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Diabetes-free life expectancy at Kanchanaburi Province in Thailand: a Comparison between Male and Female Elderly

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Abstract

Background: Diabetes is problem of growing proportion in Thailand as proportion of elderly is increasing and prevalence of diabetes among elderly is two times higher than the national figure. Focusing on healthy aging, a crucial question is whether increases in life expectancy will imply healthy life for higher proportion of elderly population.
Objectives: (i) estimation of age specific life expectancies with diabetes and without diabetes, (ii) estimation of percentage of future years of life with diabetes and without diabetes, and (iii) test the equality of diabetes-free life expectancies for male and female elderly
Data: The sample of this study included individuals aged 60 years and/ more who were interviewed for the data collection in *Kanchanaburi* Demographic Surveillance System (KDSS) at round 5 in 2004. This study used household data of KDSS for mortality and diabetes prevalence data.
Statistical Method: The Sullivan's life table method was used in this study to estimate the life expectancy with diabetes and diabetes-free life expectancy.
Results: Diabetes prevalence is higher for female elderly compare to male elderly at all ages and it shows decreasing pattern as age increases. Diabetes-free life expectancy for female elderly up to age 89 years is more than total life expectancy of their age corresponding male counterparts. The percentage of average future years expected to diabetes-free is higher for male elderly compare to female elderly at all age group except age 90 years and over.
Conclusion: Older persons at *Kanchanaburi* province in Thailand can expect to live a large portion of their remaining life without diabetes. There were no significant differences between male and female elderly regarding their diabetes-free life expectancy except the oldest group. Proportion of diabetes-free life expectancy reduces as age increase i.e. proportions of individuals' remaining life with diabetes were higher at early stage of elderly. So it may be helpful by promoting healthy eating and exercise emphasizing female at early stage of elderly to keep every elderly free from diabetes.

Introduction

Due to low infant mortality, fertility is declining in Thailand and total fertility rate has fallen to 1.5 live births per woman in 2012. The low fertility and development of mortality in other age groups are affecting to increase life expectancy at all ages and that to the proportion of elderly persons (ages 60 years or more) in Thailand. Currently 14.5%

of the Thai population are elderly and expected to rise at 19% in 2025 and is projected to approach more than one third of the total population (more than 30%) within next three decades (United Nations, 2013; Jones and Im-em, 2011; Knodel, Prachuabmoh and Chayovan, 2013).

In the setting of aging society, like Thailand, healthy aging or successful aging is aiming policy concerns. Focusing on healthy aging, a crucial question is whether increases in life expectancy will imply healthy life for higher proportion of elderly population.

In consequence of foods revolution in the world and globalization along with demographic transition, Thailand is in the 3rd stage of Epidemiologic transition. Despite the improvement of public health situation in Thailand, burdens of diseases are, considerably, shifting to no communicable diseases. Diabetes is one of the rapid growing diseases, in 2004 it had a prevalence of 6.7% among Thai population of age 15 years and over (Tiptaradol and Aekplakorn, 2012) and the prevalence was more than two times higher for elderly population than the average figure. Priority should be given to research on diabetes because the prevalence of diabetes increases with age. So that in the aging Thai population diabetes is problem of growing proportion. To gain better understanding of burdens of diabetes for elderly is deserved for future policy to maintain costs for diabetes and providing care to elderly.

Objectives

To gain insight into the disease burden for elderly from diabetes in terms of life spend with diabetes and without diabetes, the main objectives for this study are to:

(i) Estimation of age specific life expectancies with diabetes and without diabetes;

(ii) Estimation of percentage of future years of life with diabetes and without diabetes and,

(iii) Test the equality of diabetes-free life expectancies for male and female elderly.

Methodological Approach

Data

Data from *Kanchanaburi* Demographic Surveillance System (KDSS) round 5 in year 2004 have been used for mortality data and prevalence data of diabetes. Sample has been drawn from KDSS data file for selecting elderly people. This study included 4324 (male 1943, female 2381) individuals aged 60 years and/ more who were interviewed for the data collection in KDSS round 5.

Statistical Methods

The Sullivan's life table method was used in this study to estimate the life expectancy with diabetes and diabetes-free life expectancy. The Sullivan's method requires prevalence data and mortality data. Prevalence data for diabetes and mortality data come from KDSS. The KDSS contains demographic and mortality data for household members in KDSS areas. Also data on self-reported diabetes status along with other demographic data are collected for individuals participated in the census of KDSS. The Sullivan method is based on standard life table with two states such as alive and dead, the alive state again partitioned into 'disease-free' and 'diseased'(Jagger et al., 2006; Andrade, 2009). Thus using age-specific mortality data and age-specific diabetes-free (and diabetes) prevalence data, Sullivan method provides estimates of diabetes-free life expectancy (DFLE) and life expectancy with diabetes (DLE) (Andrade, 2009). Total life expectancy at specific age x is therefore disaggregated into $DFLF_x$ and DLE_x (i.e. total life expectancy at age x, = $DFLE_x$+DLE_x; where, l_x= number of survivors at age x, L_x= person years lived at age x and onwards). The general formula (based on the hypothesis that total person years lived at age x and onwards is proportional to the prevalence of diabetes at age x, π_x) for estimating $DFLE_x$ and DLE_x are provided in following form of equations:

$$DFLE_x = \frac{1}{l_x}\sum_x^w (1-\pi_x)L_x \qquad (1)$$

and

$$DLE_x = \frac{1}{l_x}\sum_x^w \pi_x L_x \qquad (2)$$

Where,

l_x= number of survivors at age x

L_x= person years lived at age x

π_x= diabetes prevalence at age x

Using equation (1) and (2), diabetes-free life expectancy and life expectancy with diabetes along with total life expectancy for male and female elderly at each age group have been calculated and provided in Table 1 and 2.

Table 1: Diabetes prevalence, total life expectancy, diabetes-free life expectancy and life expectancy with diabetes for male elderly at Kanchanburi Province in Thailand, 2004

Age group x-x+n	Diabetes Prevalence %	Total life expectancy e_x (m)	Diabetes-free life expectancy DFLE_m	Life expectancy with diabetes DLE_m	Percent of diabetes free life expectancy %DFLE_m	Percent of life expectancy with diabetes % DLE_m
60-64	4.81	18.3	17.5	0.8	95.5	4.5
65-69	4.68	14.5	13.9	0.6	95.7	4.3
70-74	4.41	11.7	11.2	0.5	95.8	4.2
75-79	5.88	8.1	7.8	0.3	96.0	4.0
80-84	2.41	6.3	6.2	0.1	97.9	2.1
85-89	2.44	5.2	5.1	0.1	98.4	1.6
90+	0.00	5.7	5.7	0.0	100.0	0.0

Note: DFLE_m= Diabetes free life expectancy for male, DLE_m= Life expectancy with diabetes for male

Authors' calculation based on data from Kanchanaburi Demographic Surveillance System (KDSS) round 5, 2004

Table 2: Diabetes prevalence, total life expectancy, diabetes-free life expectancy and life expectancy with diabetes for female elderly at Kanchanburi Province in Thailand, 2004

Age group x-x+n	Diabetes Prevalence %	Total life expectancy e_x (f)	Diabetes-free life expectancy DFLE_f	Life expectancy with diabetes DLE_f	Percent of diabetes free life expectancy %DFLE_f	Percent of life expectancy with diabetes % DLE_f
60-64	10.21	21.4	19.8	1.6	92.3	7.7
65-69	9.16	17.6	16.4	1.2	93.0	7.0
70-74	8.25	14.0	13.1	0.9	93.8	6.2
75-79	6.25	10.9	10.3	0.6	94.8	5.2
80-84	5.48	8.0	7.7	0.3	95.5	4.5
85-89	5.36	5.8	5.6	0.2	96.6	3.4
90+	0.00	4.4	4.4	0.0	100.0	0.0

Note: DFLE_f= Diabetes free life expectancy for female, DLE_f= Life expectancy with diabetes for female

Authors' calculation based on data from Kanchanaburi Demographic Surveillance System (KDSS) round 5, 2004

The hypothesis of equality of diabetes-free life expectancies between male and female elderly i.e. equality of DFLE_m and DFLE_f can be tested by following Z-score:

$$Z = \frac{DFLE\_m - DFLE\_f}{\sqrt{S^2(DFLE\_m - DFLE\_f)}}$$

If we indicate S (DFLE_m) and S (DFLE_f) as standard error of DFLE_m and DFLE_f respectively then the approximate standard error of (DFLE_m-DFLE_f) can be obtained as S (DFLE_m) + S (DFLE_f) (Jagger, 2001). Therefore the approximate Z-score would be:

$$Z = \frac{DFLE\_m - DFLE\_f}{S(DFLE\_m) + S\ (DFLE\_f)} \qquad (3)$$

According to Mather and Jagger *et al.*, the variance of diabetes-free life expectancy at age x (DFLEx) can be approximated as (Mather, 1991; Jagger, 2001)

$$S^2 = \frac{1}{l_x^2}\sum_{x}^{w-1} l_x^2\,[(1-a_x) * n * (1-\pi_x) + DFLE_{x+n}]^2 * S^2(p_x) + \frac{1}{l_x^2}\sum_{x}^{w} L_x^2\,S^2(1-\pi_x) \qquad (4)$$

Where, l_x= life table population at age x, ax=average contribution fraction who died at age x to x+n =0.5, π_x= diabetes prevalence at age x, S2 (p_x)= variance due to mortality= q2(1-q)/N_x (population at age x) , L_x=person years lived at age x, S2(1- π_x)= variance due to diabetes= πx (1- πx)/Dx (no. of deaths at age x). Using equation (4), the variance of diabetes-free life expectancy for male and female elderly at each age group has been calculated and their standard errors (square root of variances) are provided in Table 3.

Table 3: Comparison of diabetes-free life expectancy between male and female elderly at Kanchanburi Province in Thailand, 2004

Age group **x-x+n**	**Diabetes free life expectancy** *Male* **DFLE_m**	**Standard error of DFLE_m S(DFLE_m)**	**Diabetes free life expectancy** *Female* **DFLE_f**	**Standard error of DFLE_f** **S(DFLE_f)**	**Difference in DFLE between males and females DFLE_m-DFLE_f**	**Approximate standard error of difference in DFLE between males and females S(DFLE_m)+S(DFLE_f))**	**|z|**
60-64	17.5	0.78	19.8	0.81	-2.3	1.60	1.43
65-69	13.9	0.76	16.4	0.79	-2.5	1.55	1.61
70-74	11.2	0.74	13.1	0.76	-1.9	1.50	1.30
75-79	7.8	0.74	10.3	0.74	-2.5	1.48	1.72
80-84	6.2	0.85	7.7	0.72	-1.5	1.57	0.95
85-89	5.1	0.91	5.6	0.69	-0.5	1.60	0.34
90+	5.7	0.00	4.4	0.00	1.3	0.00	∞

Authors' calculation based on data from Kanchanaburi Demographic Surveillance System (KDSS) round 5, 2004

The test statistic, Z, for testing the hypothesis of equality of diabetes-fee life expectancy for male and female elderly, was calculated (using equation 3) for each age group and provided in Table 3. The hypothesis of equality of diabetes-free life expectancy for male and female will be rejected at 5% level of significance, if an absolute value of Z is ≥ 1.96.

Results and Discussion

Results show that diabetes prevalence is higher for female elderly compare to male elderly at all ages and it shows decreasing pattern as age increases up to age 89 years (Table 1 and Table 2).

Interestingly and luckily there were found no elderly with diabetes at age 90 years and over. Total life expectancy for female was higher than male at all ages from 60 to 89 years except age 90 years and over (female 4.4 years vs. male 5.7 years). The estimated diabetes-free life expectancies show that female elderly up to age 89 years are expected to live diabetes free more than total life expectancy of their age corresponding male counterparts. The percentage of average future years expected to diabetes free is higher for male elderly compare to female elderly at all age group except age 90 years and over. The results show that male elderly expects to spend at least 95% of his/her remaining life diabetes free whereas female elderly expects to spend at least 92% of his/her remaining life diabetes free. There were found no significance difference between diabetes-free life expectancies for male and female elderly (age 60 years to 89 years) at *Kanchanaburi* province. Meanwhile, elderly who reaches at 90 years of age may expect to survive completely diabetes free for his/her future life years, but the expected diabetes-free future years for male and female for those aged 90 years and over differ significantly at *Kanchanaburi* province in Thailand (Table 3)

Conclusion

Older persons at *Kanchanaburi* province in Thailand can expect to live a large proportion of their remaining life without diabetes. There were no significant differences between male and female elderly regarding their diabetes-free life expectancy except the oldest group (aged 90 years and more). Proportion of diabetes-free life expectancy reduces as age increase i.e. proportions of individuals' remaining life with diabetes were higher (even a fraction of a year for male elderly) at early stage of elderly. So it may be helpful by promoting healthy eating and exercise emphasizing female at early stage of elderly to keep every elderly free from diabetes.

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