Actuarial Society of the Philippines (ASP)
Life Insurance Committee

2017 Philippine Intercompany Mortality Study

Final Report – May 18, 2017

2017 PHILIPPINE INTERCOMPANY MORTALITY STUDY

Contents

1 Acknowledgements

This report is the work of the Actuarial Society of the Philippines (ASP) Life Insurance Committee for 2016-2017. The members of the ASP Life Insurance Committee are as follows:

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This report was made possible through the cooperation and support of the Insurance Commission of the Philippines. Special thanks are extended to the Actuarial Division of the Insurance Commission, headed by Ms. Maricel G. Basallote and consulting actuary, Ms. Ma. Asuncion D. Martin.

2 Executive Summary

The Actuarial Society of the Philippines (ASP) Life Insurance Committee spearheaded the development of this mortality study, in collaboration with the Insurance Commission. This study includes the experience of standard traditional and variable life policies over a 5-year observation period from policy anniversaries in 2009 to 2014. The mortality data came from 27 life insurance companies, representing practically 100% coverage of the Philippine Life Insurance Industry. The result of the study consists of sex-distinct, basic ultimate tables on age-last-birthday and age-nearest-birthday bases, without loadings (Annex 3).

Compared to the last Philippine Intercompany Mortality (PICM) Study covering experience from 1973 to 1978, the results from this study exhibit considerable improvement in mortality rates. This study, therefore, further emphasizes the critical need to update the old Philippine mortality table, in light of changes that affected mortality experience over the decades.

When using the results of the study, close consideration should be given to the basis and composition of the resulting mortality rates. The relative experience and exposures by various underwriting classifications and product types are indicated in this report to provide further guidance on its application. Given the rapidly changing underwriting practices and evolving life insurance market, frequent updates to this study is highly recommended.

3 Background

The last Philippine Intercompany Mortality Study which resulted to a published mortality table was presented in 1983, covering exposures observed from 1973 to 1978. Since that time, industry experience studies have shown considerable improvement in the mortality experience of life insurance companies. In addition, the life insurance industry has seen the development of new distribution channels (such as Bancassurance), products (such as Variable Life) and new operational systems (such as automated underwriting) which are likely to have contributed further to mortality differentials. It has become imperative therefore to have an updated mortality table.

Aside from its benefits for life insurance pricing, an updated mortality table could also support recent changes in regulation, such as those relating to life insurance valuation standards and risk-based capital framework, both of which require best-estimate cash flow projections.

This new mortality study was undertaken by the Actuarial Society of the Philippines (ASP) Life Insurance Committee from 2016 to 2017, in collaboration with the Insurance Commission. The result of the study consists of sex-distinct, ultimate basic mortality tables on age-last-birthday and age-nearest-birthday bases, without margins.

Although experience by underwriting class and product types seem to vary considerably as shown subsequently, no separate tables were done for such classes. Instead, the experience for various product types and classes are shown, relative to the final proposed table.

4 Study Parameters

This study covers a 5-year observation period from policy anniversaries in 2009 to policy anniversaries in 2014 for standard individual variable life and traditional policies, whereby the experience of traditional policies includes both term and non-term products. The underwriting classifications covered in the study include standard, medically and non-medically underwritten policies, as well as policies with guaranteed-issue feature. The resulting crude and graduated mortality rates are sex-distinct, and available on age-last-birthday and age-nearest-birthday bases. The resulting mortality tables are ultimate tables, representing the experience during the observation period for policy years of at least 3 years. All mortality rates are weighted by policy count. Although mortality rates and exposures are available for both age-last-birthday and age-nearest-birthday bases, this report uses age-last-birthday basis unless otherwise specified. Totals of exposures in some tables may not be exact due to rounding.

The table below contains a summary of the parameters and statistical data used in this study, and those of the previous PICM study conducted more than three decades ago.

Key Study Features	PICM (1973-1978)	PICM (2009-2014)
Observation Period	5 years (1973-1978)	5 years (2009-2014)
Product Type	Ordinary	Traditional (Term and non-term) and Variable Life
Underwriting Classification	Standard, Medically Underwritten	Standard Medical, Standard Non-medical and Guaranteed Issue.
Gender	Unisex	Sex-distinct
Ultimate Policy Years	6^{th} Policy Year and Up	3^{rd} Policy Year and Up

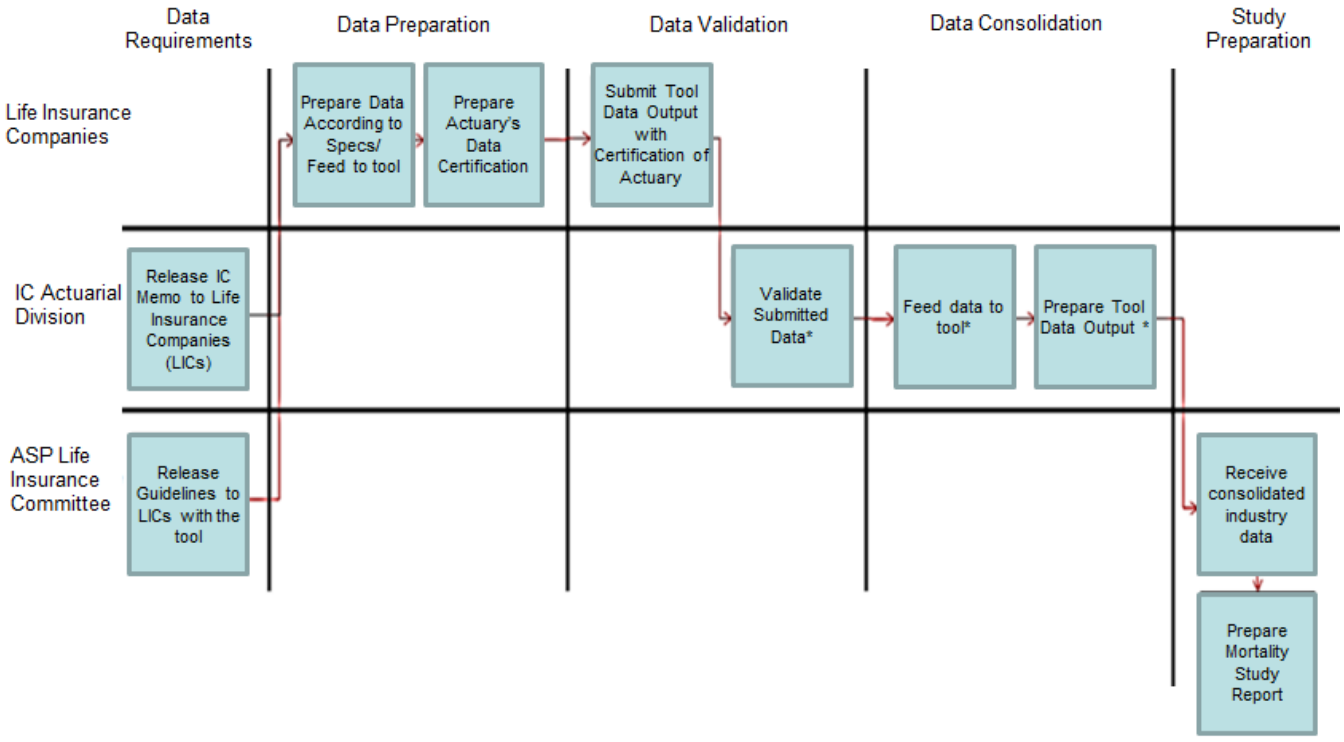
Observation Period Total Exposures	977,855 years	13,589,546 years
Observation Period Total Deaths	5,064 deaths	31,307 deaths

The mortality data came from 27 life insurance companies, representing almost 100% of the life insurance industry. The complete list of companies that participated in the study is shown in Annex 1. In contrast, only 6 companies contributed to the previous mortality study covering experience from 1973-1978.

5 Data Gathering Process

In order to gather the required data, the ASP distributed to the participants, through the Insurance Commission, the guidelines for data preparation and submission (Annex 2). The guidelines outline the study parameters and the format of the policy database that should be prepared by each company contributing to the study. The policy data will be processed by running the mortality study software provided by the ASP. This software performs data checks and calculates exposures and deaths per attained age and policy year under two age bases: (1) age last birthday and (2) age nearest birthday. The outputs of such runs are to be submitted by the participating company to the Insurance Commission. After conducting high level checks for reasonableness of the data submission from each company, the Insurance Commission runs the same software to combine the company submissions into a consolidated industry result. This industry output will then be sent to the ASP Life Insurance Committee (Committee) for further checks for reasonableness and analysis.

The entire process is depicted in the following chart:



6 Confidentiality of Contributions

Most members of the Committee are employed by life insurance companies and ideally should not have access to the data contributions at the company level. To ensure confidentiality of the submitted data, only the Actuarial Division of the Insurance Commission has access to study results on a company level. Committee members have access to the consolidated results only, after the company contributions were checked and processed by the Insurance Commission using the software provided by the ASP.

7 Data Checks

The Committee is well aware that the accuracy of the data is very critical to the integrity of the study and exerted all efforts to minimize data errors, while promoting efficiency in data collection and maintaining confidentiality of company experience through the help of the Insurance Commission.

- The mortality study software was developed from technical specifications provided by the Committee. This software underwent rigorous user acceptance testing prior to its distribution to participating companies.
- Using this software, each company only needed to prepare the policy database in a specific format as outlined in Annex 2. The software performed data checks and calculated exposures, deaths and crude rates then summarizes the result for submission to the Insurance commission.
- A half-day seminar was conducted with the company representatives to discuss the study guidelines, data preparation requirements and use of mortality study software. This helped avoid any misinterpretation with regards to the study guidelines.
- To minimize data errors and ensure reasonableness, all participating companies were required to have their data submissions certified by their representing actuary. The data certification includes a check for outliers by comparing total exposures with total policies inforce as contained in regulatory reports submitted to the Insurance Commission.
- The Insurance Commission, upon receiving submitted data per company, also conducted high level checks for reasonableness. The Insurance Commission coordinated directly with the participating company in case of any question regarding the submission, such as any observed unusual trends or figures in the submitted data.
- Upon receipt of the consolidated industry data by the Committee, checks were again conducted for unusual trends or figures on a consolidated level.

8 Observed Data Results and Trends

8.1 Total Exposures and Gender Mix

The study covers a total of 13,589,546 exposure years and 31, 307 claims, both measured by policy count.

Gender	Exposure		Claims	
	Count	Mix	Count	Mix
MALE	6,187,682	45.5%	19,947	63.7%
FEMALE	7,401,481	54.5%	11,360	36.3%
UNKNOWN	382	0.0%	0	0%
TOTAL	**13,589,546**	**100.0%**	**31,307**	**100%**

Based on exposure, 54.5% are females and 45.5% are males. An insignificant portion of the data, or about 382 exposure years, have unknown gender or no identified gender in the data submission. Since the study aims to show gender-based results, such insignificant data with unknown gender were excluded. As regards to the number of death claims, male represents 63.7%, while the balance is female at 36.3%

The following table shows the exposure and gender mix for the observation period covered in the study.

Observation Period	Exposure			Mix		Claims			Mix	
	Male	Female	Total	Male	Female	Male	Female	TOTAL	Male	Female
2009-2010	1,182,389	1,371,255	2,553,643	46%	54%	3,946	2,175	6,121	64%	36%
2010-2011	1,199,532	1,415,900	2,615,432	46%	54%	3,776	2,100	5,876	64%	36%
2011-2012	1,229,439	1,479,271	2,708,709	45%	55%	3,865	2,259	6,124	63%	37%
2012-2013	1,275,266	1,555,787	2,831,054	45%	55%	4,140	2,310	6,450	64%	36%
2013-2014	1,301,057	1,579,268	2,880,325	45%	55%	4,220	2,516	6,736	63%	37%
Total	**6,187,682**	**7,401,481**	**13,589,163**	**46%**	**54%**	**19,947**	**11,360**	**31,307**	**64%**	**36%**

The total exposure per year of observation shows steady increasing trend while the gender mix remains consistent throughout the five years of observation.

8.2 Underwriting Class and Product Type

The submitted data also provide exposures by Underwriting Classification and Product Type. The table below shows that majority of the exposures, about 56%, were non-medically underwritten. However, about 22% of the exposure have no indicated underwriting classification and are reflected in the table below as 'Unknown'. The 'Guaranteed' underwriting classification refers to guaranteed issue policies for which no underwriting selection was applied.

In terms of product type, Traditional Non-term comprised the majority at 79%, while Variable Life policies represent 17% of the exposures. The details of the exposure mix by Product Type and Underwriting Class is shown in the following table.

Product Type and Underwriting Class	Exposure				Mix			
	Traditional Non-Term	Traditional Term	Variable Life	Total	Traditional Non-Term	Traditional Term	Variable Life	Total
NONMEDICAL	6,952,657	446,324	250,108	7,649,089	51%	3%	2%	56%
MEDICAL	1,366,642	71,521	397,144	1,835,306	10%	1%	3%	14%
GUARANTEED	639,445	713	443,402	1,083,560	5%	0%	3%	8%
UNKNOWN	1,796,921	38,108	1,186,179	3,021,208	13%	0%	9%	22%
TOTAL	**10,755,665**	**556,666**	**2,276,832**	**13,589,163**	**79%**	**4%**	**17%**	**100%**

The following table summarizes the mix by Product Type through the years, which shows that the share of Variable Life has rapidly increased to 28% for the last policy year considered in the study. In contrast, the share of the Traditional Non-Term is decreasing. Based on this trend, it is expected that the mix by Product Type will continue to change in the coming years in favor of Variable Life exposures.

Policy Year	Exposure			Mix		
	Traditional Non-Term	Traditional Term	Variable Life	Traditional Non-Term	Traditional Term	Variable Life
2009-2010	2,207,921	95,520	250,203	86%	4%	10%
2010-2011	2,195,258	118,068	302,107	84%	5%	12%
2011-2012	2,198,170	122,087	388,453	81%	5%	14%
2012-2013	2,167,889	119,762	543,402	77%	4%	19%
2013-2014	1,986,427	101,229	792,668	69%	4%	28%
TOTAL	**10,755,665**	**556,666**	**2,276,832**	**79%**	**4%**	**17%**

The exposure mix by underwriting classification is also changing through the years, in favor of Guaranteed Issue policies, while the mix of non-medical cases is slightly decreasing as shown in the following table.

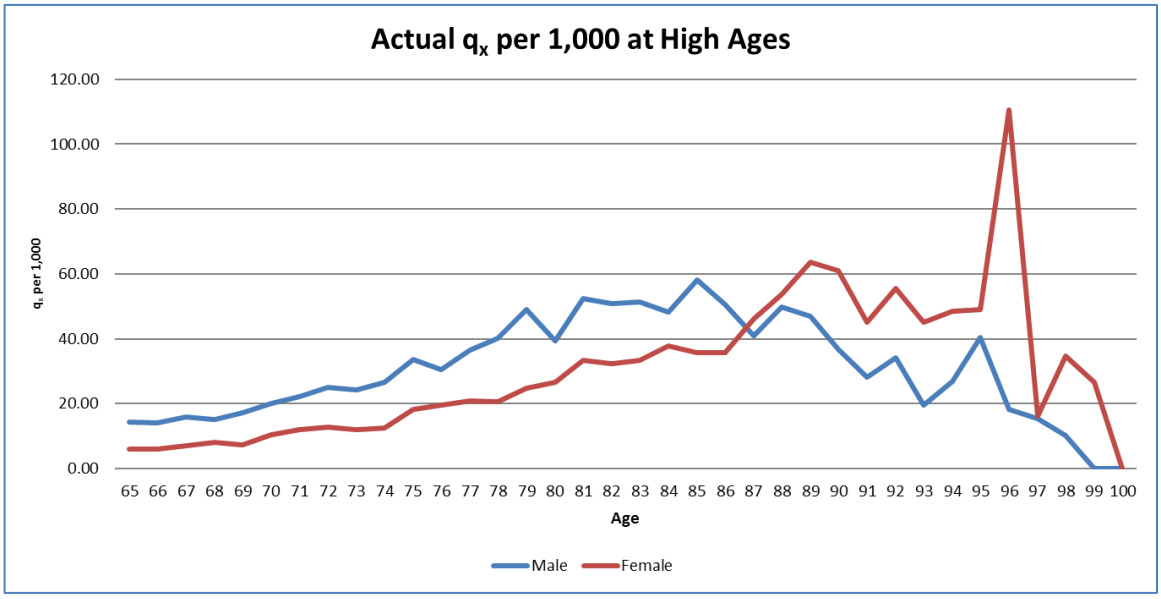
Policy Year	Exposure				Mix			
	NON MEDICAL	MEDICAL	GUAR. ISSUE	UNKNOWN	NON MEDICAL	MEDICAL	GUAR. ISSUE	UNKNOWN
2009-2010	1,482,030	344,235	166,270	561,107	58%	13%	7%	22%
2010-2011	1,520,044	349,650	175,419	570,319	58%	13%	7%	22%
2011-2012	1,566,964	362,774	191,001	587,971	58%	13%	7%	22%
2012-2013	1,598,531	378,970	232,169	621,383	56%	13%	8%	22%
2013-2014	1,481,520	399,677	318,701	680,427	51%	14%	11%	24%
TOTAL	**7,649,089**	**1,835,306**	**1,083,560**	**3,021,208**	**56%**	**14%**	**8%**	**22%**

This shift in exposure towards variable life and guaranteed issue policies would suggest further updates in the study in the near future, to determine if the claims experience of these exposure blocks would be significantly different.

9 Data Selection for Table Construction

9.1 Considerations for Older Ages

The crude rates, referring to the ratio of claims/exposure, for older ages were examined closely in terms of reasonableness. The following graph shows crude rates for older ages of the study.



Based on this graph, crude rates eventually decrease at extreme older ages, possibly because of the lack of exposures, or incidents of deaths are no longer reported to the insurance companies, thereby not materializing into claims. Given that crude rates are no longer reliable at extreme ages, the Committee had to choose the last age at which crude rates should be considered for the study.

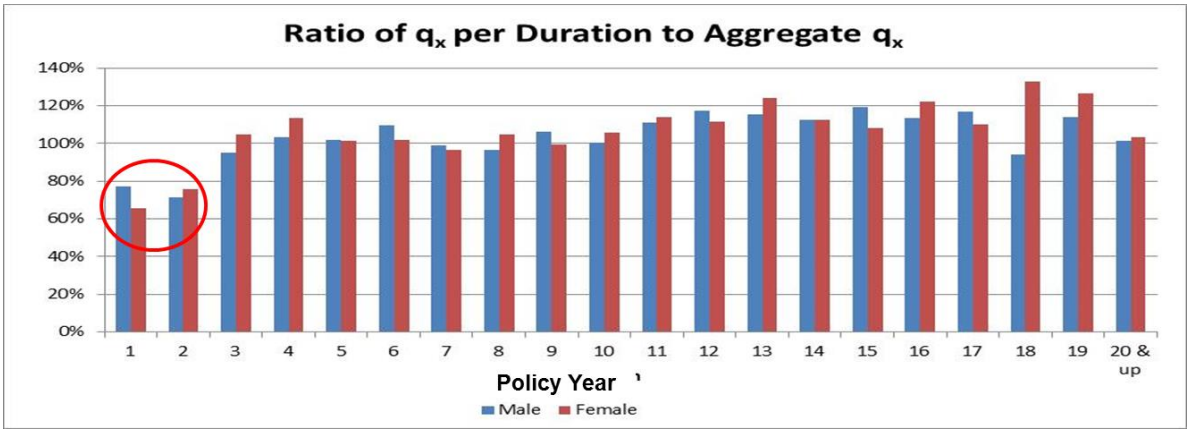
Taking note of the sudden drop in male crude rates at age 80, the Committee decided to exclude crude rates from ages 80 and above. The exposure for such ages were also reviewed and the table below shows that exposure for ages 80 and above represents merely 0.54% and 0.36% of the total male and female exposures, respectively.

Age	Male		Female	
	Exposure	% of Exposure exceeding age	Exposure	% of Exposure exceeding age
75	9,427	1.01%	7,558	0.65%
76	8,565	0.87%	6,522	0.56%
77	7,704	0.75%	5,650	0.49%
78	6,783	0.64%	4,946	0.42%
79	6,010	0.54%	4,397	0.36%
80	5,296	0.45%	3,896	0.31%
81	4,664	0.38%	3,464	0.26%
82	4,018	0.31%	3,091	0.22%
83	3,408	0.26%	2,700	0.18%
84	2,868	0.21%	2,333	0.15%
85	2,445	0.17%	1,987	0.13%

Excluding attained ages 80 and above from the study essentially excludes less than 1% of the total exposures.

9.2 Select and Ultimate Policy Years

In order to distinguish between select and ultimate policy years of the mortality rates, the Committee examined the crude rate per age and per policy year, relative to the crude rates for all policy years. In general, it was observed that the average crude rates for policy year 1 and policy year 2 were considerably lower than the aggregate crude rates for all policy years. Shown in the following table is the average crude rate across all ages for each policy year, weighed by exposure, as a ratio to the crude rate for all policy years.



It seems clear from this table that the experience for the first 2 policy years may either still have the favorable effect of underwriting, or the favorable effect of the customary 2-year contestability period, which allows insurance companies to deny claims in the first 2 years for material concealment or misrepresentation.

The Committee decided to use the experience for policy years 3 and up as the basis of the ultimate experience mortality table, hence, excluding policy years 1 and 2, which was considered as the select period. The exposures for policy years 1 and 2 represent 20% of the total exposures. Having ultimate period to begin on the 3rd policy year is the most common practice of Asian countries in mortality table construction.

9.3 Considerations for Young Ages

Excluding policy years 1 and 2 in the ultimate mortality rates immediately eliminates the experience for attained age 0 and 1 as these ages only have exposures for policy years 1 and 2. Based on the table below, excluding the experience for policy years 1 and 2 considerably reduces the proportionate exposures of juvenile ages, particularly from ages 0 up to age 8.

Age	Exposures			% of Exposure from PY 1 & 2	% of Exposure from PY 3 & Up
	Policy Years 1 & 2	Policy Years 3 and up	Total		
0	34,016	0	34,016	100.0%	0.0%
1	56,093	0	56,093	100.0%	0.0%
2	42,919	29,740	72,659	59.1%	40.9%
3	37,076	50,533	87,609	42.3%	57.7%
4	33,778	67,258	101,036	33.4%	66.6%
5	30,950	84,957	115,907	26.7%	73.3%
6	28,785	102,745	131,530	21.9%	78.1%
7	27,468	118,701	146,169	18.8%	81.2%
8	26,657	134,673	161,330	16.5%	83.5%
9	25,830	148,224	174,054	14.8%	85.2%
10	24,820	156,267	181,087	13.7%	86.3%
11	23,855	161,933	185,789	12.8%	87.2%
12	23,073	164,979	188,052	12.3%	87.7%
13	21,653	163,281	184,934	11.7%	88.3%
14	20,430	159,541	179,972	11.4%	88.6%
15	19,775	154,580	174,355	11.3%	88.7%

Based on an informal survey of underwriting practices of some participating companies, the level of underwriting done for juvenile ages is very minimal, and hence, the expected difference between select and ultimate mortality rates is not expected to be significant provided exposures are statistically significant.

The following table shows the crude rates for attained ages below 10, distinguished between crude rates for policy years 1 to 2, and crude rates for policy years 3 and up.

Qx per 1,000 at low Ages	Qx PY 1 & 2	Qx PY 3 & up	Qx PY 1&2 / Qx PY 3 & up
0	0.59	NA	NA
1	0.36	NA	NA
2	0.33	0.44	75%
3	0.08	0.30	27%
4	0.24	0.18	133%
5	0.23	0.29	77%
6	0.24	0.20	119%
7	0.15	0.35	42%
8	0.34	0.22	152%
9	0.08	0.22	36%
10	0.12	0.17	73%

Based on this table, the crude rates for policy years 1 to 2 are not consistently favorable compared to policy years 3 and up. This further suggests that underwriting selection has minimal impact on the mortality experience for very young ages.

Hence, in order to avoid discarding a significant proportion of the exposures for juvenile ages, exposures for all policy years, including policy years 1-2, were considered for ages 0 to 8 in constructing the ultimate mortality table.

9.4 Data for Ultimate Mortality Table

In summary, the table below shows the total exposures to be considered in the ultimate mortality table. About 18% of the total exposure and 14% of claims were excluded in the ultimate data.

Summary	Exposure		Claims	
	Count	% of Exposure	Count	% of Count
Included	11,145,087	82%	26,800	86%
Excluded	2,444,076	18%	4,507	14%
Ages 80 and up	60,076	0%	2,563	8%
PY 1 and 2;Ages 9 to 79	2,384,001	18%	1,944	6%
TOTAL	**13,589,163**	**100%**	**31,307**	100%

The table below summarizes data considered for the ultimate mortality table, comparing this with the previous mortality study covering 1973-1978.

Ultimate Data	1973-1978 PIC	2009-2014 PIC
Policy Year	Excluded Policy Years 5 Years and Below	Excluded Policy Year 1 and 2
Low ages	The death rate at the central age 2 was taken from the issues ages 0 to 4 at their first year and was used as a pivotal value for age 2	Included all policy years for ages 0 to 8
High Ages	Quinquennial ages up to 77	Excluded ages over 79
Exposure	977,855	11,145,087
Claims	5,064	26,800

10 Graduation of Crude Rates

10.1 Selection of Graduation Method

The Committee studied various graduation methods, also considering various graduation methods used in other mortality studies. Eventually only two graduation methods were seriously considered, namely, (1) Generalized Additive Models and (2) Whittaker-Henderson Method.

Generalized Additive Model

Generalized Linear Models (GLM) finds the relationship between a dependent variable, Y, to independent variables, X.

GLM has three elements linking the independent variables to the dependent:

1. A probability distribution from the exponential family. The error term ϵ
2. A linear predictor $\eta = \beta_0 + X_1\beta_1 + X_2\beta_2 + \cdots$
3. A link function g such that $E(Y) = \mu = g^{-1}(\eta)$.

Generalized Additive Models (GAM) adjusts the second element to allow a nonparametric smooth function, $s(x)$.

$$\eta = \beta_0 + s_1(X_1) + s_2(X_2) + \cdots$$

Examples of smoothing functions are running averages, local regression and smoothing splines.

GAM was one of the methods used to develop graduated mortality rates for this study. However, based on the analysis conducted, this method was deemed inappropriate since, to effectively use this graduation method, the mortality data needed to be segregated per observation year, which would result in low exposures for each year. This study has only a total of 13,589,546 exposures spread over 5 observation years (2009-2014).

Whittaker-Henderson

Whitaker-Henderson graduation was eventually the choice of graduation method for this study mainly because it provides flexibility to balance smoothness and fit as may be desired. In this method, the vector of graduated rates is the vector minimizing the functional:

$$F[\underline{x}] + \lambda S[\underline{x}],$$

where ,

- $F[\underline{x}] = \sum weight_i * (x_i - crude_i)^2$
- $S[\underline{x}] = \sum (\Delta \underline{x}_i^k)^2$

The first term above is the penalty for deviating away from the crude rates. The second term is penalty for non-smoothness of curve.

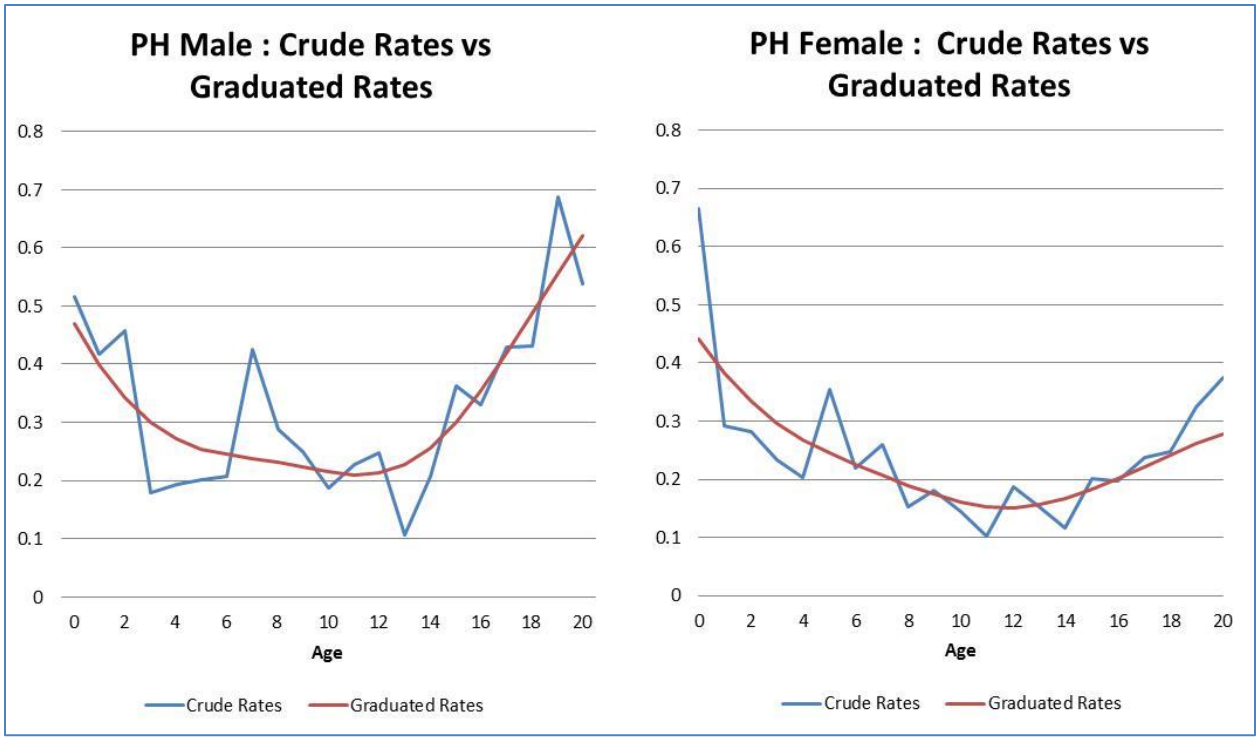
The weights have been chosen to be proportional to the exposures, as exposure divided by 10,000, just to normalize the weights. Consequently, for ages with less exposure, emphasis will be more on smoothness rather than the fidelity to the data with respect to the crude rates, i.e. fit. Conversely, ages with higher exposure will have graduated rates closer to the crude rates as fit is emphasized over smoothness.

The order of the difference operator, k, was chosen to be equal to 3 to provide ample stiffness in smoothing, but not too high to introduce unnecessary complexity in the solution.

Finally, the variable λ was chosen to provide overall all-age balance between smoothness and fit. The value of λ was chosen to be 500.

10.2 Graduated Rates

The crude rates and graduated rates for male and female, under age-last-birthday (ALB) and age-nearest-birthday (ANB) bases are shown in Annex 3. Illustrative graphs of crude rates and graduated rates are shown as follows:


PH Male : Crude Rates vs Graduated Rates
0.8
0.7
0.6
0.5
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0 2 4 6 8 10 12 14 16 18 20
Age
Crude Rates
Graduated Rates
PH Female : Crude Rates vs Graduated Rates
0.8
0.7
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0.5
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0.1
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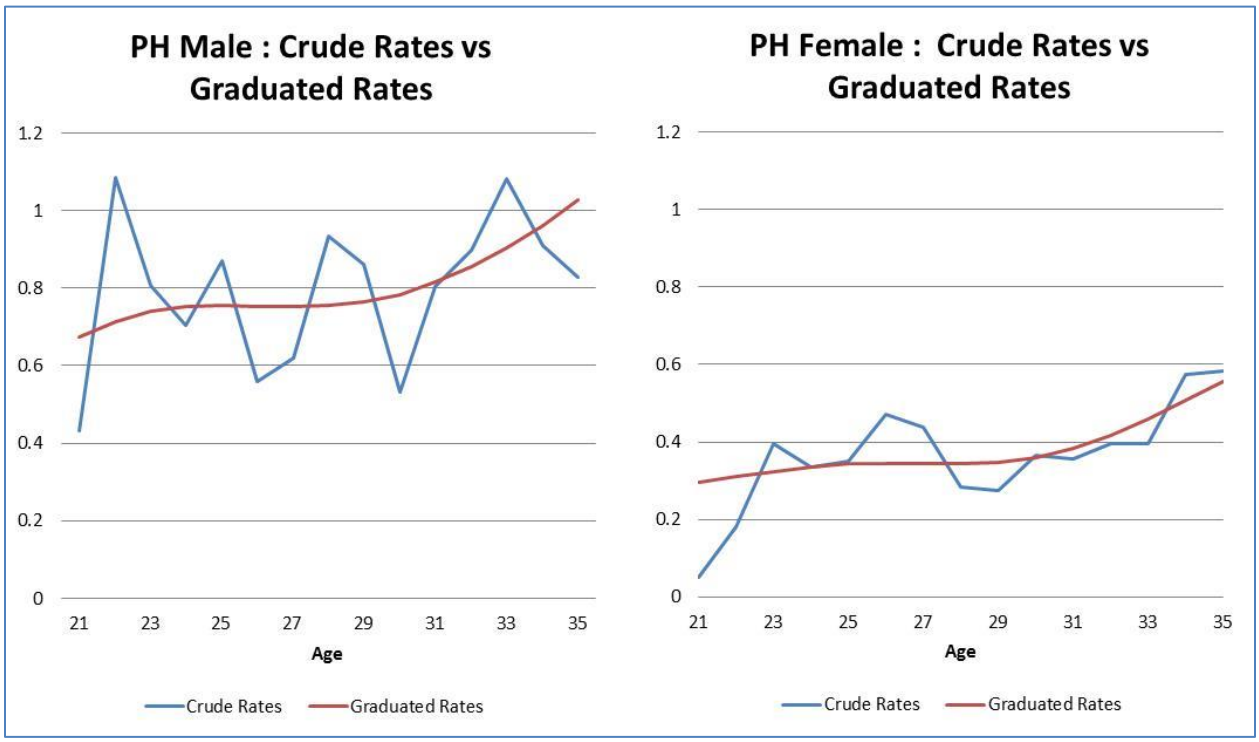
0 2 4 6 8 10 12 14 16 18 20
Age
Crude Rates
Graduated Rates


PH Male : Crude Rates vs Graduated Rates
1.2
1
0.8
0.6
0.4
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21 23 25 27 29 31 33 35
Age
Crude Rates
Graduated Rates
PH Female : Crude Rates vs Graduated Rates
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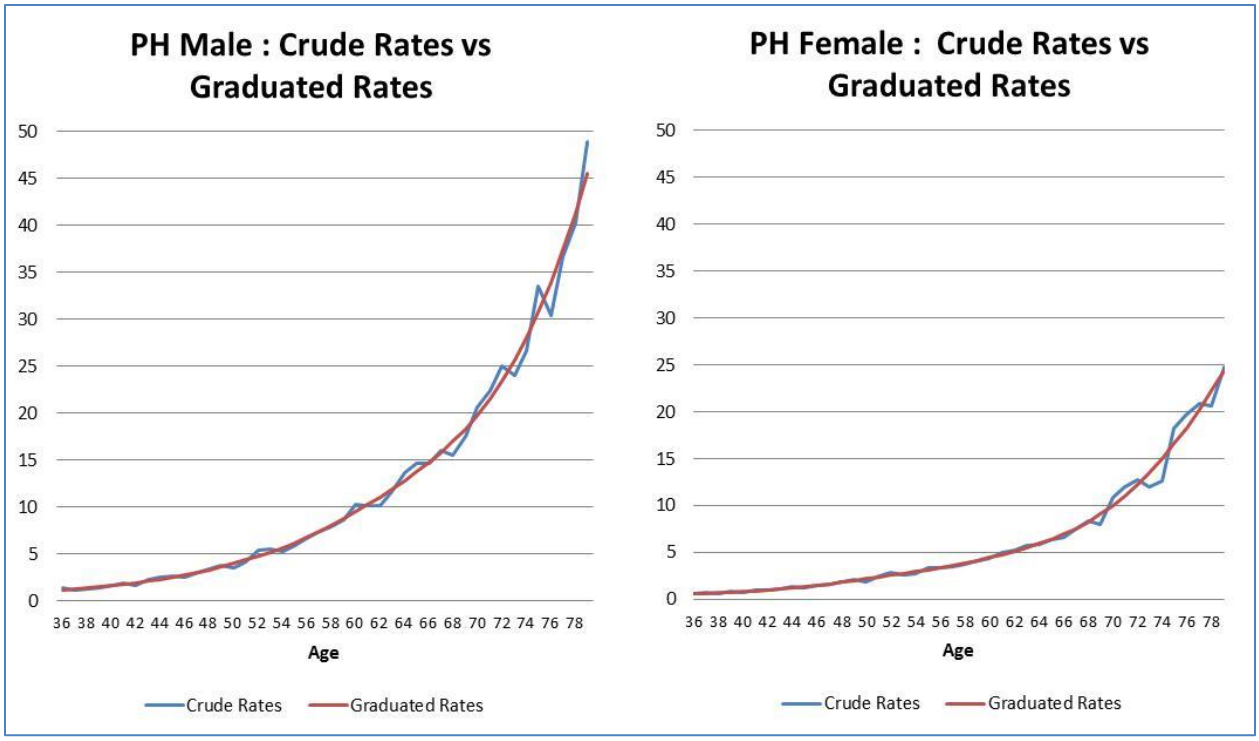
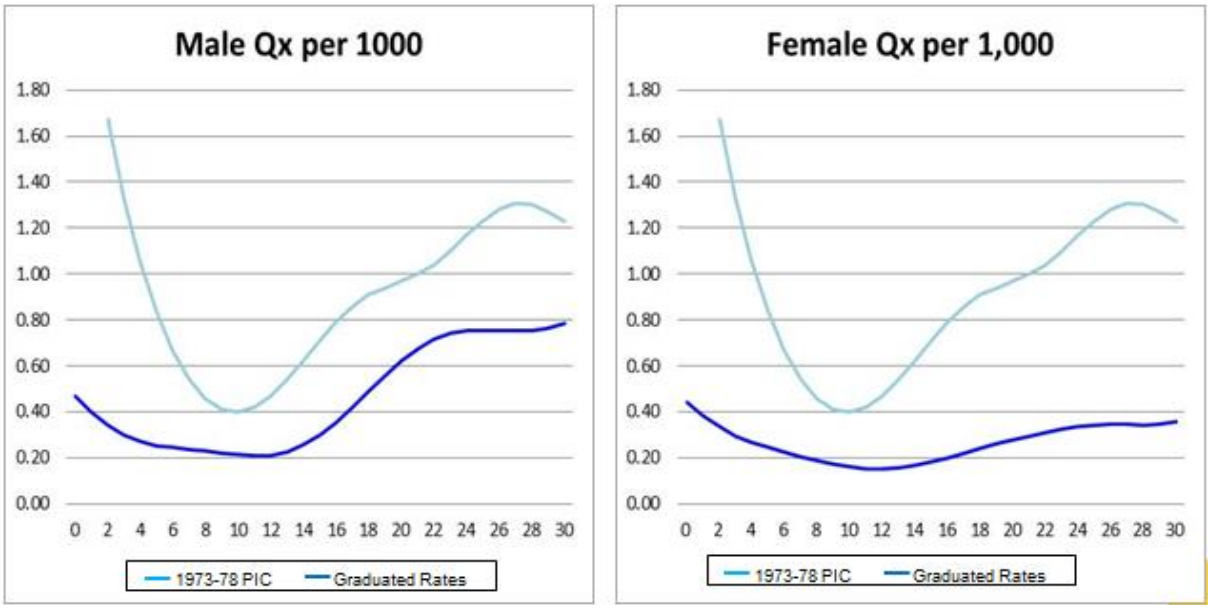
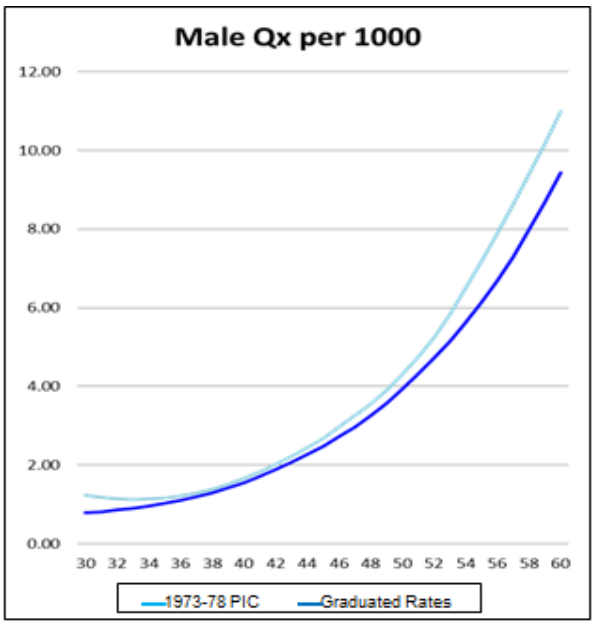
21 23 25 27 29 31 33 35
Age
Crude Rates
Graduated Rates

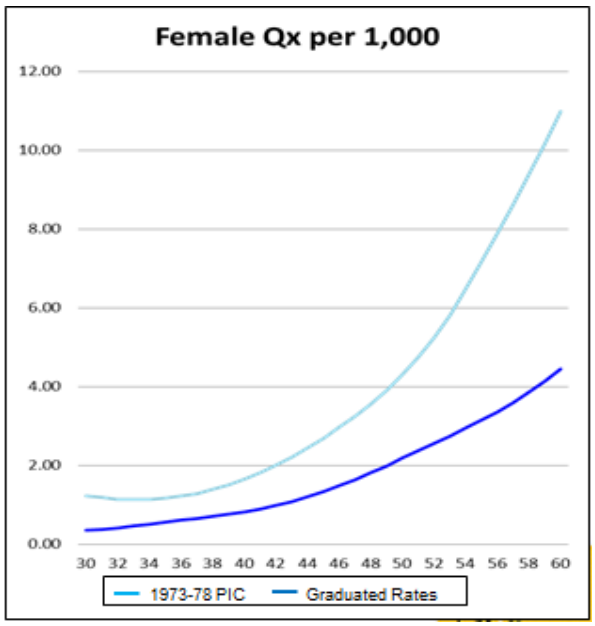


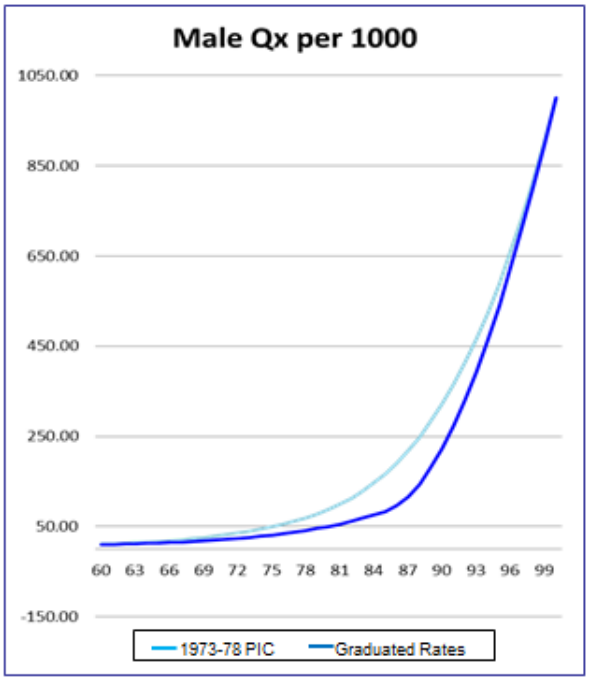
11 Comparing with 1973-78 PIC

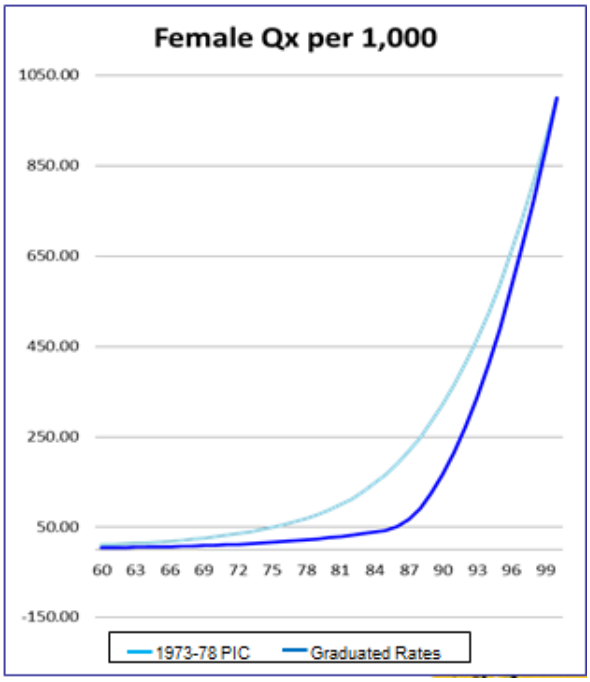
The following graphs compare the resulting graduated rates with the 1973-78 PIC Mortality Table, shown in several age brackets.











Although both male and female graduated rates are consistently lower than the unisex rates of the 1973-78 PIC, the level of the variance varies across different attained ages. Note that the last set of graphs above already contains the proposed extended rates for 80 to 100, which is discussed in a successive section of this report.

12 Testing for Fit

12.1 Testing for Fit by Gender

In order to test for fit, the expected claims based on the graduated table are compared to the actual claims of the study. The following table shows that the actual claims for both male and female are exactly equal to the expected claims based on the graduated rates.

Gender	Exposure	Claims	Expected		A/E	
			Graduated	1973-78 PIC	Graduated	1973-78 PIC
Male	5,206,707	17,223	17,223	22,045	100%	78%
Female	5,938,380	9,577	9,577	23,381	100%	41%
Total	**11,145,087**	**26,800**	**26,800**	**45,426**	**100%**	**59%**

Using 1973-1978 Basic PIC table as the basis for expected claims, the actual over expected claims is 78% and 41%, for male and female experience, respectively. Note, however, that the 1973-78 PIC table is based on a unisex table, where male and female experience is combined. There is no information available with regards to the gender mix of the data used in the 1973-78 PIC Study.

12.2 Testing for Fit by Decennial Age Brackets

The ratio of actual claims and expected claims based on the graduated table by decennial age bracket is shown in the following table. This shows that the graduate table results in slightly higher claims than actual claims for ages 21-30 and 41-50, which is offset by slightly lower claims for ages 0 to 10 and 51 to 60. Overall, the variance by decennial ages is not very significant and demonstrates a good level of fit.

A/E by Age Band	Exposure		Claims		A/E		
	Male	Female	Male	Female	Male	Female	Aggregate
0 to 10	622,649	588,190	167	140	102%	102%	102%
11 to 20	755,034	704,794	257	144	98%	104%	100%
21 to 30	531,471	602,560	391	197	98%	96%	98%
31 to 40	925,726	1,260,918	1,063	751	101%	99%	100%
41 to 50	1,117,570	1,412,286	2,960	2,018	99%	99%	99%
51 to 60	835,208	956,945	5,343	3,075	101%	100%	101%
61 to 70	328,505	339,841	4,349	2,118	99%	100%	100%
71 to 79	90,545	72,845	2,693	1,134	100%	100%	100%
Total	**5,206,707**	**5,938,380**	**17,223**	**9,577**	**100%**	**100%**	**100%**

13 Results by Various Study Parameters

The results of the study are shown in the successive sections, using various available parameters, as measured by the actual claims over expected deaths, **A/E**, where expected deaths is calculated by applying the graduated mortality table to the exposures, on age-last-birthday basis.

13.1 Observation Years

The A/E ratio per observation year is shown in the following table. Based on this table, the mortality experience does not seem to show improvements through the five years of experience as the A/E ratio does not appear to show a declining trend.

Observation Years	Exposure		Claims		A/E		
	Male	Female	Male	Female	Male	Female	Aggregate
2009-2010	1,032,970	1,151,531	3,515	1,844	107%	104%	106%
2010-2011	1,036,168	1,167,237	3,284	1,798	98%	98%	98%
2011-2012	1,041,570	1,192,978	3,333	1,946	97%	102%	99%
2012-2013	1,054,158	1,226,208	3,573	1,932	101%	96%	99%
2013-2014	1,041,841	1,200,426	3,518	2,057	98%	101%	99%
TOTAL	**5,206,707**	**5,938,380**	**17,223**	**9,577**	**100%**	**100%**	**100%**

13.2 Product Type

Traditional non-term, which comprises most of the exposure, has A/E ratio slightly higher than 100%, both for male and female. The Traditional Term products show very favorable A/E ratio for male lives but not for female lives. This observation might not have statistical credibility, considering the low exposure of Traditional Term product type.

A/E by Product Type	Exposure		Claims		A/E		
	Male	Female	Male	Female	Male	Female	Aggregate
TRADITIONAL-NONTERM	4,570,278	5,100,572	16,211	8,817	103%	104%	103%
TRADITIONAL-TERM	118,065	175,767	282	233	82%	100%	90%
VARIABLE LIFE	518,364	662,040	730	527	69%	61%	65%
TOTAL	**5,206,707**	**5,938,380**	**17,223**	**9,577**	**100%**	**100%**	**100%**

The experience of variable life product looks very favorable compared the expected claims based on the graduated mortality table, with an A/E ratio of 69% and 61%, for male and female experience, respectively.

The exposures for each product type are also shown in the table, as this gives emphasis on the level of statistical credibility that may be attributed to the observation.

13.3 Underwriting Classification

Looking at the results by various Underwriting Classifications, the experience of medically underwritten exposures is relatively lower compared to the expected claims. In contrast, the experience of the Guaranteed Issue exposure is higher than the aggregate expected claims. Based on the breakdown by gender, it is the male experience that pulled up the aggregate experience of this guarantee issue exposure block, with A/E of 118%.

A/E by Underwriting Class	Exposure		Claims		A/E		
	Male	Female	Male	Female	Male	Female	Aggregate
NONMEDICAL	2,926,468	3,479,803	9,028	5,508	102%	105%	103%
MEDICAL	739,503	755,510	3,150	1,525	85%	88%	86%
GUARANTEED	357,855	407,443	933	569	118%	100%	110%
UNKNOWN	1,182,881	1,295,624	4,112	1,975	106%	97%	103%
TOTAL	**5,206,707**	**5,938,380**	**17,223**	**9,577**	**100%**	**100%**	**100%**

The experience of the exposures with 'Unknown' underwriting class is higher than the central estimate with an A/E ratio of 103% on the aggregate. Looking at the breakdown by gender, it is the male experience that pulled up this aggregate. The 'Unknown' underwriting classification is quite significant in terms of exposure, as this block even exceeds the combined exposures of the medical and guarantee issue underwriting classifications.

13.4 Product Type and Underwriting Classification

The following table contains further interesting insights with regards the mortality experience by product type and underwriting classification.

Product Type and Underwriting Class	Exposure			Claims			A/E		
	TRAD-NONTERM	TRAD-TERM	VARIABLE LIFE	TRAD-NONTERM	TRAD-TERM	VAR LIFE	TRAD-NONTERM	TRAD-TERM	VAR LIFE
NONMEDICAL	6,100,921	220,252	85,098	14,169	282	85	104%	82%	65%
MEDICAL	1,227,573	42,870	224,570	4,315	141	219	88%	94%	56%
GUARANTEED	594,020	347	170,930	1,220	0	282	131%	0%	65%
UNKNOWN	1,748,336	30,362	699,807	5,324	92	671	110%	117%	70%
TOTAL	**9,670,850**	**293,832**	**1,180,405**	**25,028**	**515**	**1,257**	**103%**	**90%**	**65%**

The experience of the non-medical underwriting classification varies significantly by product type. Although the aggregate A/E ratio of the non-medical exposures is at 103%, the corresponding ratios for term and variable life products are considerably lower at 82% and 65%, respectively.

The A/E ratio for traditional term was relatively high only for those with unknown underwriting classification. The A/E for variable life policies is consistently low regardless of underwriting classification, even for guarantee issue. Apparently, the A/E for Guarantee issue was only high for the Traditional-Nonterm exposure, with actual claims at 131% of the expected claims based on the graduated table. Reliance on any conclusion with regards to trends on underwriting classification and product type should take into consideration the level of exposures.

13.5 Policy Years

The following table shows the A/E ratio per underwriting classification, product type and policy years 1, 2, and 3 & up. This table shows the claims experience of policy years 1 and 2, relative to the expected claims based on the graduated table.

A/E	TRADITIONAL-NONTERM			TRADITIONAL-TERM			VARIABLE LIFE		
	PY 1	PY 2	PY 3 & up	PY 1	PY 2	PY 3 & up	PY 1	PY 2	PY 3 & up
NONMEDICAL	65%	72%	104%	82%	75%	82%	43%	41%	66%
MEDICAL	53%	56%	88%	41%	53%	94%	34%	45%	56%
GUARANTEED	75%	77%	132%	NA	NA	NA	37%	59%	65%
UNKNOWN	225%	164%	110%	124%	117%	117%	37%	50%	69%
TOTAL	**71%**	**73%**	**103%**	**77%**	**73%**	**90%**	**38%**	**51%**	**65%**

The following table shows the claim experience for policy year 1 and 2 as a percentage of the claims experience for policy years 3 and up. In general, the mortality experience is favorable during the first 2 policy years, likely due to underwriting selection and the existence of the standard 2-year contestability period, which allows companies to resist claims under certain conditions. However, the favorable mortality during the first 2 policy years was not observed in the exposures with 'unknown' underwriting classification.

A/E to Ultimate A/E	TRADITIONAL-NONTERM		TRADITIONAL-TERM		VARIABLE LIFE	
	PY 1	PY 2	PY 1	PY 2	PY 1	PY 2
NONMEDICAL	63%	70%	100%	92%	65%	62%
MEDICAL	60%	63%	44%	57%	61%	81%
GUARANTEED	57%	58%	NA	NA	57%	91%
UNKNOWN	205%	149%	106%	100%	54%	72%
TOTAL	**69%**	**71%**	**86%**	**81%**	**57%**	**78%**

14 Extending Rates to Older Ages

A population or social security mortality table, with rates beyond 79 would have been useful in extending the graduated mortality rates to higher ages. However, in the absence of population mortality experience, the Committee considered various possible approaches using mathematical models.

The Committee eventually chose the Gompertz-Makeham model to extend the graduated rates. The Gompertz-Makeham is a well-known model that has long been used to estimate mortality, dating as early as the 19th century. The model has a relatively simple formula with only a few parameters involved and hence, making calculations simple.

The Gompertz-Makeham model is an extension of the Gompertz model. Under the Gompertz model, the force of mortality is estimated to be $\mu_x = Ae^{Bx}$. The Gompertz model, named after Benjamin Gompertz, assumes a constant rate of increase of μ_x with age *x*, i.e., probability of dying increases at a constant exponential rate as age increases. Consequently, it assumes that all causes of death are age-dependent, which may not be realistic as some causes of deaths, such as accidents, are not dependent of age.

William Makeham proposed in 1860 an improvement on the Gompertz model by a constant term, so that $\boldsymbol{\mu_x = Ae^{Bx} + C}$. The parameter *C* accounts for the risk of death from all causes which do not depend on age.

Using graduated rates for ages 60 to 79 and applying the Gompertz-Makeham model, the parameter values for *A*, *B*, and *C* were calculated using Least Squares Estimation. This method minimizes the squared difference between observed data and the expected values based on the assumed parametric model.

For ages 60 to 79, the force of mortality is calculated based on the following formula:

$$\mu_x^{GRAD} = -\ln(1 - q_x^{GRAD})$$

Given the force of morality for ages 60 to 79, as calculated based on the above formula, the values of *A* and *B are calculated to* minimize the following:

$$\sum_{x=60}^{79} (\mu_x^{GRAD} - Ae^{Bx} - C)^2$$

The resulting values for variables, A, B and C are shown in the following table:

	ALB MALE	ALB FEMALE	ANB MALE	ANB FEMALE
A	0.000005	0.000012	0.000005	0.000014
B	0.113796	0.096658	0.113796	0.094114
C	0.005092	0.000110	0.005092	0.000001

For ages 80 and above, $\boldsymbol{\mu_x = Ae^{Bx} + C}$. Given $\boldsymbol{\mu_x}$, the extended graduated rates can be estimated using the formula:

$$q_x^{GM} = 1 - e^{-\mu_x^{GM}}$$

where μ_x^{GM} is computed using pameter estimates for *A*, *B*, and *C.*

The Committee is aware that many recent mortality tables of other countries no longer have an omega age and rate. However, in the absence of a reliable population table, or any strong basis to assume otherwise, the Committee decided to assume an omega rate of 1 at an omega age of 100 (omega $\omega = 100$ and $q_{100} = 1$) consistent with the 1973-78 PIC table. However, such an assumption resulted to a discontinuity at age 99. To eliminate this discontinuity, the graduated rates were systematically blended with linearly interpolated rates for ages 86 to 99.

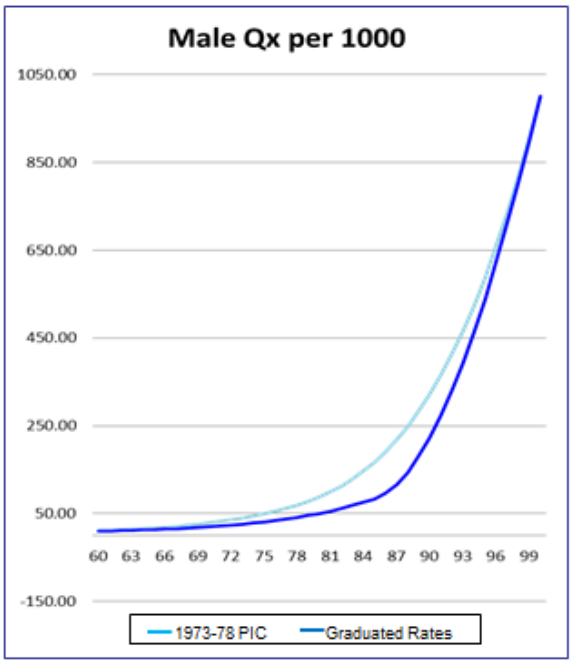
That is, for $86 \leq x \leq 99$,

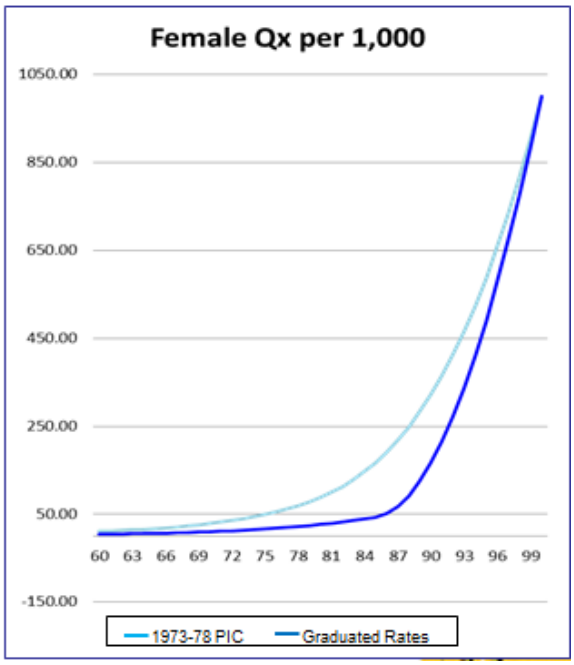
$$q_x^{GM\prime} = \frac{(100-x)q_x^{GM} + (x-85)q_x^{LINEAR}}{15},$$

where,

$$q_x^{LINEAR} = q_{85}^{GM} + \frac{x-85}{15}(1 - q_{85}^{GM})$$

The resulting extended graduated rates for ages 80 to 100 are then combined with the graduated rates for ages 0 to 79 for this study. The following graph illustrates how the resulting extended rates compare with the rates of the 1973-78 PIC.





15 2017 PIC Mortality Tables

The final result of this study consists of sex-distinct, basic ultimate tables on age-last-birthday and age-nearest-birthday bases, without loadings as shown in Annex 3.

A graphical comparison of the graduated rates against the 1973-1978 PIC Basic Table is also provided in the said Annex.

16 Loadings and Composite Tables

In the 1973-1978 PICM Study, reasonable margins or loadings were formulated as additions to the basic mortality rates to produce a mortality table that may be used as a basis for premiums and/or statutory valuation. Such loadings were intended to take care of adverse fluctuation in mortality and for contingencies.

However, since the Committee does not have a view of the variability of morality experience at company level, testing the reasonableness of any loadings that may be proposed is not possible.

More importantly, recent developments in regulations, particularly for life insurance valuation and risk-based capital framework, require the use of best-estimate cash flows and margins for adverse deviation that are determined in part by whether an addition or reduction to best-estimate mortality rates leads to higher reserves, depending on the types of products that a company sells. The Committee believes that the 2017 PICM basic, sex-distinct tables as well as the product/underwriting relative risk results of this study sufficiently enables the life company actuary to develop mortality assumptions that are appropriate for reserve valuation of his or her company's life insurance business. In addition, capital and surplus held by the company should be sufficient to cover random fluctuations in mortality and catastrophic events.

Loaded tables and composite tables (combined male/female rates) constructed from industry experience would also have limited use for product pricing, as each company should take into account, among other factors, its own underwriting policies, gender mix and product types, to arrive at an appropriate mortality assumption for its products.

Hence, the Committee deemed it no longer necessary to formulate margins to add to the basic, graduated rates or to prepare composite tables.

17 Considerations for Future Mortality Studies

For future mortality studies, the Committee recommends the following:

i. *Segregate the experience of protection and savings products*. The Committee noted that the mortality experience of variable life products seems to be significantly lower compared to traditional products despite its lower credibility. It might be worthwhile to investigate if

savings type products, such as variable life products, have a significantly different experience compared to protection products. One country in Asia has a separate mortality table for protection and savings, whereby the difference in mortality appears significant.

ii. *Segregate Guaranteed Issue underwriting class*. Based on this study, the mortality experience of guarantee issue underwriting class for traditional products is much higher compared to the graduated rates, except for guaranteed issue variable life products. It might be worthwhile to either separate this or eliminate this from the study, if the exposure is not sufficient anyway.

iii. *Include Sum Assured in the data requirements.* Some mortality studies include sum assured in the analysis as mortality experience could be different for higher sum assured.

iv. *Segregate between distribution channels.* It might also be worthwhile to investigate if there are significant differences in mortality experience when segregated by distribution channel such as Agency, Bancassurance and Mass-Marketing channels.

v. *Use Population Data for extending rates to older ages.* If a Philippine population mortality experience that extends to old ages becomes available in the future, considering such table in extending mortality rates to older ages will provide better basis and credibility than using a mathematical model.

ANNEX 1 – LIST OF PARTICIPATING COMPANIES TO THE 2017 PICM STUDY

AsianLife & General Assurance Corp. (life unit)
BDO Life Assurance Company, Inc.
Beneficial Life Insurance Co., Inc.
BPI Philam Life Assurance Corp, Inc.
Caritas life Insurance Corporation
Cooperative Insurance System of the Philippines
Country Bankers Life Insurance Corp.
First Life Financial Company, Inc.
Fortune Life Insurance Company, Inc.
Insular Life Assurance Co., Ltd, The
Manila Bankers Life Insurance Corp.
Manufacturers Life Insurance Co. (Phils.), Inc., The
Manulife Chinabank Life Assurance Corp.
Paramount Life & General Insurance Corp. (life unit)
Phil. International Insurance Co., Inc.
Philam Equitable Life Assurance Co., Inc.
Philippine American Life & General Insurance Co.
Philippine AXA Life Insurance Corp.
Philippine Life Financial Assurance Corp.
Philippine Prudential Life Insurance Co., Inc
Pioneer Life Inc.
PNB Life Insurance, Inc.
Pru Life Insurance Corp of U.K.
Sun Life of Canada (Philippines), Inc.
SunLife Grepa Financial, Inc.
United Coconut Planters Life Assurance Corp.
United Life Asssurance Corp.

ANNEX 2 – GUIDELINES TO THE PHILIPPINE INTERCOMPANY MORTALITY STUDY

(Released SEPTEMBER 2016 with Insurance Commission Circular 2016-57)

1 INTRODUCTION

1.1 The 2016 Philippine Intercompany Mortality Study (Study) is being conducted by the Actuarial Society of the Philippines Life Insurance Committee (Committee) in coordination with the Actuarial Division of the Insurance Commission (IC). The study aims to review the industry's mortality experience using more updated data, in light of current underwriting and marketing practices and new regulations. It has the ultimate goal of producing a new valuation mortality table based on the Philippine industry mortality experience.

1.2 The Committee will undertake the Study. A mortality tool (Tool) has been solely developed for this undertaking, as contracted by the ASP. To ensure data privacy and security, each company shall be provided with the tool to process their individual records. The processed data will be submitted to IC and IC will use the same tool to consolidate all data submitted. IC will then provide the consolidated data to the Committee for its further study and preparation of reports and recommendations.

2 OVERVIEW OF THE STUDY

2.1 The Study will be conducted using policy count and will only cover direct business on standard individual ordinary (whole life, endowment and term) and variable business of the industry.

2.2 The Study will cover experience from policy years starting in 2009 and ending in 2010. The exposures shall be assessed from policy year to policy year within the described period.

2.3 The Study aims to also analyze experience by attained age last birthday, attained age nearest birthday, gender, product type and underwriting class.

2.4 The Study will also track experience by policy duration each year from 1 to 9 and for policy duration 10 & up. The final select and ultimate durations will depend on the results of the study.

2.5 The results of the experience will be assessed in comparison with the Basic 1973-1978 Philippine Intercompany Mortality Table (Basic 73-78 PIC). Actual/Expected ratios will be represented and Expected will be based on the Basic 73-78 PIC.

3 PROCEDURE

3.1 Within one week from the release of these Guidelines through this Circular, each participating life insurance company should email the Committee, information on their actuarial representative (representative) and an ASP Fellow accredited by IC certifying the data and reports to be submitted to IC. The two described can be one and the same person.
Emails to the Committee can be in the following format:

To: actuarial@pldtdsl.net

Subject: 2016 Philippine Intercompany Mortality Study Representatives

Please be informed that the following will be the company representatives:

Actuarial Representative
Name: _____
Position: _____
Email address: _____
Contact #: _____

Certifying Fellow:

Name: _____
Position: _____
Email address: _____
Contact #: _____
IC Accreditation Number: _____

The Committee will then share the information with the IC Actuarial Division. The information of the Representative will also be shared with TopLogic, the tool developer. This is to ensure that any query with regards to the tool is addressed immediately. If the company wishes not to share any information with TopLogic, please inform the Committee so this can be considered.

3.2 Once the email described above is received, the Committee, with the assistance of TopLogic, will send the tool package (company code, installer, installation guide and manual). More detailed instructions will be sent thru email to the representative.

3.3 A half-day seminar will be conducted by the Committee to further guide the representatives on the procedures and expectations from the conduct of the study. The schedule shall be announced as soon as IC Circular is released.

3.4 Once the representative is ready with the tool and has the available hardware and data (as described in Sections 4 & 5), the representative must use the tool to process the data. The representative should use the manual provided to guide in the use of the tool and the instructions/demonstrations conducted by the Committee.

The tool is flexible enough to process data according to parameters set by the tool user in the settings. However, for purposes of this study, the representative is advised to only encode its assigned company code and the input & output directories and no longer change the settings as they are defaulted to the requirements of the Study.

The default parameter settings, which the representative should not change are:

Ultimate Policy Duration: **10**
Policy year from **2009** to **2014**
Batch run settings: **ASP Study**

3.5 The specified output data (as described in Section 6) and the Data Certification report (as described in Section 6 And Appendix A) must be prepared for submission to IC. The representative should ensure the company submits the required data files and report to IC within the deadline (October 24, 2016) indicated in this Circular to avoid penalties.

4 HARDWARE SPECIFICATIONS

To enable the company to run the tool, the representative must ensure that a computer with MS Excel is available.

5 DATA SPECIFICATIONS

5.1 The representative must prepare the data from the company's policy masterfile extracted not earlier than 07/01/2015, with corresponding status as of such date or later.

5.2 The data should include all direct business on basic standard individual ordinary (whole life, endowment, term) and variable life policies on or before December 31, 2013 but has not been terminated in any manner before its policy anniversary in 2009.

5.3 The following shall be excluded from the data:

- Terminated, in any manner, prior to the policy anniversary in 2009
- Issued after December 31, 2013
- Policies with substandard rating on the basic (table extra, flat extra)
- Group insurance policies

- Group conversions – group coverages that converted to individual life coverage as provided under the group contract
- Joint life policies
- Reinsurance assumed from other companies
- Personal accident insurance
- Annuities
- Riders, even term riders
- Policies with pregnancy liens when death is due to pregnancy or pregnancy-related causes.
- Policies with denied death claims, regardless of date of denial.

5.4 The data prepared shall be in Excel format, as presented below, and should have fields containing each of the following required data. Please ensure adherence to the allowed data type of each field as the tool may read the data incorrectly. The company's master file may have field names different from that tabulated below.

FIELD NUMBER	FIELD NAME	FIELD TYPE	DESCRIPTION
1	POLICY STATISTIC	INTEGER	This should be tagged as 1 for each record. It represents a policy count of 1.
2	POLICY NUMBER	CHARACTER	Policy number as used by the participating life insurance company (Optional)
3	ISSUE DATE	DATE (MM/DD/YYYY)	The policy issue date (which is the basis of the policy anniversaries)
4	BIRTHDATE	DATE (MM/DD/YYYY)	Date the insured was born
5	GENDER	CHARACTER	"MALE" - Male "FEMALE" - Female "UNKNOWN" – if Company has no means to determine gender of the insured
6	PRODUCT TYPE	CHARACTER	Categories (can be small letters): "UNIT-LINKED" "TRADITIONAL-TERM" "TRADITIONAL-NONTERM" "UNKNOWN" – if Company has no means to classify policy according to categories above.
7	PREMIUM PAYMENT PERIOD	INTEGER	Years to pay from issue date to expiration of the policy. For whole life policies, set to 99.
8	UNDERWRITING CLASS	CHARACTER	Categories (can be small letters): "MEDICAL" - Medically Underwritten, Standard "GUARANTEED" - Guaranteed Issue "NONMEDICAL" - NonMedical, including simplified "UNKNOWN" – if Company has no means to classify policy according to categories above.
9	STATUS	CHARACTER	Status of the policy as of extraction date of the policy masterfile (which must not be earlier than 7/1/2015). The categories are (can be small letters): "DEATH" "INFORCE" "TERMINATED" (Lapse, surrender, expired, matured converted to non-forfeiture (Extended

			Term/Reduced Paid-up)
10	TERMINATION DATE	DATE (MM/DD/YYYY)	Date of death, lapse, surrender, expiration, conversion to non-forfeiture (Extended Term/Reduced Paid-up), maturity. If the status is "INFORCE", the date should be the extraction date (which should not be earlier than 7/1/2015).

6 DATA AND REPORT SUBMISSION

Once the representative has successfully processed the company data using the tool, the following should be prepared for submission to IC:

a. A soft copy of the generated runtable files for Runs #1, #2, and #3. These files can be seen in the output directory set by the representative in the tool with the following file names:
   <CODE>_AL_AL_AL_<mmddyyyy>.xls
   <CODE>_ML_AL_AL_<mmddyyyy>.xls
   <CODE>_FL_AL_AL_<mmddyyyy>.xls
b. A soft copy of the consolidated database which can also be found in the output directory set by the representative. The filename is:

   <CODE>_processed_data_<version>_<mmddyyyy>.csv

c. A printout of the data certification duly signed by the ASP Fellow accredited by IC indicated by the company to ASP (as described in Section 3.1)

The above should be submitted to IC within the set deadline (October 24, 2016) in this Circular to avoid penalties.

7 RECORDS

The companies are requested to keep all files used and generated (input and output) and data certification report for at least 3 years.

ANNEX 3 – 2017 PHILIPPINE INTERCOMPANY MORTALITY: CRUDE RATES AND GRADUATED RATES

Age Last Birthday Basis (ALB) – Male

Age	Crude Rates	Graduated Rates	Age	Crude Rates	Graduated Rates	Age	Crude Rates	Graduated Rates	Age	Crude Rates	Graduated Rates
0	0.52	0.47	25	0.87	0.76	50	3.46	3.92	75	33.54	30.80
1	0.42	0.40	26	0.56	0.75	51	4.14	4.31	76	30.39	33.91
2	0.46	0.34	27	0.62	0.75	52	5.41	4.72	77	36.63	37.39
3	0.18	0.30	28	0.93	0.75	53	5.53	5.16	78	40.31	41.24
4	0.19	0.27	29	0.86	0.76	54	5.24	5.62	79	48.96	45.47
5	0.20	0.25	30	0.53	0.78	55	5.82	6.13	80		50.28
6	0.21	0.24	31	0.81	0.81	56	6.58	6.69	81		55.59
7	0.36	0.24	32	0.90	0.86	57	7.39	7.30	82		61.50
8	0.29	0.23	33	1.08	0.91	58	7.85	7.97	83		68.08
9	0.25	0.22	34	0.91	0.96	59	8.56	8.68	84		75.39
10	0.19	0.21	35	0.83	1.03	60	10.25	9.43	85		83.53
11	0.23	0.21	36	1.38	1.11	61	10.14	10.21	86		96.03
12	0.25	0.21	37	1.15	1.19	62	10.10	11.03	87		116.32
13	0.11	0.23	38	1.22	1.30	63	11.67	11.88	88		144.28
14	0.21	0.26	39	1.35	1.42	64	13.59	12.78	89		179.78
15	0.36	0.30	40	1.60	1.56	65	14.56	13.72	90		222.63
16	0.33	0.35	41	1.81	1.71	66	14.60	14.71	91		272.66
17	0.43	0.42	42	1.60	1.89	67	16.03	15.79	92		329.64
18	0.43	0.49	43	2.16	2.07	68	15.44	16.98	93		393.33
19	0.69	0.56	44	2.52	2.27	69	17.48	18.30	94		463.44
20	0.54	0.62	45	2.61	2.48	70	20.63	19.80	95		539.67
21	0.43	0.67	46	2.43	2.71	71	22.42	21.49	96		621.69
22	1.09	0.71	47	2.94	2.97	72	24.97	23.40	97		709.13
23	0.81	0.74	48	3.31	3.25	73	24.02	25.57	98		801.60
24	0.70	0.75	49	3.71	3.57	74	26.69	28.02	99		898.69
									100		1,000.00

Age Last Birthday (ALB) Basis – Female

Age	Crude Rates	Graduated Rates	Age	Crude Rates	Graduated Rates	Age	Crude Rates	Graduated Rates	Age	Crude Rates	Graduated Rates
0	0.66	0.44	25	0.35	0.34	50	1.90	2.18	75	18.23	16.56
1	0.29	0.38	26	0.47	0.35	51	2.45	2.37	76	19.68	18.30
2	0.28	0.33	27	0.44	0.34	52	2.86	2.56	77	20.91	20.18
3	0.23	0.30	28	0.28	0.34	53	2.62	2.75	78	20.64	22.21
4	0.20	0.27	29	0.28	0.35	54	2.74	2.94	79	24.80	24.37
5	0.35	0.24	30	0.37	0.36	55	3.40	3.15	80		26.65
6	0.22	0.23	31	0.36	0.38	56	3.36	3.36	81		29.31
7	0.25	0.21	32	0.40	0.42	57	3.44	3.59	82		32.22
8	0.19	0.19	33	0.39	0.46	58	3.73	3.85	83		35.42
9	0.18	0.17	34	0.57	0.51	59	4.14	4.13	84		38.94
10	0.15	0.16	35	0.58	0.56	60	4.40	4.44	85		42.79
11	0.10	0.15	36	0.65	0.61	61	4.92	4.77	86		50.99
12	0.19	0.15	37	0.67	0.65	62	5.25	5.13	87		67.49
13	0.15	0.16	38	0.65	0.70	63	5.70	5.51	88		92.23
14	0.12	0.17	39	0.79	0.76	64	5.88	5.92	89		125.16
15	0.20	0.18	40	0.74	0.82	65	6.35	6.39	90		166.21
16	0.20	0.20	41	0.93	0.89	66	6.56	6.92	91		215.30
17	0.24	0.22	42	0.92	0.98	67	7.52	7.54	92		272.34
18	0.25	0.24	43	1.12	1.08	68	8.37	8.25	93		337.23
19	0.32	0.26	44	1.33	1.20	69	7.94	9.06	94		409.86
20	0.37	0.28	45	1.22	1.33	70	10.88	9.99	95		490.10
21	0.05	0.29	46	1.44	1.48	71	12.03	11.03	96		577.82
22	0.18	0.31	47	1.64	1.64	72	12.76	12.21	97		672.84
23	0.40	0.32	48	1.83	1.81	73	11.95	13.52	98		775.01
24	0.33	0.34	49	2.12	1.99	74	12.58	14.97	99		884.14
									100		1,000.00

Age Nearest Birthday (ANB) Basis – Male

Age	Crude Rates	Graduated Rates	Age	Crude Rates	Graduated Rates	Age	Crude Rates	Graduated Rates	Age	Crude Rates	Graduated Rates
0	0.57		25	0.66	0.75	50	3.85	3.76	75	31.41	29.48
1	0.46	0.41	26	0.84	0.75	51	3.96	4.13	76	31.59	32.33
2	0.45	0.35	27	0.52	0.75	52	4.46	4.53	77	33.55	35.49
3	0.29	0.31	28	0.77	0.75	53	5.62	4.95	78	38.36	38.95
4	0.18	0.28	29	0.82	0.76	54	5.35	5.39	79	45.41	42.74
5	0.14	0.26	30	0.80	0.78	55	5.46	5.87	80		47.73
6	0.20	0.25	31	0.76	0.81	56	6.43	6.40	81		52.75
7	0.36	0.24	32	0.72	0.84	57	6.93	6.97	82		58.33
8	0.31	0.24	33	1.03	0.89	58	7.40	7.61	83		64.56
9	0.23	0.23	34	1.00	0.94	59	8.31	8.30	84		71.48
10	0.22	0.22	35	0.94	1.00	60	9.31	9.03	85		79.18
11	0.27	0.21	36	1.07	1.07	61	10.08	9.81	86		91.25
12	0.15	0.21	37	1.33	1.15	62	10.19	10.62	87		111.18
13	0.18	0.22	38	1.02	1.25	63	10.89	11.47	88		138.85
14	0.19	0.24	39	1.34	1.36	64	12.55	12.36	89		174.13
15	0.33	0.28	40	1.61	1.49	65	15.28	13.29	90		216.85
16	0.25	0.33	41	1.54	1.64	66	13.83	14.26	91		266.84
17	0.38	0.39	42	1.83	1.80	67	14.66	15.31	92		323.89
18	0.50	0.46	43	1.81	1.97	68	16.27	16.45	93		387.77
19	0.62	0.53	44	2.47	2.16	69	16.66	17.73	94		458.20
20	0.58	0.59	45	2.47	2.36	70	18.40	19.17	95		534.89
21	0.40	0.65	46	2.42	2.58	71	22.84	20.78	96		617.52
22	0.83	0.69	47	2.75	2.82	72	23.15	22.60	97		705.73
23	0.97	0.72	48	3.05	3.10	73	24.80	24.64	98		799.15
24	0.75	0.74	49	3.37	3.41	74	24.52	26.92	99		897.38
									100		1,000.00

Age Nearest Birthday (ANB) Basis - Female

Age	Crude Rates	Graduated Rates	Age	Crude Rates	Graduated Rates	Age	Crude Rates	Graduated Rates	Age	Crude Rates	Graduated Rates
0	1.07		25	0.44	0.34	50	1.97	2.09	75	16.53	15.72
1	0.39	0.30	26	0.27	0.35	51	2.27	2.28	76	19.48	17.34
2	0.22	0.29	27	0.55	0.35	52	2.57	2.47	77	17.79	19.10
3	0.18	0.28	28	0.31	0.35	53	2.68	2.66	78	21.29	21.00
4	0.28	0.27	29	0.33	0.35	54	2.83	2.85	79	23.25	23.04
5	0.37	0.26	30	0.33	0.36	55	3.13	3.04	80		25.10
6	0.20	0.24	31	0.36	0.37	56	3.31	3.25	81		27.54
7	0.25	0.22	32	0.35	0.40	57	3.21	3.47	82		30.21
8	0.20	0.20	33	0.41	0.43	58	3.55	3.72	83		33.14
9	0.20	0.18	34	0.45	0.48	59	4.20	3.99	84		36.36
10	0.14	0.16	35	0.62	0.53	60	4.18	4.28	85		39.87
11	0.09	0.15	36	0.58	0.58	61	4.58	4.60	86		47.73
12	0.18	0.15	37	0.65	0.63	62	5.29	4.94	87		63.92
13	0.16	0.15	38	0.67	0.68	63	5.35	5.31	88		88.40
14	0.13	0.16	39	0.71	0.73	64	5.74	5.71	89		121.12
15	0.15	0.17	40	0.83	0.79	65	6.18	6.16	90		162.01
16	0.22	0.19	41	0.72	0.86	66	6.29	6.68	91		211.01
17	0.19	0.21	42	1.11	0.94	67	6.47	7.27	92		268.03
18	0.24	0.23	43	0.93	1.03	68	8.71	7.95	93		332.99
19	0.27	0.25	44	1.27	1.14	69	8.82	8.72	94		405.79
20	0.34	0.27	45	1.16	1.26	70	8.93	9.59	95		486.31
21	0.32	0.29	46	1.33	1.40	71	11.60	10.58	96		574.44
22	0.08	0.31	47	1.64	1.55	72	12.58	11.67	97		670.03
23	0.33	0.32	48	1.61	1.72	73	12.73	12.89	98		772.94
24	0.31	0.33	49	2.05	1.90	74	11.01	14.23	99		882.99
									100		1,000.00