Differentials in active life expectancy by religion/religiosity among older adults in Singapore

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Presented at REVES2017

Santiago de Chile, May 17-19, 2017

Background

- Previous studies showed relationship between religion and health status as well as mortality among older adults. However, findings so far suggest only a beneficial influence of religion on different aspects of physical and mental health and mortality.

Aim of the study

- We are interested in quantifying the effect of religion/religiosity on health by estimating life, active life and inactive life expectancy for older adults in Singapore.

Data

- Nationally representative longitudinal survey of community dwelling Singaporean age 60 and above

- Baseline survey, "Social Isolation, Health and Lifestyle Survey" was conducted in 2009

- Sample size: random sampling of 8,400

- Oversampled Malays, Indians and those aged 75 and above by a factor of 2

- Face-to-face interview survey and proxy was allowed

- 4,990 sample persons answered the survey (response rate: 59.4%)

Data

- Follow-up survey was conducted in 2011-12 knows as "Panel on Health and Aging of Elderly Singaporean"

- Among 4,990 responded at wave 1, 3,103 were reinterviewed (response rate: 62.2%) including those deceased by proxy

- Third wave of the longitudinal survey was conducted in 2015 and 1,572 sample persons were reinterviewed (response rate: 50.7%)

- Matching with the Singapore Registry of Births and Deaths was conducted but used only information on date of death for those known to be dead at the time of interviewe

Religion/Religiosity

Religion	N	%	Religious service attendance	N	%
Christianity	756	16.3	Every day	100	1.6
Buddhism/Taoism	2,445	56.5	Every week	1,488	28.3
Islam	994	11.6	Every month	720	16.0
Hinduism	282	3.3	Less than once a month	1017	22.2
Other	75	1.5	Not at all	1665	31.7
No religion	438	10.8			

Note: N is without weights but % is weighted

Religion/Religiosity

- Christian, Buddhist, Muslim and Others

- Religious: more than once a month
- Non-religious: less than once a month

Health Variables

- Activities of daily living (ADLs)
  - Bath/Shower, Dress, Eat, Transfer, Toileting
- Instrumental activities of daily living (IADLs)
  - Prepare own meal, Shopping, Managing bills, Use the phone, Light house work, Take transportation, Medication

- At least one ADL or IADL difficulty: Inactive
- Otherwise: Active

Demographic and education variables

Demographic variables		N	%	Education	N	%
Age group	60-64	971	32.7	No formal education	1,832	30.8
	65-69	1,073	24.6	Primary	1,791	36.4
	70-74	855	17.4	Secondary	998	23.6
	75-79	1,007	12.5	Vocational	12	0.3
	80-84	652	7.2	Junior College	194	5.2
	85+	432	5.6	University and above	147	3.4
Sex	Males	2,253	45.8	DK	16	0.3
	Females	2,737	54.2			

Educational categories were dichotomized:
"High" includes more than secondary education

Method

- Multistate life table method: estimate total, active and inactive life expectancy by religion/religiosity
  - Only population-based estimates for today
- Software: IMaCh (Interpolated Markov Chain) v0.98r7
  - Step 1: estimate transition probabilities between state space
  - Step 2: based on estimated transition probabilities, construct life tables

Statistical background (1)

- Models the transition probabilities between absorbing and non-absorbing states even when intervals are not uniform

- Using the embedded Markov chain property, the transition matrix between two waves is the product of the elementary matrices (by month or quarter)

- Same theoretical basis as Laditka and Wolf (1998) and Izmirlian et al. (2000)*

*Izmirlian G, Brock D, Ferrucci L & Phillips C (2000) Active Life Expectancy from annual follow-up data with missing responses. *Biometrics* 56:244-8.

Statistical background (2)

- The elementary transition is modeled as a multinomial logistic thus assuming an individual is in state j at age x_i and state k after a time h then

$$\log[(p_{jk}(x_i, x_i+h)/p_{jj}(x_i, x_i+h)]=a_{jk}(h)+b_{jk}(h)x_i$$

- The smaller h is, the better the continuous time process is tracked but the greater the computational problems
- Covariates can be included, although limited

Results

Number of transitions

	Active	Inactive	Dead
Active	3,358	583	307
Inactive	179	553	337

Life expectancy in 2012: Singapore

	at age 60
Males	22.5
Females	26.1

Estimated total, active, inactive life expectancy and % of inactive life over total life expectancy at age 60 by religion for males in Singapore

Religion	Total life expectancy	Active life expectancy	Inactive life expectancy	% of Inactive
Christianity	21.4 (1.047)	18.9 (0.892)	2.6 (0.411)	12.1
Buddhism/Taoism	20.9 (0.653)	18.2 (0.545)	2.7 (0.300)	12.9
Islam	18.8 (1.016)	15.2 (0.812)	3.6 (0.560)	19.1
Others	22.5 (1.135)	19.0 (0.875)	3.5 (0.602)	15.6

Note: SE in ()

Estimated total, active, inactive life expectancy and % of inactive life over total life expectancy at age 60 by religion for females in Singapore

Religion	Total life expectancy	Active life expectancy	Inactive life expectancy	% of Inactive
Christianity	25.0 (1.016)	19.0 (0.830)	6.0 (0.671)	24.0
Buddhism/Taoism	26.0 (0.686)	19.2 (0.474)	6.8 (0.475)	26.2
Islam	22.5 (1.209)	14.7 (0.859)	7.8 (0.934)	34.7
Others	27.5 (1.439)	19.3 (0.900)	8.2 (1.139)	29.8

Note: SE in ()

Estimated total, active, inactive life expectancy and % of inactive life over total life expectancy at age 60 by sex and religiosity in Singapore

Sex	Religiosity	Total life expectancy	Active life expectancy	Inactive life expectancy	% of Inactive
Males	Religious	20.7 (0.556)	17.8 (0.473)	2.9 (0.279)	14.0
	Non religious	22.4 (1.143)	18.9 (0.881)	3.6 (0.607)	16.1
Females	Religious	25.3 (0.580)	18.5 (0.417)	6.8 (0.395)	26.9
	Non religious	27.6 (1.437)	19.5 (0.914)	8.1 (1.127)	29.3

Note: SE in ()

Estimated total, active, inactive life expectancy and % of inactive life over total life expectancy at age 60 by religiosity and education for males in Singapore

Religiosity	Education	Total life expectancy	Active life expectancy	Inactive life expectancy	% of Inactive
Religious	High	25.5 ((1.188)	22.1 (0.899)	3.3 (0.596)	12.9
	Low	19.7 ((0.911)	16.2 (0.672)	3.5 (0.503)	17.8
Non Religious	High	24.9 ((1.013)	22.2 (0.867)	2.7 (0.433)	10.8
	Low	19.0 (0.689)	16.1 (0.592)	2.9 (0.324)	15.3

Note: SE in ()

Estimated total, active, inactive life expectancy and % of inactive life over total life expectancy at age 60 by religiosity and education for females in Singapore

Religiosity	Education	Total life expectancy	Active life expectancy	Inactive life expectancy	% of Inactive
Religious	High	32.3 (1.668)	24.6 (1.027)	7.7 (1.217)	23.8
	Low	27.5 (1.182)	18.9 (0.626)	8.6 (0.905)	31.3
Non Religious	High	29.2 (1.28)	23.3 (0.996)	5.9 (0.842)	20.2
	Low	24.2 (0.653)	17.5 (0.532)	6.7 (0.436)	27.7

Note: SE in ()

Conclusions

- Differences in estimated total, active and inactive life expectancies by religious affiliation or religiosity measured by religious service attendance are somewhat expected directions.

- However, these differences are not statistically significant probably because of sample size for the analyses.

Limitation

- Only limited controlled variables

- Number of transitions from inactive to active is still small.

- Response rates are relatively low.