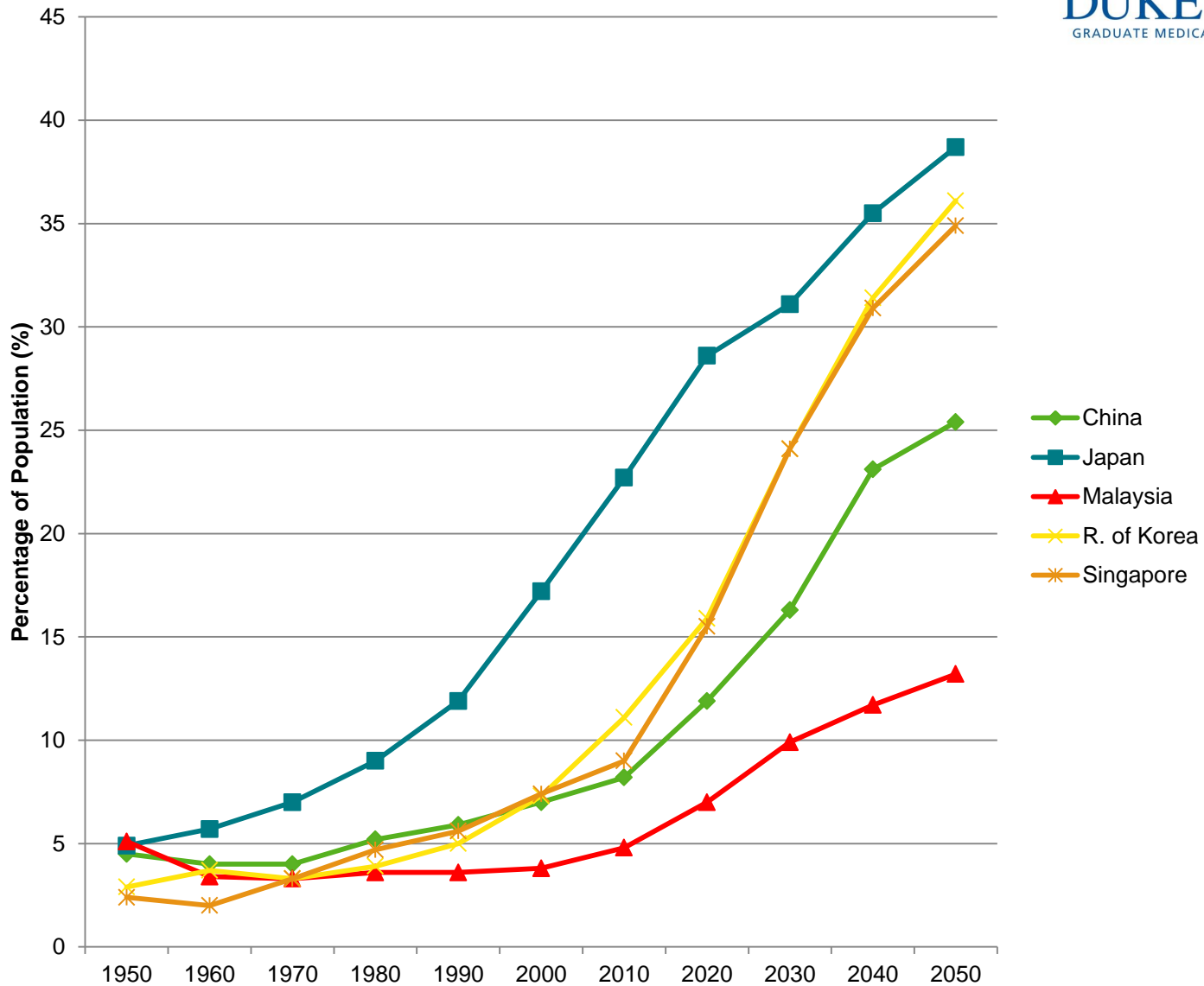
Chi-Tsun Chiu<sup>1</sup>, Angelique Chan<sup>1</sup>, Victoria Haldane<sup>1</sup>, David Matchar<sup>1,2</sup>, Yasuhiko Saito<sup>1,3</sup>

<sup>1</sup>Duke-National University of Singapore, <sup>2</sup>Duke University School of Medicine, <sup>3</sup>Nihon University

# Introduction

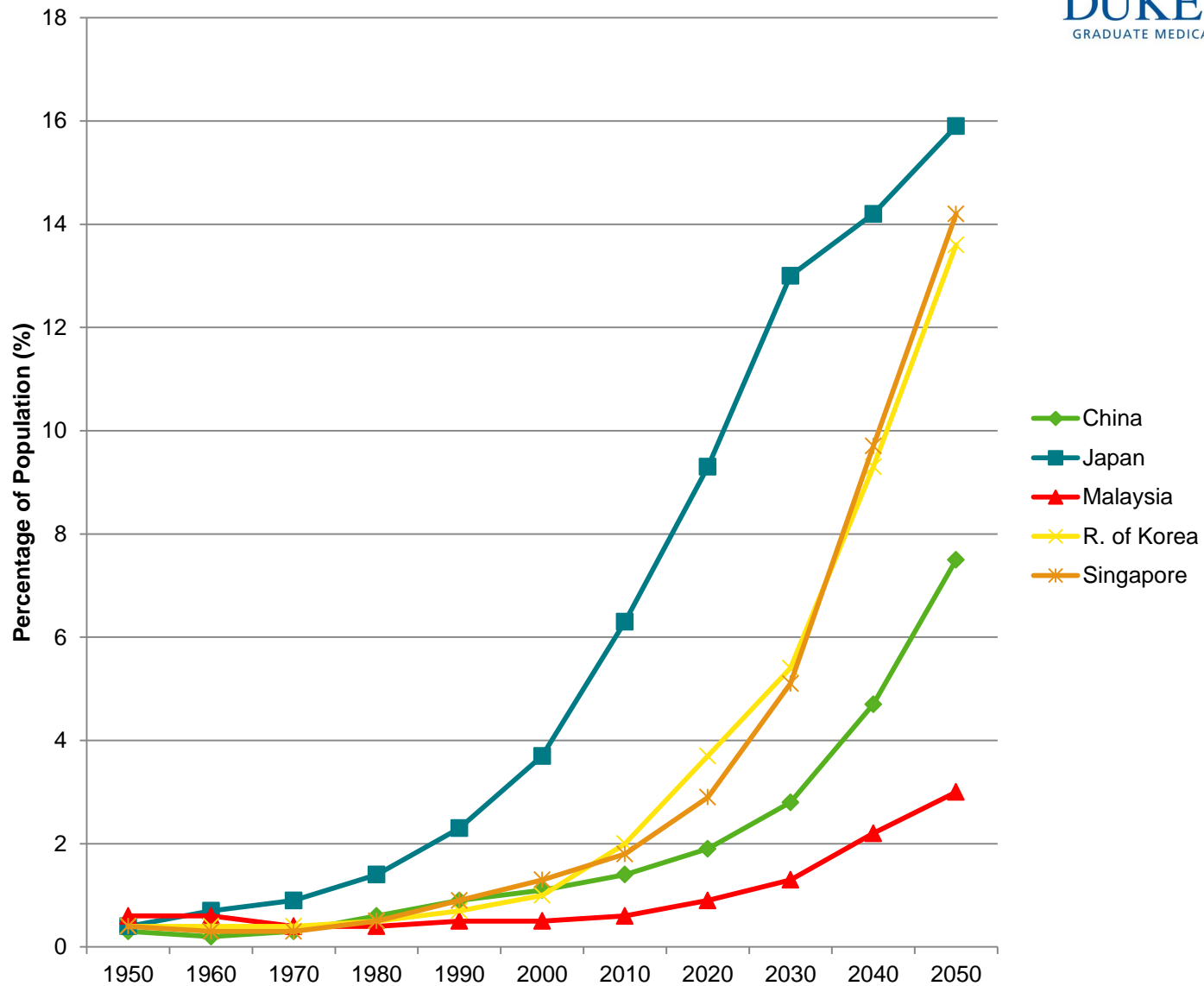
- Singapore
  - Experiencing the rapid population aging
    - Proportion over 65 years old will increase from 9% (2010) to 19% in 2030.
  - Changing demographic landscape:
    - Increases in longevity
    - Declining fertility rates
    - Rising non-marriage rates
    - Rising divorce rates
    - Migration

# Figure 1: Percentage of Population aged 65+



Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, *World Population Prospects: The 2010 Revision*, <http://esa.un.org/unpd/wpp/index.htm>

# Figure 2: Percentage of Population aged 80+



Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, *World Population Prospects: The 2010 Revision*, <http://esa.un.org/unpd/wpp/index.htm>

# Implications of Demographic Trends

- Fewer family members available to support older adults
- Sandwich generation caring for children below 12 and members aged 65+ simultaneously
- Longer period of caregiving → increased financial and emotional burden

# Recently Increased Dialogue On:

- Burden of chronic disease
- Caregiving
- Long term care
- Role of family versus the State in providing care
- Sustainable health system

# Policy Priorities for Older Persons in Singapore

- Maximize family care
- Promote aging in place
- Strengthen community based health care services
- Minimize hospitalizations and institutionalization
- Improve provision and quality of LTC services

**NEED FOR EVIDENCE-BASED POLICY FORMULATION**

# Active Life Expectancy and Functional Limitations among Older Singaporeans: Gender, Educational and Ethnic Differences

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## Aims

- To examine health differences for older Singaporean by sex, education and ethnicity using the incidence-based multistate life tables (SPACE program).

# Theory background

- Sex

- females live longer but have more functional limitations and shorter ALE than their male counterparts

(Crimmins et al. 1996; Geronimus et al. 2001; Kaneda et al. 2004; Keeler et al. 2010; Konno et al. 2004; Zimmer and House 2003).

- women continued to experience more functional limitations with increasing age, with little change when adjusted for explanatory factors

(Read and Gorman 2006)

- women were more likely to be functionally limited than men.

(Yong et al. 2010)

# Theory background

- Education
  - education creates a foundation for the factors that ultimately determine socioeconomic status and impact upon health (Ross and Mirowsky 1999)
  - lower levels of education correlate to less years of active, healthy life (Crimmins and Saito 2001)

# Theory background

- Ethnicity
  - Cultural differences have been shown to affect health outcomes in Western countries
  - Singapore's multi-ethnic composition makes it an excellent test ground for teasing out the effects of SES and culture on ethnic disparities in health.

## Data

- A nationally representative longitudinal data
- Aged 60+, N=4,990 (2009)
- Wave 2 (2011)
- Analysis sample: N=3,142

# Measures

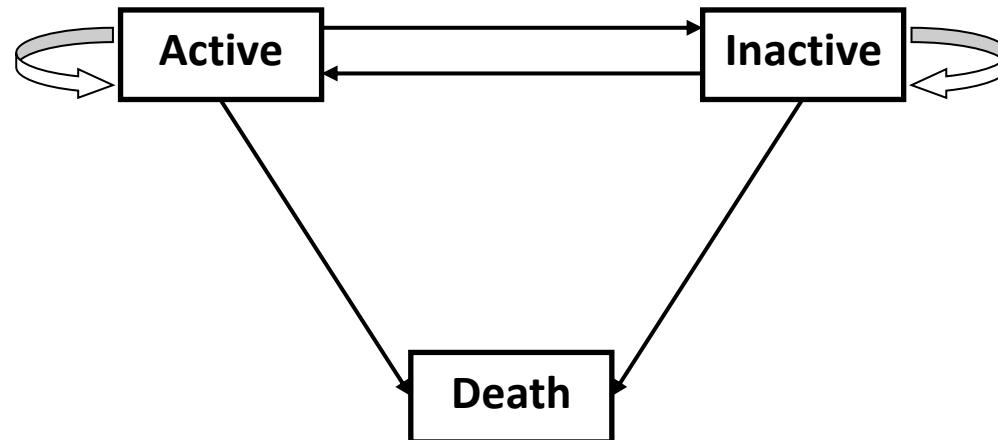
- Death data
  - linked to a registry system from Singapore Ministry of Health
  - follow-up interviews (from family members)
- Functional limitations
  - Self-reported difficulty in performing at least one of 9 NAGI items.
    - Inactive: Have difficulty performing any one of the 9 items
    - Active: Have no difficulty performing all 9 items

# Measures

- Sex
- Education was considered a SES indicator.
  - High: at least secondary education
  - Low: no formal education or only primary education
- Ethnicity
  - Chinese
  - non-Chinese (including Malay, Indian, others)

## Method

- Transition probability
  - Multinomial logistic regressions
    - $\ln(p_{ij}/p_{ii}) = \beta_{0ij} + \beta_{1ij} * \text{Age} + \beta_{2ij} * \text{Sex}$
    - $\ln(p_{ij}/p_{ii}) = \beta_{0ij} + \beta_{1ij} * \text{Age} + \beta_{2ij} * \text{Education}$
    - $\ln(p_{ij}/p_{ii}) = \beta_{0ij} + \beta_{1ij} * \text{Age} + \beta_{2ij} * \text{Ethnicity}$





## Method

- Multistate life table (MSLT)
  - The SPACE program was used to estimate MSLT functions and their sampling variability.
  - Simulation cohort  $N=100,000$
  - Bootstrap  $N=300$
  - An advantage of using the SPACE program is that standard errors can be estimated and the distribution of MSLT functions can be investigated. (see Cai et al. 2010 in Demographic Research for details)

# RESULTS

# Population-based estimates at age 60

		TLE	ALE	IALE	%(ALE/TLE)
<b>Sex</b>	Males	21.4 (20.18, 22.72)*	16.2 (15.17, 17.31)*	5.2 (4.32, 6.09)*	75.0%
	Females	25.6 (24.07, 27.09)	9.9 (9.04, 10.85)	15.6 (14.24, 17.03)	40.5%
<b>Education</b>	Low	22.4 (21.14, 23.56)*	11.5 (10.57, 12.36)*	10.9 (9.84, 11.94)	52.0%
	High	27.9 (24.94, 30.96)	16.9 (15.05, 18.68)	11.1 (8.55, 13.62)	61.9%
<b>Ethnicity</b>	Chinese	24.0 (22.76, 25.26)	13.6 (12.67, 14.44)*	10.5 (9.43, 11.48)	57.1%
	non-Chinese	21.5 (19.90, 23.10)	10.9 (9.66, 12.22)	10.6 (9.02, 12.10)	53.1%

TLE: Total Life Expectancy; ALE: Active Life Expectancy; IALE: Inactive Life Expectancy

\* p < 0.05 comparing TLE, ALE or IALE between sex, education or ethnicity groups.

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# Status-based estimates, at age 60 (Initial state: Active)

		TLE	ALE	IALE	%(ALE/TLE)
<b>Sex</b>	Males	21.5 (20.22, 22.76)*	16.4 (15.38, 17.49)*	5.1 (4.19, 5.92)*	76.0%
	Females	25.7 (24.15, 27.20)	10.8 (9.91, 11.67)	14.9 (13.50, 16.27)	44.4%
<b>Education</b>	Low	22.4 (21.23, 23.65)*	12.2 (11.31, 13.03)*	10.3 (9.24, 11.29)*	55.7%
	High	28.0 (24.97, 30.99)	17.3 (15.49, 19.05)	10.7 (8.19, 13.23)	63.8%
<b>Ethnicity</b>	Chinese	24.1 (22.86, 25.36)	14.1 (13.24, 14.96)+	10.0 (9.00, 11.02)	59.7%
	non-Chinese	21.6 (19.95, 23.19)	11.7 (10.44, 12.92)	9.9 (8.38, 11.41)	57.0%

TLE: Total Life Expectancy; ALE: Active Life Expectancy; IALE: Inactive Life Expectancy

\* p < 0.05; + p < 0.1 comparing TLE, ALE or IALE between sex, education or ethnicity groups.

# Status-based estimates, at age 60 (Initial state: Inactive)

		TLE	ALE	IALE	%(ALE/TLE)
<b>Sex</b>	Males	21.0 (19.66, 22.33)*	14.3 (13.08, 15.49)*	6.7 (5.69, 7.72)*	64.8%
	Females	25.4 (23.86, 26.90)	8.2 (7.25, 9.12)	17.2 (15.76, 18.63)	32.4%
<b>Education</b>	Low	22.1 (20.86, 23.39)*	9.6 (8.68, 10.58)*	12.5 (11.36, 13.63)*	42.5%
	High	27.8 (24.73, 30.84)	14.7 (12.72, 16.66)	13.1 (10.47, 15.72)	51.6%
<b>Ethnicity</b>	Chinese	23.6 (22.33, 24.93)	11.5 (10.47, 12.44)*	12.2 (11.05, 13.29)	47.3%
	non-Chinese	21.3 (19.66, 22.84)	8.4 (7.06, 9.78)	12.8 (11.20, 14.47)	39.2%

TLE: Total Life Expectancy; ALE: Active Life Expectancy; IALE: Inactive Life Expectancy

\* p < 0.05 comparing TLE, ALE or IALE between sex, education or ethnicity groups.

## Summary

- Sex is associated with
  - TLE, IALE ~ both are higher among Women
  - ALE ~ it is higher among men
- Education is associated with
  - TLE and ALE ~ both are higher among those with high education
  - Higher educated have higher TLE due to higher ALE.
- Ethnicity is associated with ALE ~ Higher among the Chinese



# Our next steps: Two possible directions

- (1) Age-Friendly City
  - Meaning
    - Address the challenges of urban aging and best capitalize on the resources available in urban centers to promote active aging (WHO 2007)
    - Active aging is “the process of optimizing opportunities for health, participation and security in order to enhance quality of life as people age” (WHO 2007)
  - Aim:
    - To provide information base for “Age-Friendly City” in Singapore through better understanding health differences on functional limitations by sex, education or ethnicity

## Our next steps: Two possible directions

- (2) Including disability measures
  - Four health states:
    - Active, With functional limitation (but not disabled), Disabled, Death
    - Estimating transitions probabilities and health expectancy
  - Reason
    - People who have difficulty performing any one of 9 NAGI items are almost disabled.
    - To separate functional limitation and disability may help to clarify the health differences on health expectancies by sex, education, and ethnicity



Thank You

Partner in Academic Medicine



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## Health transitions from wave 1 to wave 2, overall, by sex, education, and ethnicity

Health State at Wave 1	Health State at Wave 2						Total	
	Active		Inactive		Dead			
	#	%	#	%	#	%	#	%
<b>Overall</b>								
Active	1117	35.6%	399	12.7%	73	2.3%		
Inactive	306	9.7%	1053	33.5%	194	6.2%	3142	100.0%
<b>Men</b>								
Active	789	76.5%	181	17.5%	62	6.0%	1032	100.0%
Inactive	117	30.6%	189	49.5%	76	19.9%	382	100.0%
<b>Women</b>								
Active	328	58.9%	218	39.1%	11	2.0%	557	100.0%
Inactive	189	16.1%	864	73.8%	118	10.1%	1171	100.0%
<b>Low Education</b>								
Active	655	64.6%	298	29.4%	61	6.0%	1014	100.0%
Inactive	232	18.1%	871	68.1%	176	13.8%	1279	100.0%
<b>High Education</b>								
Active	462	80.3%	101	17.6%	12	2.1%	575	100.0%
Inactive	74	27.0%	182	66.4%	18	6.6%	274	100.0%
<b>Chinese</b>								
Active	782	72.2%	261	24.1%	40	3.7%	1083	100.0%
Inactive	232	20.5%	761	67.4%	136	12.0%	1129	100.0%
<b>Non-Chinese</b>								
Active	335	66.2%	138	27.3%	33	6.5%	506	100.0%
Inactive	74	17.5%	292	68.9%	58	13.7%	424	100.0%