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Mortality rates and life expectancy improvements among Malaysian elderlies

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Article Info

ABSTRACT

This paper presents a study on mortality rates and life expectancy improvements among elderly people in Malaysia. The central age-specific mortality rates will be analyzed according to genders. The expectation of future lifetime of these old age people will be estimated using the actuarial life table approach. Two different types of life table will be developed, including life table for males and females, to compare the results of mortality rates and life expectancies between genders. Results show that, mortality rates of Malaysian elderly, for both males and females are increasing almost in linear pattern by age, and this trend is consistent from 1950 to 2015. Comparison between genders shows that mortality of elderly females is generally lower than males at almost all ages. Nonetheless, mortality rates of Malaysian elderly males are declining faster than Malaysian elderly females. Life expentancies of females are higher than males for age groups 60 to 70, and lower than males for age 75 and above. Results also indicate that Malaysian elderly populltion is aging faster from previous generation in which elderly males age 85+ in 2010-2015 can live longer by 123% than thise in 1950-1955.

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1.   INTRODUCTION

Nowadays, population of older people has been growing rapidly all over the world and this phenomenon also known as population aging. Population aging happens when life expectancy of the whole population increases whereas the mortality rates decreases over the years with confluence of low fertility rate. The life expectancy has improved due to some factors such as socio-economic status, medical improvement, nutrition & diet, lifestyle and living environment. These changes seem a good improvement achieved by the country, however it actually affects other parties such as policy makers and insurance companies.

Population aging has occurred in many countries, and has been observed in [1-4]. According to [5], Malaysia will be an ageing nation in year 2030, which is when 14% of the population will be those who are aged 60 years old and over while in [6], it reported that Malaysia prepares to be an aging country when 7% of the people reach 65 years and older by 2030. I has been reported that by year 2050, the worldwide population age 60 years old and above will increase by more than three times [7]. Some developed countries already reached an aging population status. For example, in Australia, the percentage of people age 65 years and above for the year 2018 is 16.44% representing 24,898,152 people.

In relation to this ageing issue, the Malaysian Government has raised the retirement age for both public and private sector employees from 55 years old (private sector) and 58 years old (public sector) to 60 years old

in 2014 [5]. These changes reflect longevity risk: the risk that people live longer than expected as a result from the uncertainties in mortality patterns [8]. The Malaysian population age-structure is experiencing major modifications that is the percentage of the working-age population will reduce while the percentage of old age people will develop considerably after some time, leading to population ageing [9-11]. This provides challenge to the nation as it will cause problems especially through government spending on pensions, healthcare, and social programs.

The trends of mortality rates by specific age group and gender in Malaysia has been observed by [12] and [13], and yet results showed that more services are needed to improve the elderly needs and wellbeing since the number of elderlies are increasing recently. Although there are numerous researchers studied on Malaysians population mortality rates, only few study had focus on elderly groups. The study conducted in [14] proposed a new hazard function that implies the conditional specific on frailty. Research study in [15] have reviewed the trends and patterns of old age mortality and cause-of-death for Eastern and South-Eastern Asian countries in general by examining the data on old age mortality in terms of life expectancy at age 65, age-specific death rates and the data on cause-of-death accordingly. However, as far as we concern, no previous study have really estimate the speed of aging among Malaysian elderlies. This kind of indicator is important to help government to plan and take proper action.

The life table approach will be implemented for evaluating and comparing mortality current conditions in populations [16]. Actuarial life table is commonly described as a valuable analytical tool for demographers, epidemiologists, actuaries and other researchers. According to [17], life table is developed to measure mortality, survivorship and life expectancy for people of every age and sex. It fits the mortality experience of a population at various ages into a single descriptive statistical model. In [18] stated that the life table is a key summary tool for evaluating and comparing mortality conditions in populations. In addition, life table analysis encourages comparison of mortality experience between different population [19]. Furthermore, life tables provide a relationship between mortality and life expectancy [20]. Thus, this research developes life table for Malaysian elderlies and to analyse its trends over the years.

This paper presents the mortality rates and life expectancy improvements among Malaysian elderlies to analyze central death rates of Malaysia elderly and to estimate the life expectancies of Malaysian elderly using actuarial life table approach. Furthermore, to know how fast the Malaysian population aging, life expectancy improvement will be estimated.

2.   RESEARCH METHODS

In this study, we estimate the age-specific central death rates of Malaysia elderly using formula as in (1):

$$Mx, t = \frac{Dx, t}{Px, t} \tag{1}$$

where:
Mx, t is the central death rate of elderlies age x in year t
Dx, t is the number of death of elderlies age x in year t and
Px, t is the number of elderly population age x in mid year as of 1 July in year t

It is noteworthy that data for the number of death and population of Malaysian elderlies Dx, t were obtained from the [13] and in five-year age and time intervals. Once the central death rates are estimated, the Malaysian elderlies' life expectancies are estimated using the standard actuarial life table approach. Next, in order to estimate the life expectancy of old-age, we follow and apply the formulas and notations used in [17] to develop Malaysian life tables and described as in the Table 1.

Table 1 represents the life table approach that include several components. nMx is the central death rate, nqx is the probability of person age x dies before age $x + n$ and npx is the compliment of nqx which is equal to $1 - nqx$. The l_x is referred to the number of people who survive to age x and this is based on a radix. ndx is the number of people who die between age x and $x + n$ while nLx express the number of person years lived between age x and $x + n$. $S(x, n)$ will indicate the survival function whereas Tx is referred as the total number of person years lived after age x. Lastly, e_x is the life expectancy at for a person age x. The developed life table will compare the relationship between mortality rates and life expectancies between genders among elderlies in Malaysia.

Table 1. Life table notations and formulas

Column	Notation	Definition	Formulae
1	x	Age	-
2	n	Age interval	-
3	nMx	Central death rate	$nMx = \dfrac{nDx}{nPx}$
4	nqx	Probability of dying	$nqx = \dfrac{n(nMx)}{(1 + n(1-a)(nMx))}$
5	npx	Probability of surviving	$npx = 1 - nqx$
6	l_x	Number of survivors	$l_x = \dfrac{l(x+n)}{nPx}$
7	ndx	Number of deaths	$ndx = lx - l(x+n)$
8	nLx	Number of person-years lived	$nLx = \dfrac{nDx}{nMx}$
9	$S(x,n)$	Survival ratio	$S(x,n) = \dfrac{nL(x+n)}{nLx}$
10	Tx	Persons-year lived	$Tx = T(x+n) + nLx$
11	e_x	Expectation of life	$e_x = \dfrac{Tx}{nLx}$

3.   RESULTS AND DISCUSSION

Figure 1 are plotted using the results obtained from the (1). The full black lines represent Malaysian elderlies' log central death rates in year 1950 whereas the dashed lines represent year 2015. Firstly, we compare mortality of elderlies by different age groups. Generally, mortality rates of Malaysian elderly males and females are increasing almost in linear pattern by age, and this trend is consistent from 1950 to 2015. The increase in elderlies' mortality by age due to the tendency to have more health problems at higher ages. According to [21], age also could be part of the possible factors that affect muscle activity. More worrisome, the growth of Malaysia elderly's population recorded higher level of disability and frailty in the society [22].

Secondly, the comparison of mortality rates between genders shows that the mortality rates among Malaysian elderly females are generally lower than males at almost all ages. This shows that, in terms of mortality, elderly women are healthier and live longer than men, which is consistent with few studies like [23-25]. For example, for age 60, the log mortality rate for females in 1950 was lower than males which are -1.67086 compared to -1.5453785. Consistently, for age 85, female's log death rate is -0.71627 compared to -0.60983 for males. In line with other countries' mortality trends by gender, it is reported that in United States (US), mortality rates of females are consistently lower compared to males [26]. However, it is noteworthy that in 2015, for age 80 years old and older the mortality rate of females is higher than males.

Finally, it is interesting to know how mortality rates of Malaysian elderlies decreased by year from 1950 to 2015 for both genders. This trend is usually called as "mortality improvement". From the Figure 1, a decline in mortality from 1950 to 2015 shows by gaps between full lines and dashed lines. For males, wider gaps can be seen for age groups 70 years and older compared to those below 70 years old. Whereas for females, the gap is narrower as age increases, indicating the mortality rates does not improves much for older groups. This shows that the mortality rates of Malaysian elderly males are improving faster than Malaysian elderly females. This finding contradicts the trend in East Asian region where females had faster mortality decline than males' [15]. An enormous improvement in public health and Medicare led to an overall decrease in death rates. Malaysia has shown a positive trend on their people's health status as a result of the government's emphasizing on the health care technology development and improvement.

Once the central death rates of Malaysian elderlies were estimated, we develop the life tables for each gender by calculating each component of life tables. See Tables 2 and 3 for complete life tables of Malaysian Elderlies. Tables 2 and 3 show life expentancies of females are higher than males for age groups 60 to 70, then lower than males for age 75 and above. The life expectancies of Malaysian elderly males and females age 60 in 2015 are 21.32 and 22.73 years, indicating the 60-year old women can live longer than men. In contrast, for the oldest old age group which are those who are aged 85 and above, elderly males are expected to live longer than females--- 9.05 years for males and 7.62 years for females. Next, we estimate how rapid the life expectancy increases by years and results are presented in Table 4.

Table 4 shows that the life expectancy for Malaysian elderly is generally continue increasing from year 1950-1955 to 2010-2015 for all elderlies age 60 years old above. For Malaysian males who reach age of 60 years old in year 2010-2015, they were expected to live for another 21.32 years, compared to the same age population in 1950-1955 the life expectancy was only 14.56. This means that newer generation can live longer by 46% than previous generation. Similarly, Malaysian elderly female's age 60 years in 2010-2015 were expected to live for another 22.73 years increased by 5.75 years (34%) as compared to those in 150-1955. Elderly males age 85+ shows the highest percentage of life expectancy improvement in which newer generation

can live longer more than double compared to older generation. Males age 85+ in 2010-2015 can live up to 9.07 years, which is 123% longer than those in 1950-1955. Although these findings seem good news to some people, it is often overlooked. For instances, infrastructure, work opportunities, family support and health care facilities are some of the crucial areas that require change to help the expected need of this old age throughout their survival years.
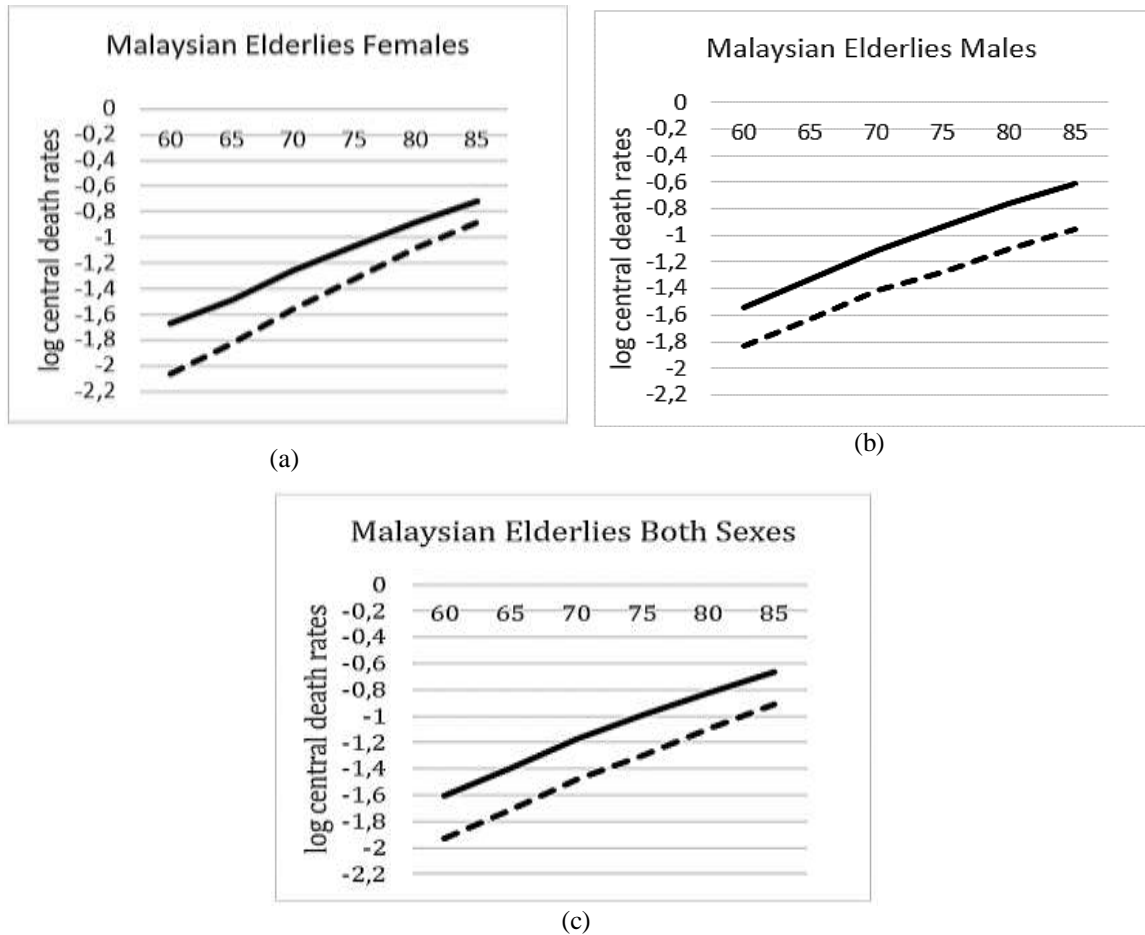

(a)   (b)

(c)

Figure 1. The estimated log central death rates $M_{x,t}$ of Malaysian elderlies males, (a) females (b) and both genders (c) from year 1950 (full line) to 2015 (dashed line)

Table 2. Malaysian elderly males mortality table in year 2010-2015

x	n	$_nP_x$	$_nD_x$	$_nM_x$	a	$_nq_x$	$_np_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
60	5	2782545	41203	0.01481	0.5	0.07140	0.9286	85,355	6,094	411539	1,819,722	21.32
65	5	1915831	45587	0.02379	0.5	0.11229	0.8877	79,261	8,901	374053	1,408,183	17.77
70	5	1262199	48232	0.03821	0.5	0.17440	0.8256	70,360	12,271	321124	1,034,131	14.70
75	5	838859	44804	0.05341	0.5	0.23560	0.7644	58,089	13,686	256232	713,007	12.27
80	5	418709	32707	0.07811	0.5	0.32676	0.6732	44,404	14,509	185745	456,774	10.29
85	5	162276	17899	0.11030		1.00000	0.0000	29,894	29,894	271029	271,029	9.07

Table 3. Malaysian elderly females mortality table in year 2010-2015

x	n	$_nP_x$	$_nD_x$	$_nM_x$	a	$_nq_x$	$_np_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
60	5	2723040	23692	0.00870	0.5	0.04258	0.9574	91,889	3,912	449663	2,088,273	22.73
65	5	1934312	28893	0.01494	0.5	0.07200	0.9280	87,976	6,334	424047	1,638,610	18.63
70	5	1312330	36202	0.02759	0.5	0.12903	0.8710	81,642	10,534	381876	1,214,563	14.88
75	5	916477	43397	0.04735	0.5	0.21170	0.7883	71,108	15,053	317906	832,687	11.71
80	5	481145	39372	0.08183	0.5	0.33966	0.6603	56,054	19,040	232673	514,781	9.18
85	5	186894	24522	0.13121		1.00000	0.0000	37,015	37,015	282108	282,108	7.62

Table 4. Malaysian elderly life expectancy improvement by age group

Age	Males			Females		
	1950-1955	2010-2015	% of increment	1950-1955	2010-2015	% of increment
60	14.56	21.32	46%	16.98	22.73	34%
65	11.41	17.77	56%	13.62	18.63	37%
70	8.74	14.70	68%	10.62	14.88	40%
75	6.69	12.27	83%	8.25	11.71	42%
80	5.12	10.29	101%	6.42	9.18	43%
85	4.07	9.07	123%	5.20	7.62	46%

4. CONCLUSION

This paper estimates the life expectancy and its improvements among Malaysian elderlies in Malaysia using the life table approach. The analysis of central death rates showed that both males and females are increasing almost in linear pattern by age, associated with health problems that generally occurred at later ages. Comparison between genders shows that Elderly females have lower mortality rates than males at almost all ages, nonetheless, mortality improvement is higher for males. The estimation of mortality improvements clearly showed that recent elderly generations tend to live significantly higher than previous generation, hence informing policymakers to have a proper planning for social benefits related to elderlies. The results of this study can be useful for further research particularly that estimates the costs of pensions or long term care insurance.

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