How Long People Live in a Religious State? Evidence Based on the Proposed Indicator of Religious Life Expectancy

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Abstract

Most of the humans in the world live their lives by following a certain religion. Empirical research is needed to explore the time span of religion in people's lives. This paper proposed an indicator that calculates the average number of years that a person lives in a religious state. By taking Pakistan as a case study and using the secondary data of age-specific mortality rates, eight different methods i.e., linear method, exponential method with second and third degree, Farr's method, Chiang's method, Reed and Merrell's method, Greville's method and Fregany's method are used to calculate the life expectancy and religious life expectancy. It is a well-known fact that females live longer than males. Our findings confirmed this fact; 65.70 years male life expectancy at birth and 67.59 years female life expectancy at birth in Pakistan. A similar trend is observed that female religious life expectancy 45.93 years is higher compared to their male counterparts 36.45 years. Though based on different methods the pattern of religious life expectancy values is almost similar. Notably, the proposed index is an easy to estimate measure and it could best be used to calculate the religious life span of individuals belonging to other divine religions of the world.

Keywords

Indicator, Life table, life expectancy, religious life expectancy, Pakistan.

1. Introduction

If the global population is differentiated based on religion, only 16 percent identify themselves as non-believers, whereas believers are on the continuous rise (84%) in the world. In a day-to-day life of humans, religion not only acts as an agency of socialization among people but also seems to be the regulator of human values. Human values vary from person to person and from organization to organization, for example, in the court of the justice process, the statements of witness are sought through giving an oath on a religious book. This religious reflection is not confined to this simple example, but, given that there are 193 independent countries in the world: some of these countries with their official names are listed below: The Islamic Republic of Afghanistan, The Arab Republic of Egypt, The Islamic Republic of Iran, The Islamic Republic of Mauritania, and The Islamic Republic of Pakistan etc. In these few names, the word 'Islamic' presents a role of religion as a marked face as a first introduction of the country. The Vatican City is the powerful Centre of Roman Catholicism exhibits a substantial role of religion of the Vatican government. The Church of England is the largest Christian denomination of United Kingdom. The average number of attendees in the Church of England was 740,000

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on a particular Sunday in 2016 (Botting, 2017). Forwarding these remarks, more than 70% of 193 countries of the world used the word 'Republic' in their official name. A self-explanatory meaning of the word republic is: "supreme power is held by the people and their elected representative", given that most of the people belong to a certain religion would translate the word republic to a specific religion. There are official holidays to perform the religious obligation—Christmas, Easter, Eid-ul-Azha, Holi are some of the most common ones. There exist a rich literature that religion plays a great role in decisions of individual's life—fertility, family planning choices, marriage attitudes, gender names are just few dimensions mentioned here (Ali and Ushijima, 2005; Frejka and Westoff, 2008; Jones and Nortman, 1968; Liefbroer and Rijken, 2019; Marks, 2005; Nasir and Hinde, 2011).

The practice of religion stays inside the lives of peoples. Even for some people religion is a matter of life and death. Apart from the segregations of different religions of the world (for example Christian, Muslims, Jews, Hinduism, sand many others), it is firmly observed that religion contributed as a compulsory part and parcel of an individual's life. A simple, novel empirical methodology to understand the religious part in the lifetime of individuals is a subject for the present work. People's lifetimes are measured through an indicator known as 'Life expectancy' (the number of years that a new born is expected to live on average). To amalgamate the time of religion spent by individuals with life expectancy, this paper develops an empirical analysis by assembling survey data to test a new indicator—religious life expectancy (RLE).

2. Religious life expectancy: the proposed indicator

RLE accounts for two elements: religious time spending and life expectancy. RLE is a single number indicator, and it may be interpreted as the "average number of years a man or woman lives in a religious state". This indicator aims to look at a person's years of life but in a religious state. The Religious Life Expectancy was calculated by using empirical data of the age-specific death rates (ASDR) and the age-specific religious proportion (ASRP). The estimation of the RLE follows the construction of life table technique used to calculate the life expectancy (Hinde, 2014; Rowland, 2003; Shryock and Siegel, 1980). For the calculations of life table columns age specific mortality rates (m_x) are required. The traditional life table consists of the following columns:

Column 1: x (age interval).
Column 2: Death Probability q_x within age interval [x, x+n], this column needs age-
           specific death rates (m_x).
Column 3: Number of survivors l_x from birth to exact age *x*.
Column 4: Deaths d_x within the age interval [x, x+n].
Column 5: Person-years L_x lived within the basic age interval [x, x+n).
Column 6: Total Person year lived T_x after the particular age *x*.
Column 7: life expectancy e_x at age *x*.

Age-specific religious proportions are required for the calculation of RLE. After obtaining these proportions, the calculation of RLE is straight forward. The new column in the traditional life table is the weighted number of person-year at each age by the age-specific religious proportions (PR_x). Then like in a regular life table function, RL_x is Person year in the religious state would be calculated as follows:

$$(L_x)(PR_x) = RL_x$$

$$PR_x = \frac{N_r}{T_p}$$

where, N_r = number of religious persons at time t and T_p = total number of persons (religious total).

Religious life expectancy (RLE) is estimated by dividing the cumulative person year in the religious state by l_x column i.e.,

$$Re_x = \frac{RT_x}{l_x}$$

where, RT_x = Cumulative from the last class.

Yamane's Formula

$$n = \frac{N}{1 + N(e^2)}$$

3. Life table construction methods

There are many methods available to make an ordinary life table using data on age-specific death rates. To do comparison and direction as well as magnitudes of RLE values, the following methods are applied to construct the ordinary and religious life table (see Table 1).

Table 1: Different methods of construction of life table.

Life Table Method	Death Probability q_x (p_x Survival)	Person-years L_x lived
Linear	$q_x = \dfrac{2m_x}{2 + m_x}$	$L_x = \dfrac{n}{2}(l_x + l_{x+n})$
Exponential (2nd degree)	$q_x = 1-e^{(-n.m_x)}$	$L_x = \dfrac{n}{2}(l_x + l_{x+n}) + \dfrac{n}{24}(d_{x+n} + d_{x-n})$
Exponential (3rd degree)	$q_x = 1-e^{(-n.m_x)}$	$L_x = \dfrac{n}{2}(l_x + l_{x+n}) + \dfrac{n}{24}(d_{x+n} - d_{x-n})$
Farr's	$p_x = \left(\dfrac{2-m_x}{2+m_x}\right)^2$	$L_x = \dfrac{n}{2}(l_x + l_{x+n})$
Chiang's	$q_x = \dfrac{n.m_x}{1+(n-a_x).m_x}$	$L_x = n.(l_x - d_x) + a_x.d_x$
Lowell Reed and Margaret Merrell	$q_x = 1 - e^{-n.m_x - an^3*m_x^2}$	$T_x = -0.20833 l_{x-5} + 2.5 l_x + 5\sum_{\alpha=1}^{\infty} l_{x+5\alpha}$
Greville's	$q_x = \dfrac{m_x}{\frac{1}{n} + \left[m_x\left(0.5 + \frac{n}{12}\right).\{m_x - k\}\right]}$	$L_x = \dfrac{d_x}{m_x}$
Fregany's	$q_x = 1 - e^{(-n.m_x)}$	$L_x = \dfrac{d_x}{m_x}$

4. Application

To test the proposed indicator, we applied it on the secondary data for Pakistan, published by "World Health Organization", available online (World Health Organization, 2019). The data comprises of information regarding age-specific death rates for many years, but we used age-specific death rates only for the year 2016 as it was the most recent data. In addition, we also decided to survey and collect the information from both the Muslim males and females through a questionnaire regarding their religious time spending. Yamane's formula has been used, which is described in section 2 for selecting the sample. The data has been collected from different houses using simple random sampling technique. A few respondents didn't fill questionnaire properly which were excluded. Sample of 178 males and 178 females was taken to find the age-specific religious proportion and both genders were classified into twelve different age groups.

5. Results

The overall life expectancy at birth for the male and female population of Pakistan is calculated to be 65.7 and 67.59 years, respectively (details life table calculations not shown here). Results indicate that females have a better life span as compared to males. The life expectancy and RLE both for males and females are presented in Tables 2 to 5. The life expectancy having the age group 10-14 is (61.8 years) and (63.62 years) for males and females, respectively. In Pakistan (2016), the RLE having age group 10-14 is 36.5 and 44.1 years for males and females, respectively. It shows that the female RLE is also 7.6 years higher than the male RLE. The analysis further revealed that a male who has completed 65 years will live about 4.1 years in a religious state, while a 65-year-old female will live about 4.7 years in a religious state.

The female having the age group 10-14 have a maximum life expectancy (63.74 years) under the second-degree exponential method and the age group of 65-69 has a life expectancy of 14.51 years (Table 4). When comparing other methods, the minimum life expectancy of females at the age group 10-14 was revealed to be 60.54 years and at the age group of 65-69 have a life expectancy of 11.05 years under the Reed and Merrell's method.

Demographically, it is observed that females live longer than males. In our findings, females seemed better survivors than males (Table 2 and 4). A similar trend is observed that female religious life expectancy is higher compared to their male counterparts (Figure 1 and Table 5). After 45 years of life, the religious life expectancy for males and females was revealed to be similar. The only exception is observed under Chiang's method: male (43.7 years) and female (43.6 years) religious life expectancy revealed to be closer.

Table 2: Life Expectancy by using different life table methods (Male).

Age group	Life Expectancy							
	Linear	Exp. 2nd Degree	Exp. 3rd Degree	Farr's	Chiang	Reed and Merrill	Greville	Fregany
10-14	61.84	61.69	61.92	61.89	60.51	58.61	61.65	61.54
15-19	57.14	56.99	57.22	57.19	55.81	53.89	56.94	56.83
20-24	52.41	52.26	52.50	52.46	51.09	49.16	52.22	52.10
25-29	47.66	47.51	47.75	47.71	46.34	44.39	47.46	47.35
30-34	43.12	42.96	43.20	43.17	41.80	39.83	42.91	42.80
35-39	38.53	38.37	38.61	38.58	37.21	35.22	38.32	38.21
40-44	34.07	33.91	34.15	34.12	32.76	30.73	33.86	33.75
45-49	29.71	29.54	29.79	29.76	28.41	26.34	29.49	29.38
50-54	25.40	25.22	25.48	25.45	24.11	21.99	25.17	25.06
59-60	21.33	21.14	21.42	21.39	20.06	17.88	21.09	20.98
60-64	17.60	17.38	17.68	17.65	16.34	14.10	17.33	17.23
65-69	14.10	13.86	14.19	14.16	12.86	10.58	13.79	13.70

Table 3: Religious Life Expectancy by using different life table methods (Male).

Age group	Religious Life Expectancy							
	Linear	Exp. 2nd Degree	Exp. 3rd Degree	Farr's	Chiang	Reed and Merrill	Greville	Fregany
10-14	36.5	36.5	36.5	36.5	43.7	36.0	36.5	36.4
15-19	34.5	34.5	34.5	34.5	41.8	34.0	34.5	34.5
20-24	32.3	32.3	32.3	32.3	38.0	31.8	32.3	32.3
25-29	29.4	29.4	29.4	29.4	34.3	28.9	29.4	29.3
30-34	26.6	26.7	26.7	26.6	30.6	26.1	26.7	26.6
35-39	25.1	25.1	25.1	25.1	26.3	24.6	25.1	25.0
40-44	22.9	22.9	22.9	22.9	23.6	22.4	23.0	22.9
45-49	19.2	19.2	19.2	19.2	19.8	18.7	19.2	19.2
50-54	15.5	15.5	15.5	15.5	15.7	15.1	15.5	15.5
59-60	12.0	12.0	12.0	12.0	12.4	11.6	12.0	12.0
60-64	8.5	8.5	8.5	8.5	8.9	8.2	8.5	8.5
65-69	4.1	4.1	4.1	4.1	4.5	3.9	4.1	4.1

Table 4: Life Expectancy by using different life table methods (Female).

Age group	Life Expectancy							
	Linear	Exp 2nd Degree	Exp 3rd Degree	Farr's	Chiang	Reed and Merrill	Greville	Fregany
10-14	63.62	63.74	63.52	63.67	62.31	60.54	63.43	63.32
15-19	58.92	59.05	58.82	58.97	57.62	55.83	58.74	58.63
20-24	54.20	54.33	54.11	54.26	52.91	51.10	54.02	53.91
25-29	49.46	49.59	49.36	49.52	48.17	46.35	49.28	49.17
30-34	44.70	44.83	44.60	44.75	43.41	41.58	44.51	44.40
35-39	39.91	40.04	39.81	39.96	38.62	36.78	39.72	39.61
40-44	35.29	35.41	35.18	35.34	34.00	32.13	35.09	34.98
45-49	30.78	30.91	30.68	30.84	29.51	27.60	30.58	30.47
50-54	26.35	26.48	26.24	26.41	25.09	23.14	26.15	26.04
59-60	22.08	22.21	21.97	22.14	20.83	18.82	21.86	21.76
60-64	18.08	18.21	17.96	18.14	16.85	14.78	17.85	17.75
65-69	14.38	14.51	14.24	14.45	13.17	11.05	14.12	14.02

Table 5: Religious Life Expectancy by using different life table methods (Female).

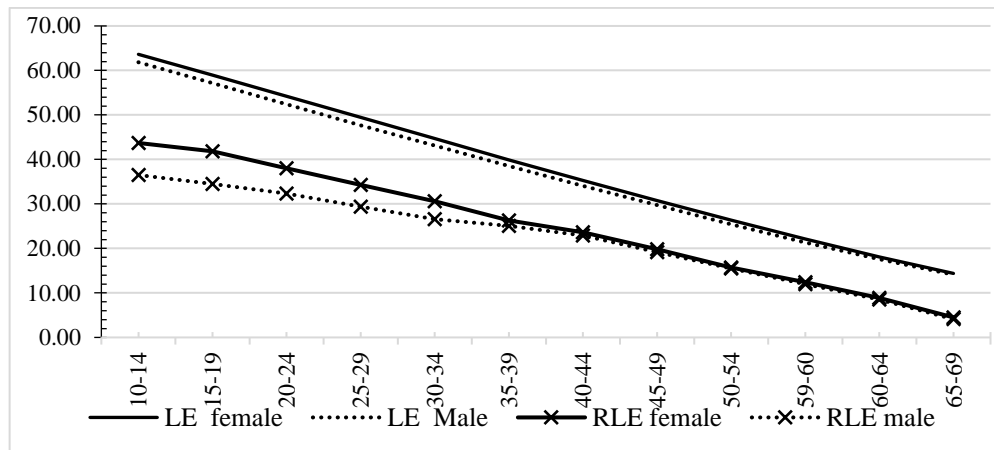| Age group	Religious Life Expectancy							
	Linear	Exp 2nd Degree	Exp 3rd Degree	Farr's	Chiang	Reed and Merrill	Greville	Fregany
10-14	43.7	44.1	44.1	44.1	43.6	43.7	44.1	44.1
15-19	41.8	42.2	42.2	42.1	41.7	41.8	42.2	42.1
20-24	38.0	38.5	38.4	38.4	37.9	38.0	38.5	38.4
25-29	34.3	34.7	34.7	34.7	34.2	34.3	34.7	34.7
30-34	30.6	31.0	31.0	31.0	30.5	30.6	31.0	30.9
35-39	26.3	26.7	26.7	26.7	26.2	26.3	26.7	26.6
40-44	23.6	24.0	24.0	24.0	23.5	23.6	24.0	24.0
45-49	19.8	20.2	20.2	20.2	19.7	19.8	20.2	20.1
50-54	15.7	16.1	16.1	16.1	15.6	15.7	16.1	16.1
59-60	12.4	12.8	12.8	12.8	12.4	12.4	12.8	12.7
60-64	8.9	9.2	9.1	9.1	8.8	8.9	9.2	9.1
65-69	4.5	4.7	4.7	4.7	4.5	4.5	4.7	4.7

Figure 1: Life expectancy and religious life expectancy of males and females using linear method.

6. Discussion

Measuring life expectancy is a significant indicator of human wellbeing and quality of life. In this paper, a new indicator for social development is introduced, Religious Life Expectancy, which does not use any economic measurements but combines religion and life expectancy in one number. The RLE is a social indicator that is based on human characteristics; mortality and Religiousness, and not on Gross Domestic Products (GDP). Therefore, there can be no failure of RLE in catching its social benefits for a better quality of life. Our results showed that the RLE indicator is very simple and comprehensive to measure how much people live in their religious state.

Pakistan has experienced an impressive increase in life expectancy in the last seven decades. Moreover, females residing in Pakistan have about 2 years higher life expectancy at the time of birth as compared to males (World Bank, 2019). Our findings on life expectancy also suggest longer life spans of females. This finding is consistent with other published work—not only at the national level; the life expectancy at birth of females is higher compared to males, but also across six other geographic regions (urban, rural, Punjab, Sindh, Khyber, and Balochistan); high life expectancy of females is empirically observed. Women in Pakistan live in a stressful environment, are less empowered, and lack of choices to decide family planning (Zafar and Malik, 2016), and other household chores (Ibtasam et al., 2018). With all these hassles they have a better life expectancy in all age groups. Results revealed that differences in life expectancies of males and females are getting closer with the increase in age groups. At a younger age, females have better life expectancy while in the older group it's about like to men.

The findings of the new indicator RLE showed interesting results. The males in their young age groups, showed less involvement in the religion having about 7 years less RLE compared to females. The possible grounds are that some of the males, in their younger age groups are more exposed to new ideas that undermined their religious beliefs and others are busy in their study and earning tasks (De Vaus and McAllister, 1987). Pakistani females, on the other part, due to general social rules like; motherhood and homemaking, are a little bit less exposed to modern ideas and religion live an important part in their lives. They more frequently perform religious obligations to survive and secure their

standing in the family. Many people accept those girls for marital life who are keenly involved in religious practice, and it seemed to be a set standard in the mind of patriarchal male-dominated Pakistan. Sometimes the only option left to women is to pray to Allah even for their values and for due rights. Other reasons of higher RLE for female could be their less participation in labour force as compared to their male counterparts (Sarwar and Abbasi, 2013). Therefore, females have more time to perform religious commitment in their younger age groups.

We need to identify the mechanism by which religion affects the life expectancy of females or even males in our society. Good religion understating and involvement enables humans to understand the meaning of life and sense of living. Religion is considered one of the major sources to generate a meaningful life. Generally, religion is more appealing to women than men. Our findings can be linked that one possibility of higher life expectancy of females, is more participation in religious activities. As religious participation are close to nature and natural living always improves the quality of life hence improve life expectancy. Analysis results showed that as people (both male and female) getting older their life expectancies are getting closer (less than half year gender gap after 60 years of age). Gender gaps in RLE are also getting closer after the age of 40 years. It's less than 1 year after the age of 40 years and even less than half years after their 50th birthday.

7. Final remarks

Population's health of a society is related to its greater life expectancy. Globally life expectancy is on the rise. In addition, in a recent study, religious beliefs are positively associated with longevity (Wallace, Anthony, End, and Way, 2019). This paper used eight different life table methods to find out the "life expectancy" and "Religious Life Expectancy". The use of different life table methods helps to identify the pattern of RLE. These findings suggest that there are fewer variations in the magnitude of the values calculated for life expectancy and religious life expectancy. Though based on different methods the pattern of RLE values is almost similar. For example, among females comparing across eight different methods, 44.1 years is observed to be the highest value of RLE whereas 43.7 years as the lowest value of RLE. Through these findings, it could be empirically said that about two-thirds lifetime of the individual is spent in a religious state. In conclusion, we use simple and easy to use methodology to explore the person's religious life span.

8. Study limitations and future directions

This study is limited to give the information of how many years the Muslims in Pakistan devote to religion during their life span. There could be likely variations of the Muslims living in other parts of the world. These results are not universal and should be interpreted with caution. In addition, the study has the potential to be replicated for other religions—Christianity, Judaism etc. are the most common and divine religions in the world. In numerical terms there are about 4300 religions in the world. The indicator is assumed to work well to explore the RLE's of different religions. In addition, there are several sects within any religion. The proposed approach is also assumed to work well to explore the religious time span of say Roman Catholic versus Protestants or the Ahl-e-Taseh (Shia) versus Ahl-e-Hadith (Deo-bandi or Wahabi) and these directions could be considered as future lines to work.

Appendix

A.1 Questionnaire

Person No	Age Interval	Date of Birth	Gender	Sects	Prayers	Time	Compulsory Religious Obligations	Score	Conclusion
1.			☐ Male ☐ Female	☐ Sunni ☐ Ahl-hadith ☐ Shia'a ☐ Deo-bandi ☐ Others If Yes Specified	☐ Fajar ☐ Zuhr ☐ Asar ☐ Maghrib ☐ Isha	☐ Ba-jamat ☐ In-time ☐ Qaza	☐ Fasting ☐ Hajj ☐ Zakat ☐ Other _____		☐ Religious ☐ Not Religious
2.			☐ Male ☐ Female	☐ Sunni ☐ Ahl-hadith ☐ Deo-bandi ☐ Shia'a ☐ Others If Yes Specified	☐ Fajar ☐ Zuhr ☐ Asar ☐ Maghrib ☐ Isha	☐ Ba-jamat ☐ In-time ☐ Qaza	☐ Fasting ☐ Hajj ☐ Zakat ☐ Other _____		☐ Religious ☐ Not Religious
3.			☐ Male ☐ Female	☐ Sunni ☐ Ahl-hadith ☐ Deo-bandi ☐ Shia 'a ☐ Others If Yes Specified	☐ Fajar ☐ Zuhr ☐ Asar ☐ Maghrib ☐ Isha	☐ Ba-jamat ☐ In-time ☐ Qaza	☐ Fasting ☐ Hajj ☐ Zakat ☐ Other _____		☐ Religious ☐ Not Religious
4.			☐ Male ☐ Female	☐ Suni ☐ Ahl-hadith ☐ Shia 'a ☐ Deo-bandi ☐ Others If Yes Specified	☐ Fajar ☐ Zuhr ☐ Asar ☐ Maghrib ☐ Isha	☐ Ba-jamat ☐ In-time ☐ Qaza	☐ Fasting ☐ Hajj ☐ Zakat ☐ Other _____		☐ Religious ☐ Not Religious
5.			☐ Male ☐ Female	☐ Suni ☐ Ahl-hadith ☐ Deo-bandi ☐ Shia 'a ☐ Others If Yes Specified	☐ Fajar ☐ Zuhr ☐ Asar ☐ Maghrib ☐ Isha	☐ Ba-jamat ☐ In-time ☐ Qaza	☐ Fasting ☐ Hajj ☐ Zakat ☐ Other _____		☐ Religious ☐ Not Religious
6.			☐ Male ☐ Female	☐ Suni ☐ Ahl-hadith ☐ Deo-bandi ☐ Shia 'a ☐ Others If Yes Specified	☐ Fajar ☐ Zuhr ☐ Asar ☐ Maghrib ☐ Isha	☐ Ba-jamat ☐ In-time ☐ Qaza	☐ Fasting ☐ Hajj ☐ Zakat ☐ Other _____		☐ Religious ☐ Not Religious
7.			☐ Male ☐ Female	☐ Suni ☐ Ahl-hadith ☐ Deo-bandi ☐ Shia 'a ☐ Others If Yes Specified	☐ Fajar ☐ Zuhr ☐ Asar ☐ Maghrib ☐ Isha	☐ Ba-jamat ☐ In-time ☐ Qaza	☐ Fasting ☐ Hajj ☐ Zakat ☐ Other _____		☐ Religious ☐ Not Religious

Appendix A.2. Life Expectancy and Religious Life Expectancy of males and females using Chiang's Method.

						Ordinary and Religious Life Expectancy by Chiang's Method							
				Ordinary Life Table						Religious Life Table			
Ages	n	m_x	a_x	q_x	l_x	d_x	L_x	T_x	E_x	PR_x	RL_x	RT_x	RE_x
<1	1	0.066	0.24	0.06	1000	67.63	966.18	65747.53	65.75				
1-4	4	0.004	1.52	0.02	932.37	14.80	3699.87	64781.35	69.48				
5-9	5	0.001	0.50	0.00	917.57	4.58	4576.40	61081.47	66.57				
10-14	5	0.001	0.50	0.00	912.99	4.55	4553.57	56505.08	61.89	0.43	1951.53	33283.66	43.58
15-19	5	0.001	0.50	0.00	908.44	4.53	4530.86	51951.50	57.19	0.47	2146.20	31332.13	41.65
20-24	5	0.001	0.50	0.00	903.91	4.51	4508.27	47420.64	52.46	0.62	2781.70	29185.93	37.94
25-29	5	0.001	0.50	0.00	899.40	8.95	4474.62	42912.37	47.71	0.60	2684.77	26404.24	34.20
30-34	5	0.001	0.50	0.00	890.45	8.86	4430.10	38437.75	43.17	0.37	1632.14	23719.46	30.48
35-39	5	0.002	0.50	0.01	881.59	13.13	4375.14	34007.65	38.58	0.50	2187.57	22087.32	26.18
40-44	5	0.003	0.50	0.01	868.46	17.20	4299.33	29632.52	34.12	0.83	3582.78	19899.76	23.52
45-49	5	0.004	0.50	0.02	851.27	21.02	4203.79	25333.19	29.76	0.82	3439.47	16316.98	19.71
50-54	5	0.006	0.50	0.03	830.25	32.55	4069.86	21129.40	25.45	0.82	3329.89	12877.51	15.65
55-59	5	0.01	0.50	0.05	797.70	50.20	3862.97	17059.53	21.39	0.83	3219.14	9547.63	12.36
60-64	5	0.016	0.50	0.07	747.49	67.75	3568.10	13196.56	17.65	1.00	3568.10	6328.48	8.79
65-69	5	0.027	0.50	0.12	679.75	97.61	3154.72	9628.46	14.16	1.00	3264.20	3264.20	4.46
70-74	5	0.045	0.50	0.19	582.14	124.23	2600.11	6473.74	11.12				
75-79	5	0.075	0.50	0.28	457.91	146.38	1923.57	3873.62	8.46				
80-84	5	0.126	0.50	0.40	311.52	142.39	1201.65	1950.05	6.26				
85+	5	0.242	0.50	0.58	169.14	114.77	748.40	748.40	4.42				

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