PAKISTAN SOCIETY OF ACTUARIES

Standard Life Table for Pakistani Insured Population

February 2013

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1. Introduction and Background

1.1. Over the last couple of decades, it was strongly felt that the life insurance industry in Pakistan needed a new life table. The current published mortality table EFU (1961-66) was based on almost half a century old data. Claims data of all life insurance companies indicated improvement over EFU (61-66). It was generally believed that the mortality of the Pakistani insured population had improved substantially over the period. This was also highlighted when LIC 1994-96 ultimate mortality table was published and companies realized that their own experience was closer to that of LIC 94-96 rather than EFU 61-66.

1.2. Few years back Pakistan Society of Actuaries (PSoA) undertook the project of developing a mortality table for Pakistani insured population. The significance of the project further increased when Securities and Exchange Commission of Pakistan (SECP) requested the PSoA to prescribe a mortality table for Pakistani insured lives to be used in determination of statutory reserves.

1.3. The major requirement for this project was the availability of reliable and credible data. After initial discussions with all life insurance companies it was felt that only State Life had the credible data required for developing the standard life table for Pakistan. Accordingly, State Life was requested to provide the desired information to PSoA so that a new mortality table could be developed for the country.

1.4. On PSoA's request State Life carried out an investigation into its mortality experience over the period 2001-2005. The investigation was carried out in 2008 and the results were shared with PSoA (Supplement 1), along with the data used in the mortality investigation. PSoA would like to thank State Life for the tremendous efforts it took in carrying out the remarkable investigation.

1.5. A working group of PSoA was formed to review the mortality investigation exercise carried out by State Life and to suggest possible ways to arrive at the final new mortality table for Pakistani insured population. The working group submitted its report in July 2010 (Supplement 2).

1.6. PSoA conducted a seminar on 12th July 2010 to discuss the report submitted by its working group in order to establish a consensus among actuaries on the development of a new life table for Pakistan. The recommendations made in the seminar were then incorporated by the working group (Supplement 3).

1.7. The results were then presented to the PSoA Council and the basis of the new mortality table was finalized.

1.8. Section 2 of this report presents the basis of the finalized mortality table while Section 3 presents the finalized mortality table. Conclusion is presented in Section 4.

2. Basis of the mortality table

2.1. The starting age of the life table is set at '0' (zero) years and the ending age at '100' (hundred) years.

Ages 20 – 68 years

2.2. The Census Method with policy year rate interval was used for calculating the observed mortality rates on SLIC's data. The observed rates were analyzed for policies with duration 2 & over and were calculated using the following formula:

$$\overset{\circ}{q}_x = \frac{Deaths}{Exposed-to-Risk} = \frac{\theta_x}{E_x} = \frac{\theta_x}{\{\sum_{t=2000}^{2004} \frac{1}{2}[P_x(t)+P_x(t+1)]\}+\frac{1}{2}\theta_x}$$

where:

- $\overset{\circ}{q}_x$ is the observed mortality rate at age x nearest birthday
- E_x represents the number of policies exposed to the risk of dying during the investigation with attained aged x nearest birthday.
- $P_x(t)$ is the number of policies with lives aged x nearest birthday at the policy anniversary preceding time t. t represents 31st December for the calendar years 2000 to 2005.
- θ_x is the number of policies where death occurred during the investigation period at age x nearest birthday at the policy anniversary preceding death.

2.3. Mortality rates for ages 20 years to 68 years were determined by graduating the State Life observed mortality rates for ages 20 years to 68 years using the following Modified Perk's Formula:

$$q_x = \frac{a+bc^x}{kc^{-ex}+f+dc^x}$$

where

a =	0.001069265
b =	0.000004779
c =	1.152905077
d =	0.000123285
e =	0.027100246
f =	(0.560532521)
k =	1.901522309

Ages below 20

2.4. Mortality rates over the ages 0-19 years were determined using a table based method instead of formula based method.

2.5. The curve for ages 20 – 68 years was extrapolated over ages 0 – 19 years with reference to 1999 Indonesia TMI II Male Table and by using graduated rate at age 20 as the base.

Ages above 68

2.6. Mortality rates over the ages 69 – 100 years were determined using a table based method instead of formula based method.

2.7. The curve for ages 20 – 68 years was extrapolated over ages 69 – 100 years with reference to Malaysia 1996[1] Statutory Valuation Mortality Table and by using graduated rate at age 68 as the base.

[1] As per the "Table Manager Standalone Program Version 3.01" downloaded from SOA website, Malaysia 1996 Statutory Valuation Mortality Table is used for statutory valuation in Malaysia for male lives. For female lives, this table is rated down 3 years.

3. SLIC (2001-05) Individual Life Ultimate Mortality Table

Age (x)	q_x	l_x
0	0.0021064	1,000,000
1	0.0005381	997,894
2	0.0004987	997,357
3	0.0004921	996,859
4	0.000479	996,369
5	0.0004528	995,891
6	0.0004331	995,441
7	0.0004068	995,009
8	0.0003806	994,605
9	0.000374	994,226
10	0.0003675	993,854
11	0.0003871	993,489
12	0.0004265	993,104
13	0.0004987	992,681
14	0.0005774	992,186
15	0.0006693	991,613
16	0.0007612	990,949
17	0.0008399	990,195
18	0.000899	989,363
19	0.0009383	988,474
20	0.000958	987,546
21	0.0009737	986,600
22	0.0009911	985,639
23	0.0010105	984,663
24	0.0010322	983,668
25	0.0010566	982,652
26	0.001084	981,614
27	0.001115	980,550
28	0.0011501	979,456
29	0.0011899	978,330
30	0.0012351	977,166
31	0.0012866	975,959
32	0.0013454	974,703
33	0.0014125	973,392
34	0.0014893	972,017
35	0.001577	970,569
36	0.0016775	969,039
37	0.0017926	967,413
38	0.0019243	965,679
39	0.0020751	963,821
40	0.0022477	961,821
41	0.0024451	959,659
42	0.0026705	957,312
43	0.0029277	954,756
44	0.0032208	951,961
45	0.0035539	948,895
46	0.0039319	945,522
47	0.0043596	941,804
48	0.004842	937,699
49	0.0053843	933,158
50	0.0059913	928,134
51	0.0066677	922,573
52	0.0074177	916,422
53	0.0082444	909,624
54	0.0091499	902,125
55	0.0101348	893,870
56	0.011198	884,811
57	0.0123361	874,903
58	0.0135439	864,110
59	0.0148134	852,407
60	0.0161348	839,780
61	0.017496	826,230
62	0.0188832	811,774
63	0.0202819	796,445
64	0.0216766	780,292
65	0.0230523	763,378
66	0.0243946	745,780
67	0.0256905	727,587
68	0.0275119	708,895
69	0.0294624	689,392
70	0.0322454	669,081
71	0.0353316	647,506
72	0.0387569	624,629
73	0.0424229	600,420
74	0.0463834	574,949
75	0.0507006	548,281
76	0.055437	520,482
77	0.0606463	491,628
78	0.0662301	461,813
79	0.0722332	431,227
80	0.078709	400,078
81	0.0857111	368,588
82	0.0932841	336,996
83	0.1013923	305,560
84	0.1100535	274,578
85	0.1192588	244,360
86	0.129035	215,218
87	0.1394177	187,447
88	0.1506567	161,314
89	0.1626094	137,011
90	0.1753202	114,732
91	0.1889855	94,617
92	0.2039709	76,736
93	0.2206064	61,084
94	0.239472	47,608
95	0.2608351	36,207
96	0.2849634	26,763
97	0.3123474	19,137
98	0.3436562	13,159
99	0.3792108	8,637
100	0.4196696	5,362

4. Conclusion

4.1. The mortality table presented above has been approved by the PSoA council members.

4.2. Securities and Exchange Commission of Pakistan may prescribe margins to be added in the mortality rates for Statutory Valuation purpose.

4.3. Since the mortality table is based on the data containing both male and female lives, it is suggested that 2-3 years age setback should be used for female lives.

4.4. PSoA would like to thank Mr. Amin Nizar Ali and Mr. Naveed Shahid for their tremendous contribution in developing this mortality table.

Supplement 1: State Life Individual Mortality Investigation 2001-2005

1. Data

1.1. State Life carried out a massive exercise of data collection and compilation for the investigation. To calculate the exposures, in force policies records at the year-end 2000-2005 were used. To determine the deaths incurred during the analysis period, death intimations during 2001-2007 were considered. Since the basic information essential for mortality investigation such as date of death were not available on State Life's IT system, missing information were collected manually from the zones. The exposure figures were adjusted for late death intimations.

1.2. Due to the shortcomings in the structure of the IT system, it was not possible to identify the gender, medical/ non-medical, smoker/ non-smoker, cause of death and multiple policies on the same life. Accordingly, the unit of investigation used to account for exposed-to-risk and deaths was number of policies rather than number of lives. Data analyzed includes policies accepted on special terms, policies issued on female lives and multiple policies on individual lives.

1.3. *Exclusions*:

The following data was excluded from the investigation:

a. Paid-up policies due to longer reporting lags (inclusion of these policies may have resulted in understatement of mortality).

b. Joint Life Policies as the investigation is on an individual life basis (inclusion of such plans may have resulted in underestimation of mortality).

c. Single premium plans due to longer reporting lags. Single premium policies form a very small proportion of State Life's overall business.

d. Annuities (mortality experienced by annuitant is different from mortality of individual life assured).

e. Child Education and Marriage Plans which continue to participate in State Life surplus even after the death of the policyholder. A greater reporting lag is anticipated for these plans as compared to other plans which could impact the mortality results.

f. Repudiated cases.

g. Non-Declinature (ND) cases were excluded from the inforce data at years end 2004 and 2005 and from the deaths 2005. However, it was not possible to identify ND cases in the earlier years. Under the ND scheme, people who do not want to fulfill State Life's medical requirements or are unable to fulfill them due to their present state of health can be insured subject to certain terms and conditions and are charged an ND extra.

h. Errors in the data (e.g. policies erroneously captured as deaths, duplicate cases etc.).

1.4. A preliminary duration wise study suggested that there was a possible select period of at least 2 policy years. Over the age range 9-66 observed rates at duration 0 were lower than the observed rates at durations 2 & over for approximately 84% of the 58 ages. For duration 1,

observed rates were lower for 52% of the ages as compared to those for duration 2 & over. Therefore, the study focused on calculating the ultimate rates for durations 2 & over.

1.5. The total data for durations 2 & over used in the mortality investigation is:

- Total exposed to risk 4,346,998
- Total Deaths 19,833

The breakup of exposures and deaths by age is given in **Appendix 1**.

2. Method Used

2.1. The **Census Method with policy year rate interval** was used for calculating the observed mortality rates. The observed rates were analyzed for policies with duration 2 & over and were calculated using the following formula:

$$\overset{\circ}{q}_x = \frac{Deaths}{Exposed-to-Risk} = \frac{\theta_x}{E_x} = \frac{\theta_x}{\{\sum_{t=2000}^{2004} \frac{1}{2}[P_x(t)+P_x(t+1)]\}+\frac{1}{2}\theta_x}$$

where

- $\overset{\circ}{q}_x$ is the observed mortality rate at age x nearest birthday
- E_x represents the number of policies exposed to the risk of dying during the investigation with attained aged x nearest birthday.
- $P_x(t)$ is the number of policies with lives aged x nearest birthday at the policy anniversary preceding time t. t represents 31st December for the calendar years 2000 to 2005.
- θ_x is the number of policies where death occurred during the investigation period at age x nearest birthday at the policy anniversary preceding death.

3. Graduation Methods Used

3.1. The observed experience was graduated using the following formulas. The graduated mortality rates were arrived at by minimizing the sum of weighted average least squares.

a. Gompertz's formula (3 variables)
b. Makeham's formula (3 variables)
c. Heligman and Pollard's formula (8 variables)
d. Linear transformation of LIC (94-96) ultimate mortality table
e. Linear transformation of EFU (61-66) and LIC (94-96) ultimate mortality tables
f. Modified Perk's formula (7 variables)

The details of the formulas and the weights used are given in **Appendix 2**.

4. Goodness of Fit tests

4.1. Following goodness of fit tests were applied to determine the best fit:

- Chi-squared test

- Individualized Standard Deviation test
- Maximum likelihood test
- Test of smoothness
- Signs of deviation test
- Test for changes of sign

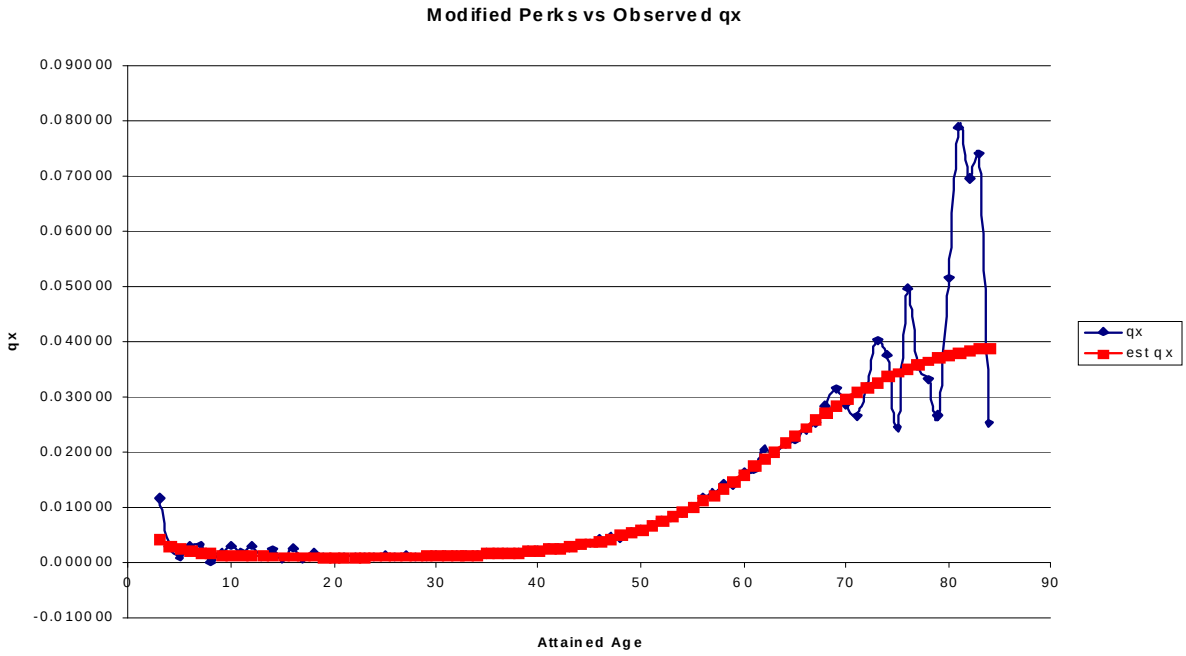
The details of the results of the above tests are given in **Appendix 3**.

5. Selected Model

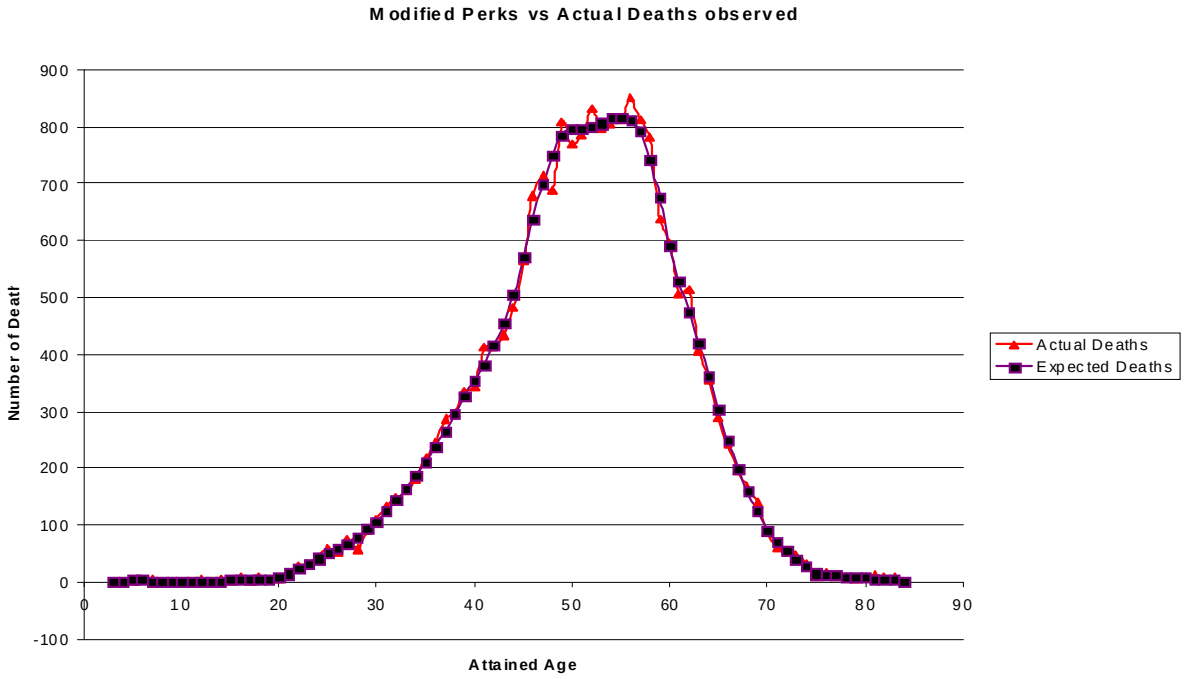
5.1. In light of the above goodness of fit tests, graduated mortality rates generated using ***Modified Perk's formula*** closely represents the mortality experience of State Life.

5.2. The table of ultimate mortality rates for durations 2 & over generated using Modified Perk's formula is given in **Appendix 4**.

5.3. A graphical comparison of the graduated rates using the Modified Perks formula and the observed mortality rates are given below:

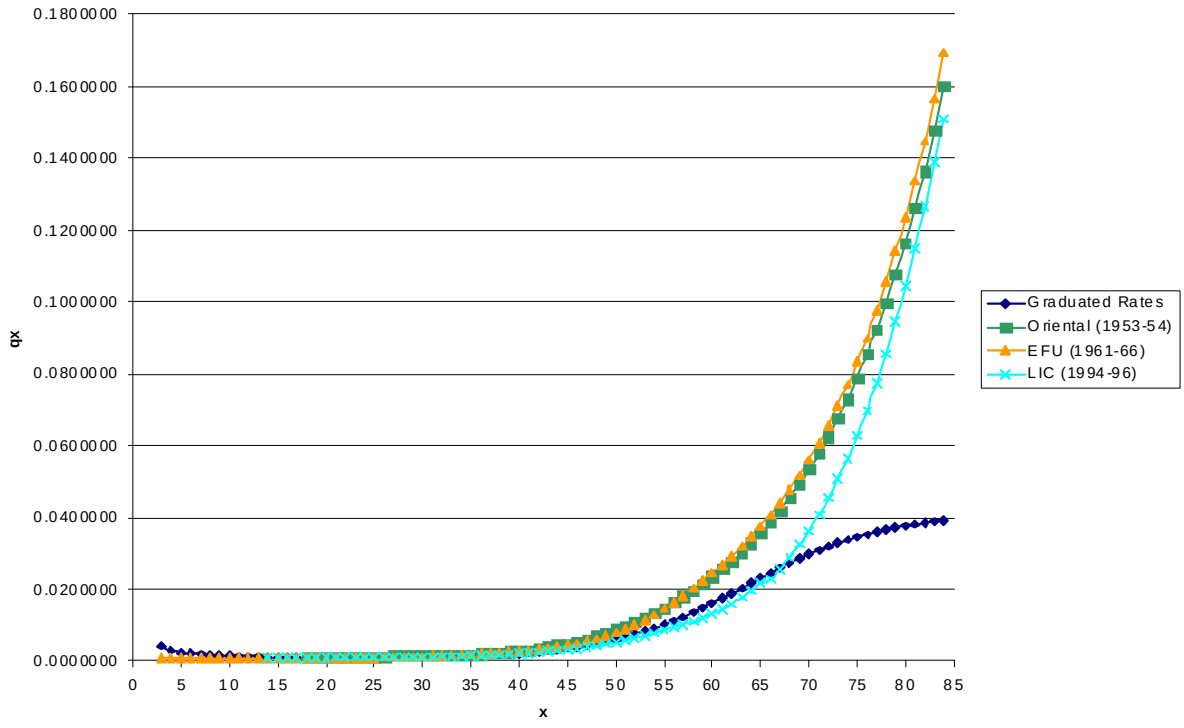


5.4. The actual deaths observed compared with those expected using the graduated rates are depicted in the following graph:



2

5.5. The graduated rates generated using Modified Perks formula compared with EFU (1961-66), LIC (1994-96) and Oriental (1953-54) are given below.



[2] Actual Deaths 19,833; Expected Deaths 19,760; Actual Deaths / Expected Deaths = 1.004.

6. Conclusion & Recommendations of the Study

6.1. The study highlighted the problems in the collected data and concluded that the data was not sufficient to carry out a true study of homogenous lives. It was observed that "it would be ideal to segment the data by gender, medical/ non-medical, standard/ sub-standard lives, occupational code, terms of acceptance, etc." Accordingly, the study recommended improvement in State Life systems, especially with reference to data collection and recording.

Appendix 1

Breakup of Exposures and Deaths by Age

Age (x)	Ex	Θx	Age (x)	Ex	θx	Age (x)	Ex	Θx
1	-	-	**29**	77,328	90	**57**	64,377	811
2	-	-	**30**	86,646	111	**58**	55,063	781
3	87	1	**31**	96,800	133	**59**	45,707	639
4	1,032	3	**32**	107,635	149	**60**	36,740	595
5	2,104	2	**33**	118,162	161	**61**	30,321	506
6	2,138	6	**34**	126,994	179	**62**	25,240	515
7	1,644	5	**35**	135,526	217	**63**	20,682	406
8	1,244	-	**36**	143,877	244	**64**	16,692	354
9	1,104	2	**37**	149,786	287	**65**	13,059	288
10	1,039	3	**38**	154,668	297	**66**	10,128	242
11	1,055	2	**39**	158,106	335	**67**	7,720	195
12	1,411	4	**40**	157,947	344	**68**	5,849	166
13	1,784	2	**41**	156,143	413	**69**	4,408	139
14	2,297	5	**42**	155,240	413	**70**	3,077	88
15	2,885	2	**43**	154,840	433	**71**	2,301	61
16	3,573	9	**44**	156,048	482	**72**	1,736	55
17	4,294	3	**45**	159,797	563	**73**	1,215	49
18	5,064	9	**46**	161,680	679	**74**	826	31
19	5,817	5	**47**	159,385	713	**75**	409	10
20	8,722	6	**48**	154,263	689	**76**	362	18
21	13,949	14	**49**	145,304	808	**77**	308	11
22	23,386	27	**50**	132,550	769	**78**	272	9
23	31,048	33	**51**	119,126	784	**79**	226	6
24	38,979	44	**52**	107,636	832	**80**	175	9
25	46,249	60	**53**	97,722	796	**81**	140	11
26	53,474	52	**54**	89,130	806	**82**	115	8
27	60,702	76	**55**	80,789	811	**83**	95	7
28	68,753	58	**56**	72,733	850	**84**	80	2

Appendix 2

	Method	Equation	Weights
(i)	Gompertz	$\hat{p}_x = \exp\left[-\hat{A} - \frac{\hat{B}(\hat{c}-1)}{\ln \hat{c}}\hat{c}^x\right]$ $\hat{q}_x$ = 1- $\hat{p}_x$ $\hat{A}$ = 0.00019562 $\hat{B}$ = 0.000058 $\hat{c}$ = 1.09518159	$E_x/\overset{\circ}{q}_x$
(ii)	Makeham	$-\ln p_x = \alpha + \beta e^{\gamma x}$ where α= A β= B(c-1)/lnc γ = lnc with $\hat{A}$ = 0.000203271 $\hat{B}$ = 0.000057483 $\hat{c}$ = 1.095423569	$E_x/\overset{\circ}{q}_x$
(iii)a	Heligman and Pollard (1)	$q_x/p_x = A^{(x+B)^c} + D\exp\{-E(\ln x - \ln F)^2\} + GH^x$ where $\hat{A}$ = 0.129114589 $\hat{B}$ = 0 $\hat{c}$ = 0.476209344 $\hat{D}$ = 0.000468923 $\hat{E}$ = 12.149944680 $\hat{F}$ = 22.394850627 $\hat{G}$ = 0.000063773 $\hat{H}$ = 1.095024039	$E_x/\overset{\circ}{q}_x$
(iii)b	Heligman and Pollard (2)	The equation is the same as (iii)a. The graduation parameters are as follows: $\hat{A}$ = 0.310581129 $\hat{B}$ = 0	$E_x/\overset{lici}{q}_x$

		$\hat{c}$ = 0.636353358 $\hat{D}$ = 0.000434847 $\hat{E}$ = 14.717113745 $\hat{F}$ = 24.357452474 $\hat{G}$ = 0.000057104 $\hat{H}$ = 1.097615056	
(iv)	Linear transformation of LIC 94-96 ultimate mortality table	$\hat{q}_x = a\, {}^{lici}q_x + b$ Where $\hat{a}$ = 1.134330606 $\hat{b}$ = -0.000022549	$E_x / {}^{lici}q_x$
(v)	Linear transformation of LIC 94-96 and EFU 61-66 ultimate mortality tables	$\hat{q}_x = a\, {}^{lici}q_x + b\, {}^{efu}q_x$ Where $\hat{a}$ = 0.774216015 $\hat{b}$ = 0.227626398	$2E_x / [{}^{lici}q_x + {}^{efu}q_x]$
(vi)	Modified Perks formula	$\hat{q}_x = \frac{a + bc^x}{kc^{-ex} + f + dc^x}$ Where $\hat{a}$ = 0.00218 $\hat{b}$ = 0.00001 $\hat{c}$ = 1.15260 $\hat{d}$ =0.00032 $\hat{e}$ = 0.71257 $\hat{f}$ = 2.64635 $\hat{k}$ = -2.86626	$E_x / {}^{\circ}q_x$

Appendix 3

Results of Chi-Squared Test:

Graduation method	Degrees of freedom	Observed Value	Chi-squared test statistic at 10% significance level	Chi-squared test statistic at 5% significance level	Chi-squared test statistic at 1% significance level	Result
Gompertz	62	430.76	76.63	81.38	90.80	Fails
Makeham	62	425.69	76.63	81.38	90.80	Fails
Heligman and Pollard (1)	60	246.90	74.40	79.08	88.38	Fails
Heligman and Pollard (2)	58	180.43	72.16	76.78	85.95	Fails
Linear transformation of LIC 94-96	63	250.31	77.75	82.53	92.01	Fails
Linear transformation of EFU 61-66 and LIC 94-96	63	218.49	77.75	82.53	92.01	Fails
Modified Perks formula	59	67.23	73.28	77.93	87.17	Passes

Results of Other Tests:

	Graduation Method						
Test	Gompertz	Makeham	Heligman and Pollard (1)	Heligman and Pollard (2)	Linear transformation of LIC 94-96	Linear transformation of EFU 61-66 and LIC 94-96	Modified Perks formula
[3]Individualized Standard Deviation	60.35 (fails)	55.77 (fails)	21.26 (fails)	27.06 (fails)	24.92 (fails)	27.89 (fails)	8.07 (fails at 5% level of significance but passes at 1%)
[4]Maximum likelihood test for age range (14-84)	-118,956	-118,955	-118,907	-118,902	-118,949	-118,929	-118,837 (largest value)
Test of smoothness	0.000752	0.000758	0.005989	0.000830	0.009351	0.006621	0.000811
[5]Test of Signs of Deviation	-0.6626 (passes)	-0.6626 (passes)	1.7669 (passes)	1.7802 (passes)	2.0175 (fails)	0.1187 (passes)	-0.2209 (passes)
[6]Test of changes of sign	-6.56 (fails)	-6.56 (fails)	-2.78 (fails)	-2.87 (fails)	-3.35 (fails)	-2.87 (fails)	0.11 (passes)

[3] Chi-squared test at 95% confidence interval; Degrees of freedom 3; Test Statistics 7.8147.

[4] $\Lambda = \sum_x \theta_x \ln q_x + (E_x - \theta_x) \ln p_x$

[5] Test statistics of unit normal distribution at upper and lower 2.5% regions = 1.96, -1.96.

[6] Test statistic of unit normal distribution at lower 5% regions = -1.645

Appendix 4

The table of ultimate mortality rates for durations 2 and over generated using Modified Perk's Formula:

x	Graduated qx	lx	x	Graduated qx	lx	x	Graduated qx	lx
3	0.00413635	1,000,000	**32**	0.00133148	959,129	**61**	0.01742812	813,273
4	0.00299380	995,864	**33**	0.00139673	957,852	**62**	0.01882803	799,099
5	0.00239779	992,882	**34**	0.00147249	956,514	**63**	0.02024952	784,054
6	0.00203389	990,502	**35**	0.00156019	955,106	**64**	0.02167857	768,177
7	0.00179011	988,487	**36**	0.00166142	953,616	**65**	0.02310084	751,524
8	0.00161661	986,717	**37**	0.00177801	952,031	**66**	0.02450226	734,163
9	0.00148784	985,122	**38**	0.00191202	950,338	**67**	0.02586961	716,175
10	0.00138936	983,657	**39**	0.00206576	948,521	**68**	0.02719091	697,647
11	0.00131241	982,290	**40**	0.00224182	946,562	**69**	0.02845591	678,678
12	0.00125138	981,001	**41**	0.00244309	944,440	**70**	0.02965626	659,365
13	0.00120253	979,773	**42**	0.00267275	942,133	**71**	0.03078568	639,811
14	0.00116329	978,595	**43**	0.00293430	939,615	**72**	0.03183994	620,114
15	0.00113182	977,457	**44**	0.00323155	936,857	**73**	0.03281674	600,370
16	0.00110684	976,350	**45**	0.00356860	933,830	**74**	0.03371558	580,668
17	0.00108740	975,270	**46**	0.00394983	930,497	**75**	0.03453744	561,090
18	0.00107283	974,209	**47**	0.00437981	926,822	**76**	0.03528457	541,711
19	0.00106266	973,164	**48**	0.00486327	922,763	**77**	0.03596020	522,597
20	0.00105658	972,130	**49**	0.00540500	918,275	**78**	0.03656827	503,805
21	0.00105439	971,103	**50**	0.00600966	913,312	**79**	0.03711317	485,381
22	0.00105603	970,079	**51**	0.00668167	907,823	**80**	0.03759961	467,367
23	0.00106151	969,054	**52**	0.00742499	901,757	**81**	0.03803235	449,794
24	0.00107095	968,026	**53**	0.00824288	895,062	**82**	0.03841616	432,688
25	0.00108453	966,989	**54**	0.00913764	887,684	**83**	0.03875564	416,066
26	0.00110255	965,940	**55**	0.01011034	879,573	**84**	0.03905520	399,941
27	0.00112537	964,875	**56**	0.01116053	870,680			
28	0.00115345	963,789	**57**	0.01228603	860,963			
29	0.00118738	962,678	**58**	0.01348273	850,385			
30	0.00122780	961,535	**59**	0.01474445	838,919			
31	0.00127553	960,354	**60**	0.01606297	826,550			

Supplement 2: Suggestions Submitted by the Working Group to Develop a Standard Life Table for Pakistan

Supplement 2: Suggestions submitted by the working group to develop a standard life table for Pakistan

1. Introduction

1.1. A working group of PSoA was formed to review the mortality investigation carried out by State Life and to develop a life table for Pakistan in light of the results of SLIC mortality investigation. Following were the members of the working group:

- Mr. Amin Nizar Ali, FSA, FPSA
- Mr. Naveed Shahid, ASA, APSA

1.2. The working group reviewed the mortality investigation exercise carried out by State Life and submitted its report in July 2010. The report presented the observations regarding the mortality exercise carried out by State Life and suggested possible way forward to develop a standard life table for Pakistan insured population. The report also highlighted the points that need to be reflected upon before finalizing the new life table for Pakistan. This section presents the work done by the working group.

2. Observations regarding State Life Individual Mortality Investigation 2001-2005

2.1. State Life has made a great effort in carrying out an investigation into its mortality experience and working group would like to thank State Life for the tremendous efforts.

2.2. Although, the study concluded that the data was not sufficient to carry out a true study of homogenous lives, the working group strongly felt that it can be the basis of a new unisex life table for Pakistan; especially keeping in mind that the EFU (61-66) was formulated using only 123,457 units exposed to risk and only 386 deaths (*Exposed-to-risk formula used was obtained as the sum of all policies obtaining age x at the end of any year from 1961 to 1966 with curtate duration of at least three years. To this was added the number of deaths at each attained age during the second half of the calendar years 1961 to 1966 with curtate duration of at least 3 years at the end of the calendar year of death*).

2.3. However, for developing a life table based on State Life's mortality experience, there is limited data at older ages (especially above age 73 there are less than 1000 exposures at each age) and there seems to be data credibility issues at younger ages. The total exposure related to ages less than 10 years with duration greater than or equal to 2, is 9,352 with 19 deaths. The working group spotted some exposures with ages less than 10 years relating to some Child Protection Plans, which points out to the fact that the ages of the child have been captured against the policies instead of the life assureds' age.

2.4. The results of State Life mortality investigation indicate higher mortality at younger ages and favorable mortality at other ages as compared to EFU (61-66). The mortality improvements are more prominent at the older ages, in particular over the ages 35-70 years which show that on average crude mortality rates are around 70% of EFU (61-66) mortality.

2.5. The graduated rates developed by using Modified Perk's formula results in higher mortality at ages up to 27 years as compared to EFU (61-66) table, with significantly high differences in rates at minor ages. The graduated rates are higher than LIC (94 – 96) in the age bands 1 – 21

and 29 – 67 and lower for all other ages. At older ages, the formula produces significantly lower mortality rates as compared to EFU (61-66) and LIC (94-96). At age 84, the qx is 0.0390552 as against 0.1695471 and 0.1510772 of EFU (61-66) and LIC (94-96) respectively. If the curve at older ages is extrapolated using the same formula, the difference between the curves increases as the curve generated using Modified Perk's method is almost flat over the ages 75-100. Therefore, a statutory mortality table for individual lives generated using the same modified perk's formula will not be a good idea.

3. Developing a Standard Life Table for Pakistan

3.1. As highlighted in Section 2 above, the exposed to risk at certain age bands in State Life's data are small in number and may not offer credible experience for the mortality table. Based on this observation the State Life data was bifurcated into following three age bands:

I. Younger ages, 19 years and below
II. Ages 20 to 65 years; [The exposures over the ages 66-70 are reasonable and can be used in the analysis; but since the shape of the mortality curve started to change over these ages i.e. it started to flatten out (in fact the change has started from age 60 year), it was felt that using this data would result in considerably lighter mortality rates at older ages as compared to other published mortality tables used in the analysis. Hence, the data over this age band was ignored for the analysis purpose].
III. Older ages, 66 years and above.

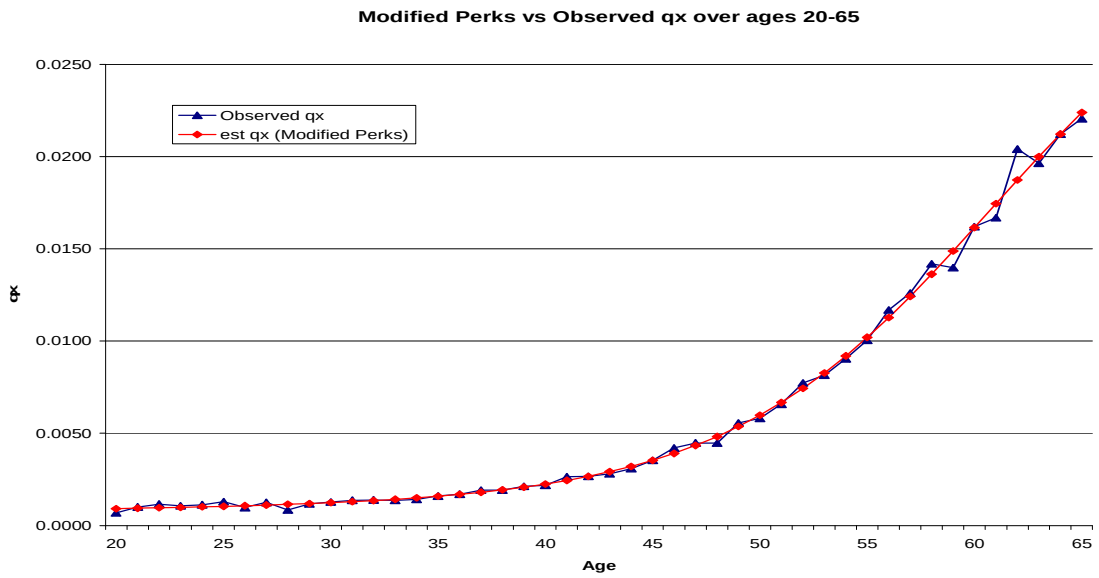
3.2. The first band account for around 0.9% of the total exposure and around 0.3% of all deaths. Furthermore, there are no deaths at ages 1, 2 and 8. Second band contributes to around 98.2% in exposure and 94.1% in deaths. Third band contributes to around 0.9% in the exposure and 5.6% in deaths

3.3. For first band the working group strongly felt that the data is insufficient and therefore will not be appropriate for the construction of the country life table. Accordingly they suggested alternate methods to determine the mortality rates for this age band in para 3.7 below.

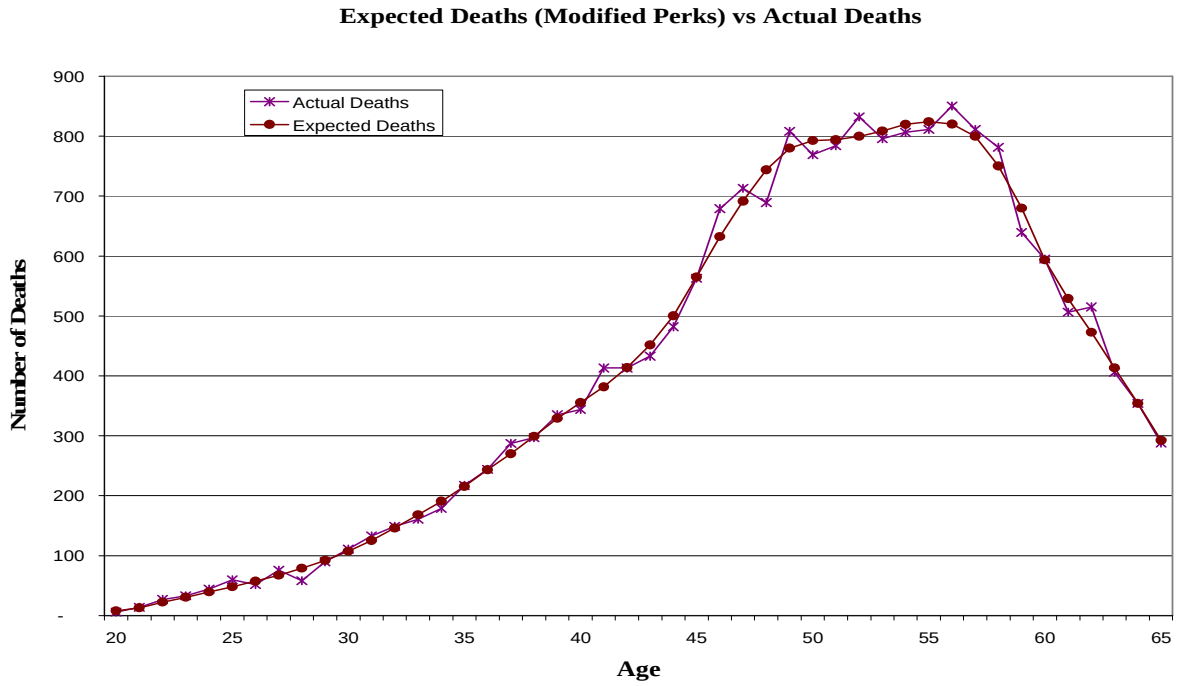
3.4. The working group observed that the second band had sufficient exposure and may be used to calculate credible rates. Six graduation methods used by State Life as mentioned in section 3 of Supplement 1 were applied over this age band. Microsoft Excel Solver was used to determine the values of the parameters for each graduation method such that the sum of weighted average least squares was minimized. Details of formula and parameters are given in **Appendix 5.** The graduated rates were tested for best fit by using the goodness of fit tests mentioned in section 4 of Supplement 1. The results of the tests are annexed at **Appendix 6.**

3.5. The graduated rates using the Modified Perk's formula again represented the best fit for the State Life mortality experience. A graphical comparison of the graduated rates using the Modified Perks formula and the observed mortality rates over the ages 20-65 is given below:

Supplement 2: Suggestions submitted by the working group to develop a standard life table for Pakistan



The actual deaths observed compared with those expected using the graduated rates are depicted in the following graph:



[7]

3.6. For the age band 66 and above, the working group presented different methods to calculate the mortality rates which are given in para 3.8 below.

[7] Actual Deaths 18,653; Expected Deaths 18,611; Actual Deaths / Expected Deaths = 1.002.

3.7. **Extrapolation of the Curve at Younger Ages:**

In order to handle mortality rates at ages less than 20 years we can consider the following:

a) Start the table at age 10 and ignore the ages below 10 years for the life table.[8]

b) Extrapolate the curve over ages 10-19 years using the same Modified Perk's formula used to determine the rates over ages 20-65 years.

c) Extrapolate the curve over ages 10-19 years with reference to a standard published mortality table.

Appendix 7 presents the mortality rates generated over 10-19 years with reference to each of the LIC (94-96), Malaysia 1996 Statutory Valuation Mortality Table and 1999 Indonesia TMI II Male Table and by using graduated rate at age 20 as a base. *(For the source and the utility of Malaysian and Indonesian published tables refer to para 3.10 below).* The appendix also provides the rates determined using modified perks formula as mentioned in (b) above. Moreover, for each option presented, Actual to Expected (A/E) death ratios for policies with durations 2 & over and for policies with durations 0, 1, and 2 & over have also been presented.

d) Assume a predefined value at q_{10} and then apply any distribution or curve fitting methods to join this value with the curve representing graduated rates over ages 20-65 years. However, in absence of credible insured data at younger ages for Pakistani insured lives, the selection of q_{10} becomes subjective and this method may not be preferred.

3.8. **Extrapolation of the Curve at Older Ages:**

We can extrapolate the curve from age 66 onwards by agreeing on one of the following ways:

a) Extrapolate the curve using a formula in such a way that the last value generated is a predefined value [like the value published in EFU (61-66) or LIC (94-96) or some other value **OR** we may assume mortality rate of 1 at age x (say 105)]. For this purpose we can use the following formulas:
   i) Gompertz's Formula
   ii) Cubic Polynomial Formula
   iii) Coale-Kisker Formula

b) Extrapolate the curve by assuming **mortality improvement** of X% (say, 40%[9]) at age 66 as compared to EFU (61-66) table and then reducing mortality improvement rate by y%

[8] If ages 0-9 years are to be included then we may determine the rates with reference to a published table.

[9] The improvements in graduated rates as compared to EFU (61-66) rates at ages 63, 64 & 65 are 37.2%, 38.7% & 40.4% respectively.

(say 1%) at each successive age. We can also set the mortality improvement reduction rates in such a way that the q_{100} equals a predefined value.

c) Extrapolate the curve through **linear transformation** of LIC (94-96) and EFU (61-66) ultimate mortality tables with parameters determined by carrying out graduation over the ages 20-65 years.

d) Extrapolate the curve with reference to a **standard published mortality table**.

3.9. For demonstration purposes, the working group calculated the morality rates as follows:

i) For age band 10 – 19 years, mortality rates are determined with reference to LIC (94-96) and using graduated rate at age 20 as a base.

ii) For age band 20 – 65 years, mortality rates are determined by graduating the State Life data using the Modified Perks method.

iii) For age band 66 – 100 years, mortality rates are generated using the methods mentioned in para 3.8.

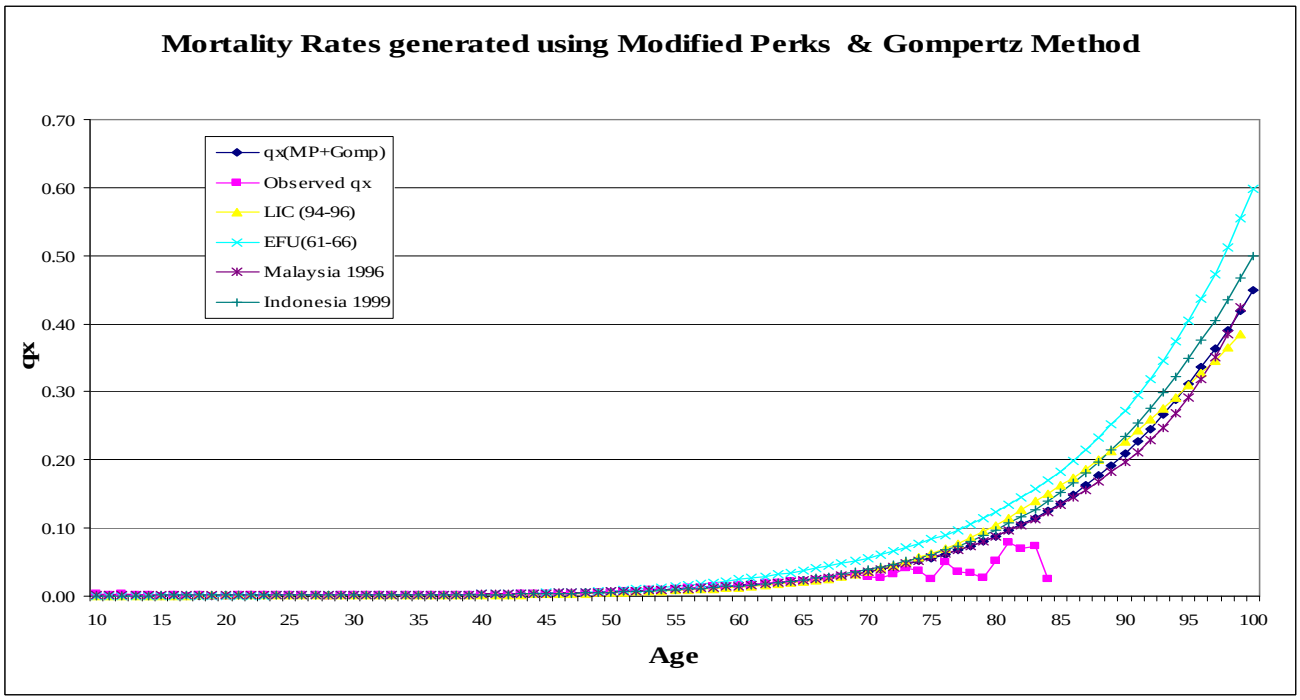
For all the options given under 3.8 [except 3.8(c) & 3.8(d)], q_{100} is assumed equal to [10]0.75 times q_{100}^{EFU}. For presenting the option 3.8(d), Malaysia 1996 mortality table was used as a standard table for extrapolating the curve at older ages. The tables of mortality rates are given in **Appendix 8.**

3.10. The following graphs present the mortality curves generated using the process mentioned in para 3.9. The graphs compare the mortality curves with the crude mortality rates experienced by SLIC and with EFU (61-66), LIC (94-96), 1999 Indonesia TMI II Male and Malaysia 1996[11] Statutory Valuation mortality curves***. Please note that all the tables except for Indonesian table are used for Insured Mortality while 1999 Indonesia TMI II Male table is used for Annuitant Mortality.*** The Malaysia 1996 and Indonesia 1999 tables are obtained from the "Table Manager Standalone Program Version 3.01" downloaded from the Society of Actuaries (SOA) website.

[10] Over the age band 20-65, the ratio of Expected Deaths from Graduated Rates and Expected Deaths from EFU (61-66) is 0.74.

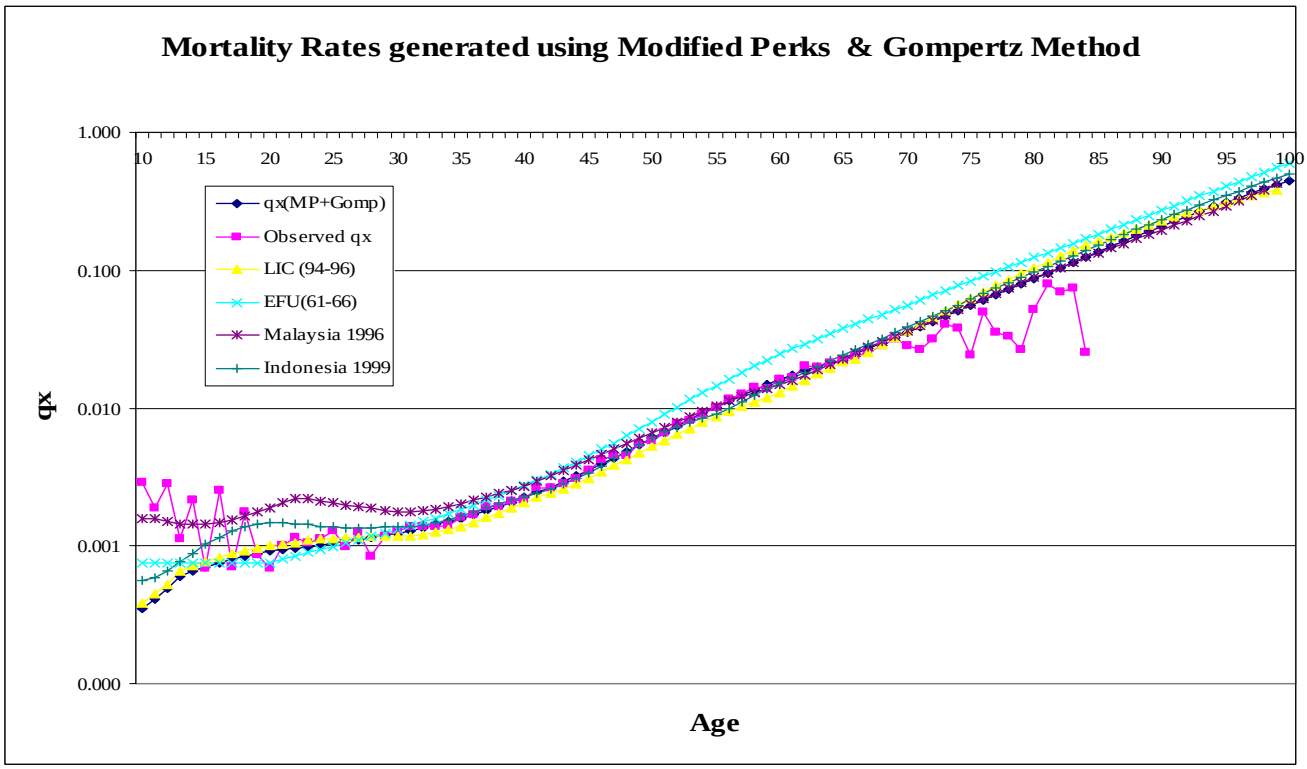
[11] As per the "Table Manager Standalone Program Version 3.01" downloaded from SOA website, Malaysia 1996 Statutory Valuation Mortality Table is used for statutory valuation in Malaysia for male lives. For female lives, this table is rated down 3 years.

Supplement 2: Suggestions submitted by the working group to develop a standard life table for Pakistan



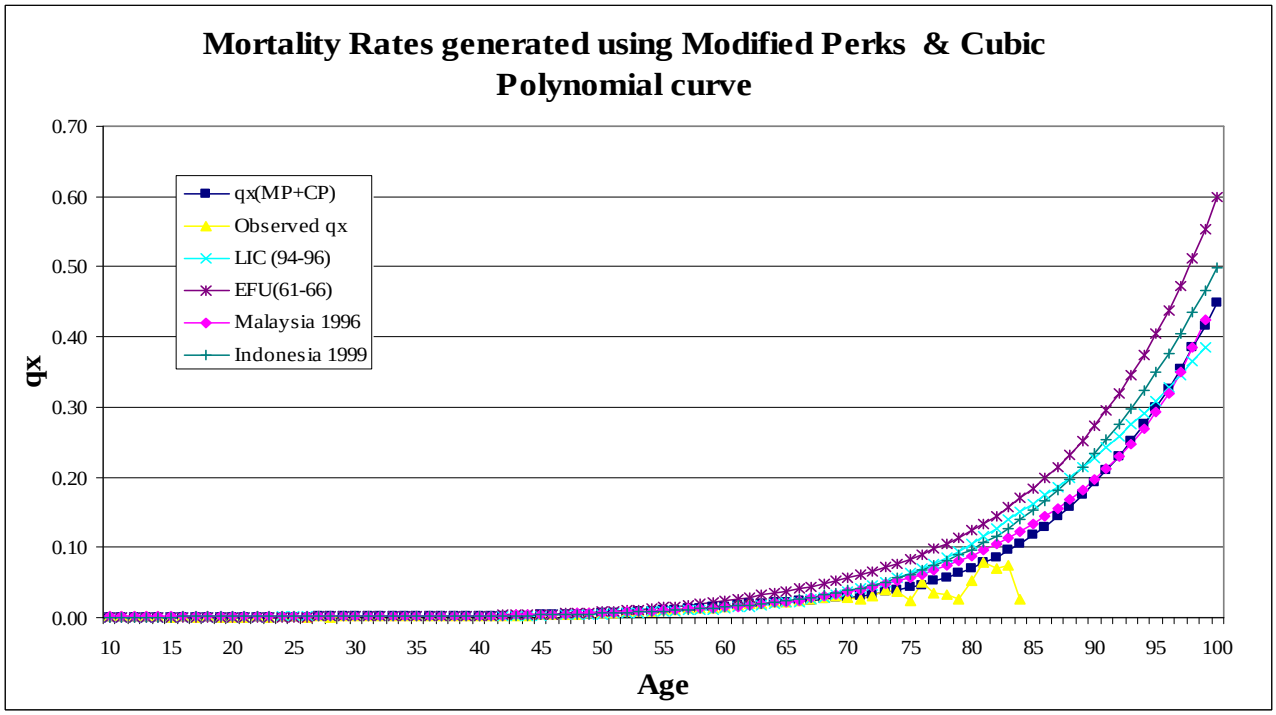
[12]

The above graph on logarithmic scale is given below:



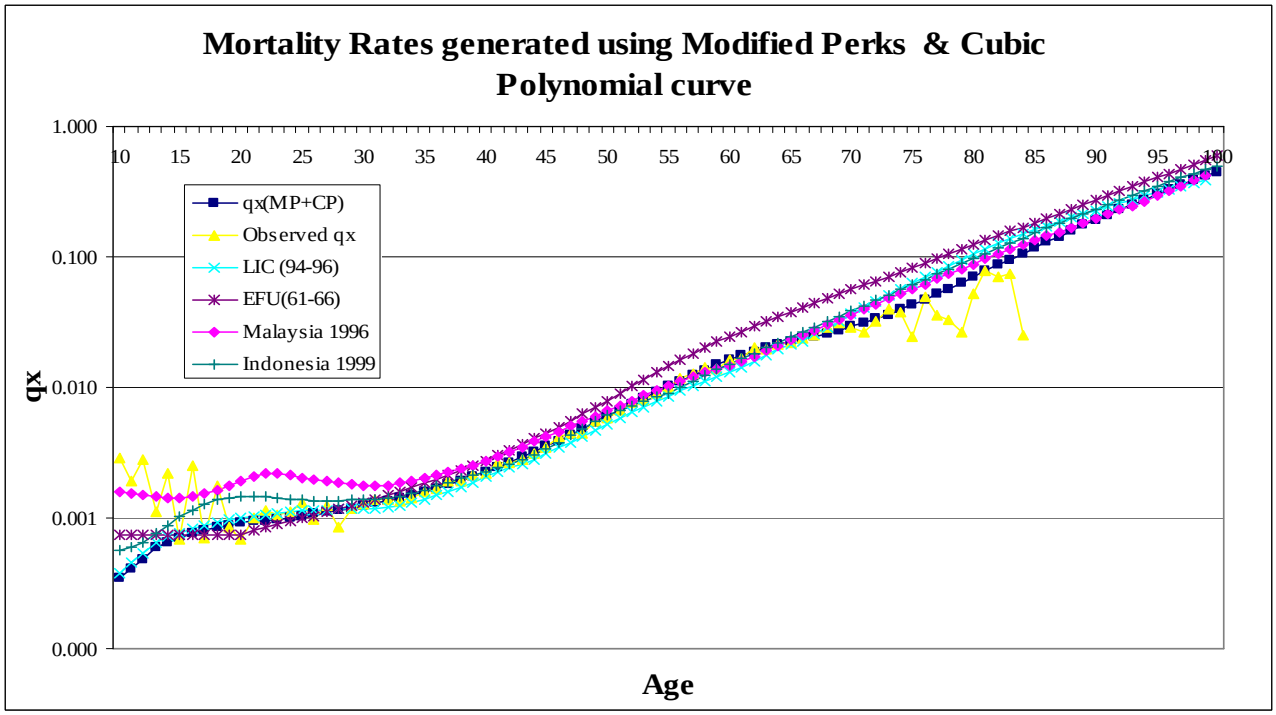
[12] Gompertz Formula used: $q_x = 1 - [\exp(-B(C-1)C^X / \ln C)]$; where B = 0.0000497 and C = 1.0979567

Supplement 2: Suggestions submitted by the working group to develop a standard life table for Pakistan



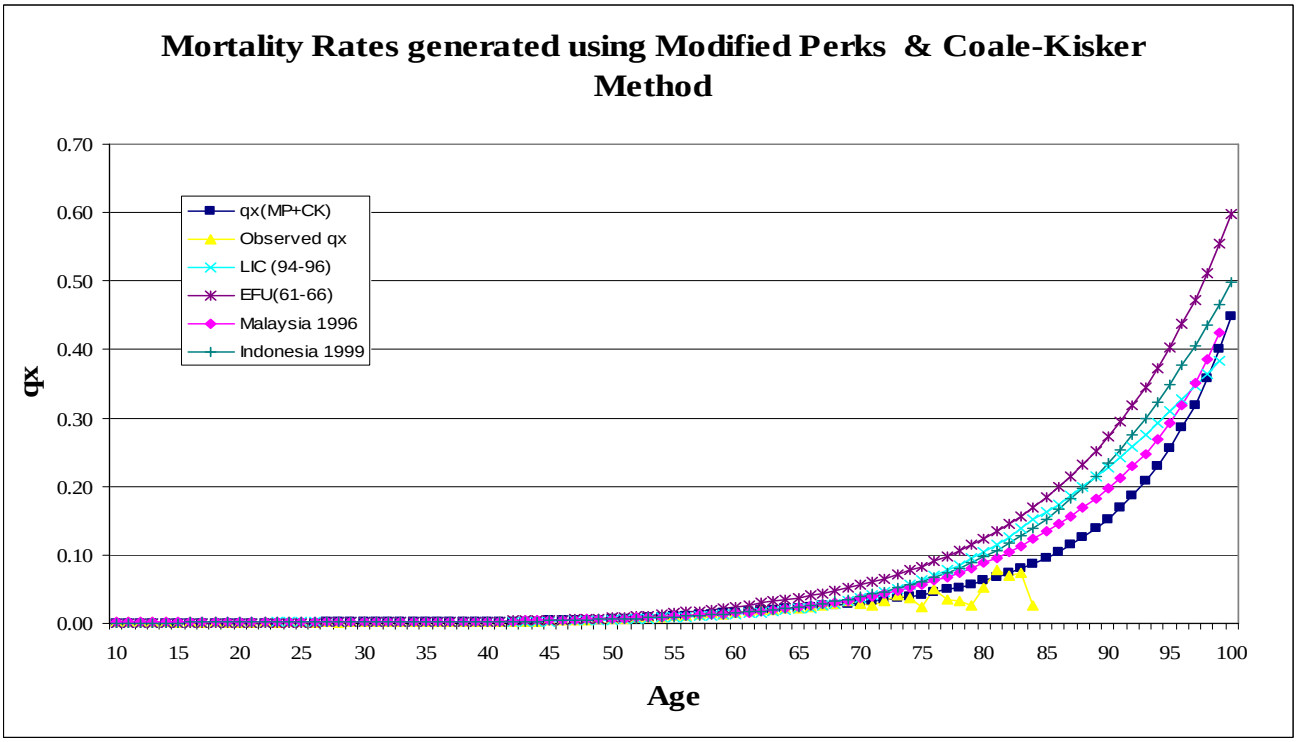
13

The above graph on logarithmic scale is as follows:



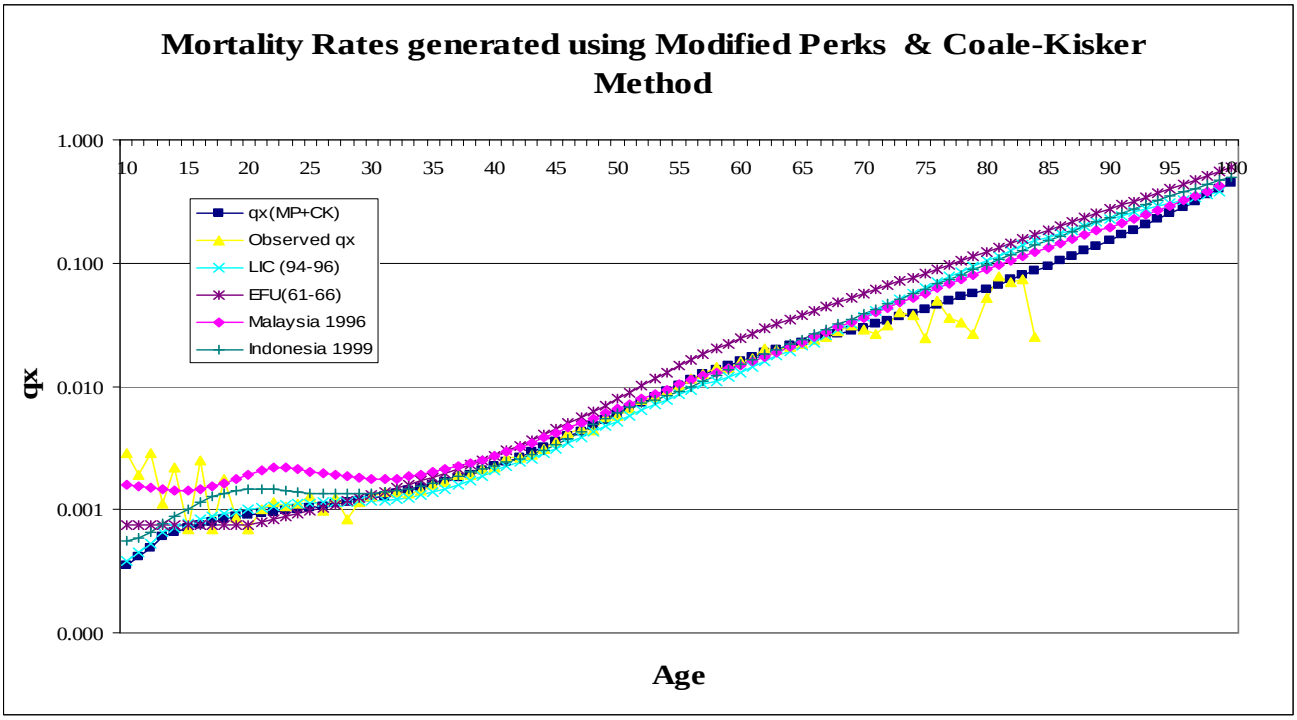
[13] Cubic Polynomial Extrapolation: $q_x = ax^3 + bx^2 + cx + d$; where a = 0.0000090388, b = -0.001763633, c = 0.11586302, d = -2.53963638.

Supplement 2: Suggestions submitted by the working group to develop a standard life table for Pakistan



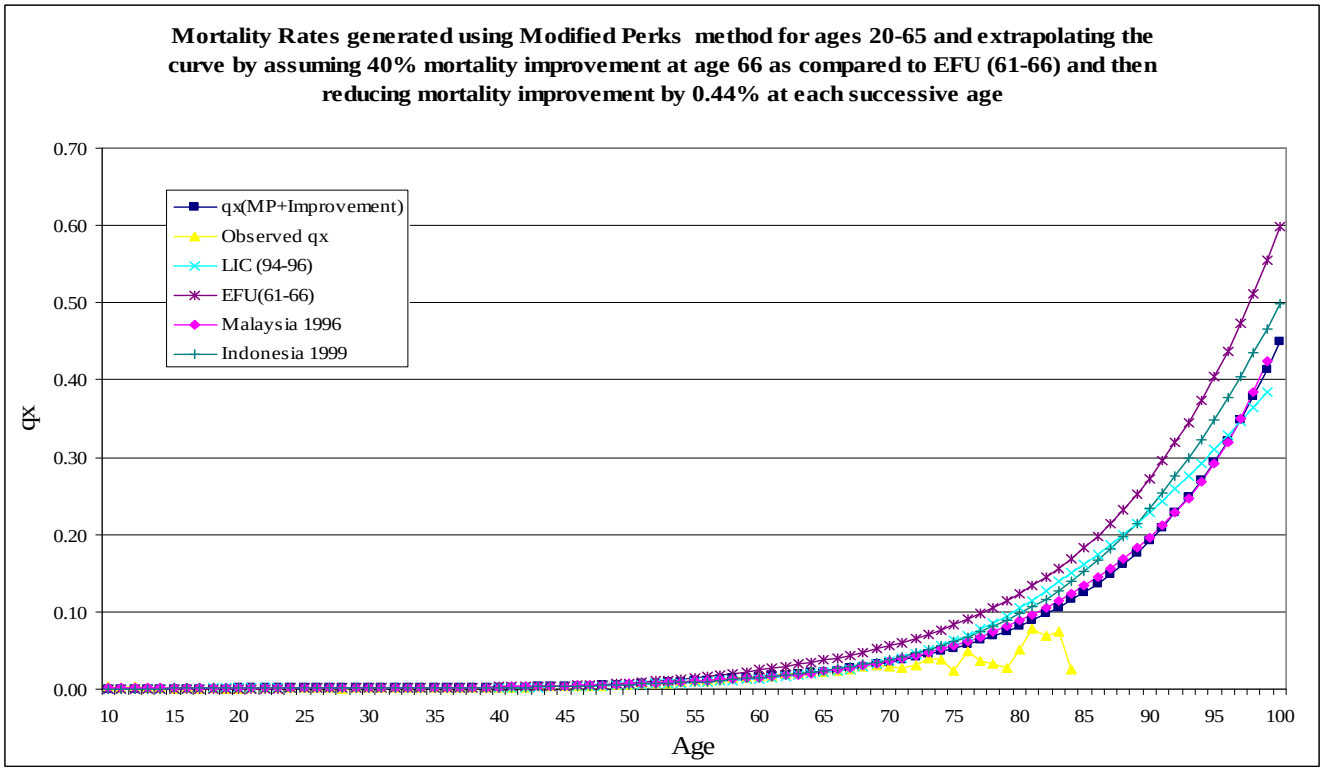
14

The above graph on logarithmic scale is given below:

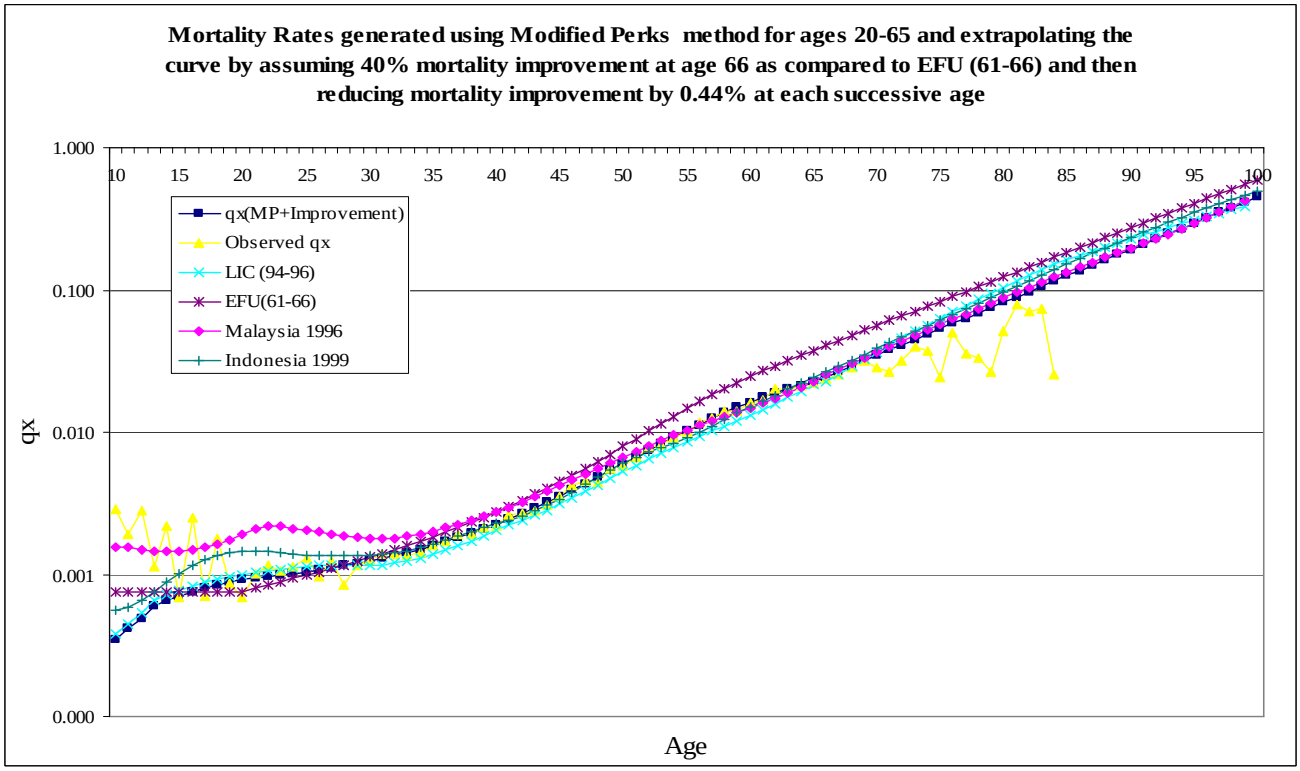


[14] $q_x = q_{(x-1)} * \exp(K65 + (x-65)*S)$; where
$K65 = \ln(q_{65}) - \ln(q_{64}) = 0.053603$
$S = -[\ln(q_{64}/(0.75*q_{100}(EFU)))+(100-64)K65] / 630 = 0.001782$

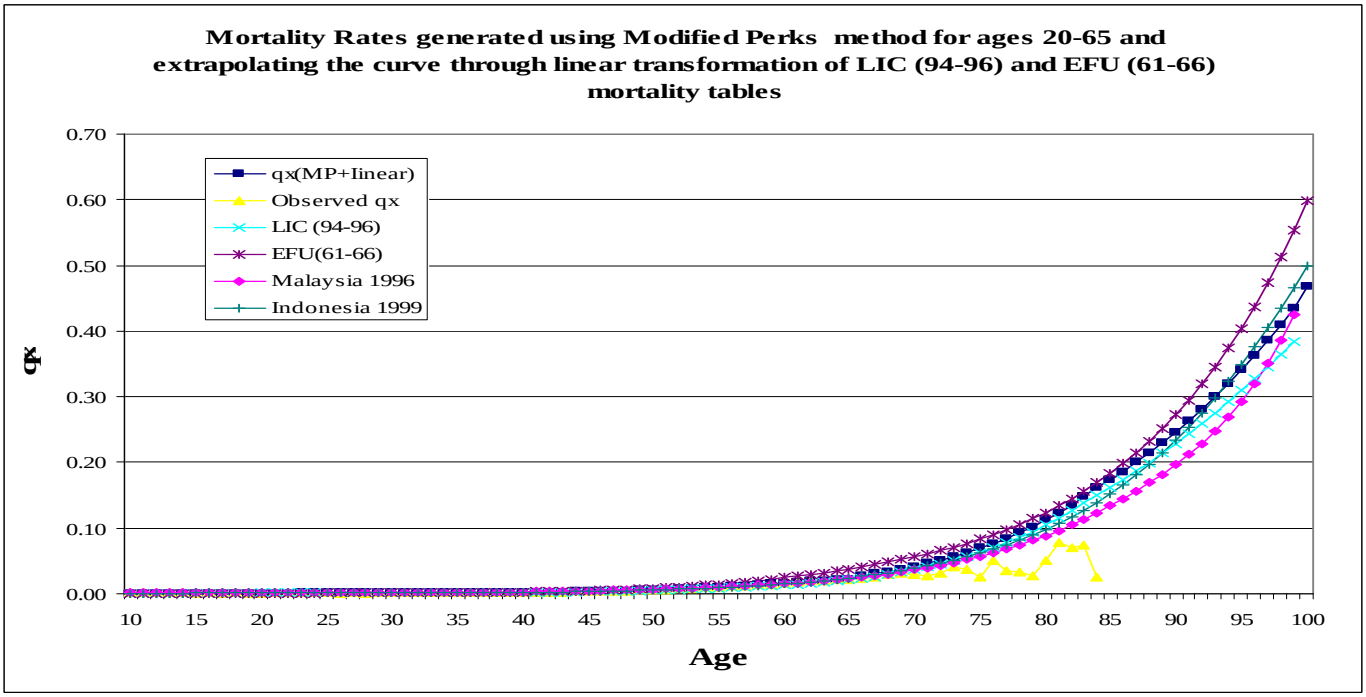
Supplement 2: Suggestions submitted by the working group to develop a standard life table for Pakistan



On logarithmic scale the above graph is as follows:

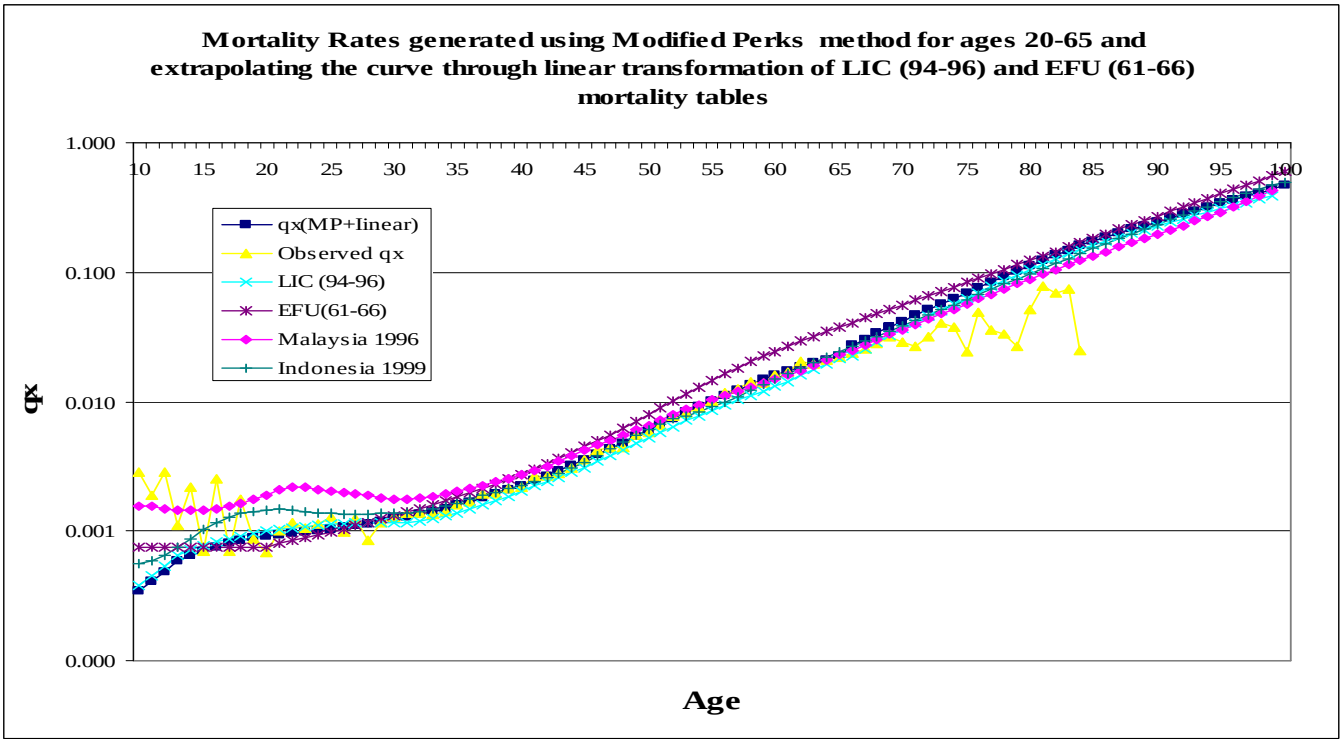


Supplement 2: Suggestions submitted by the working group to develop a standard life table for Pakistan



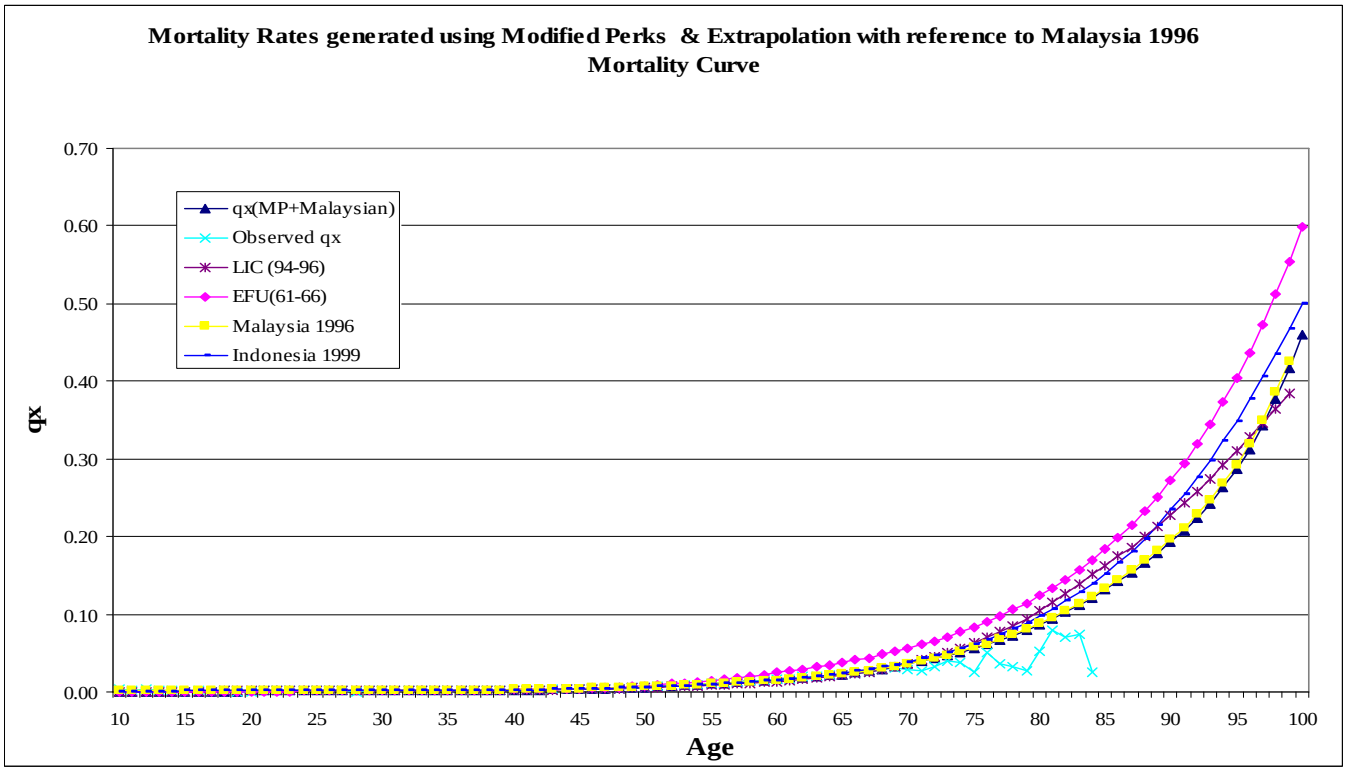
15

On logarithmic scale the above graph is as follows:

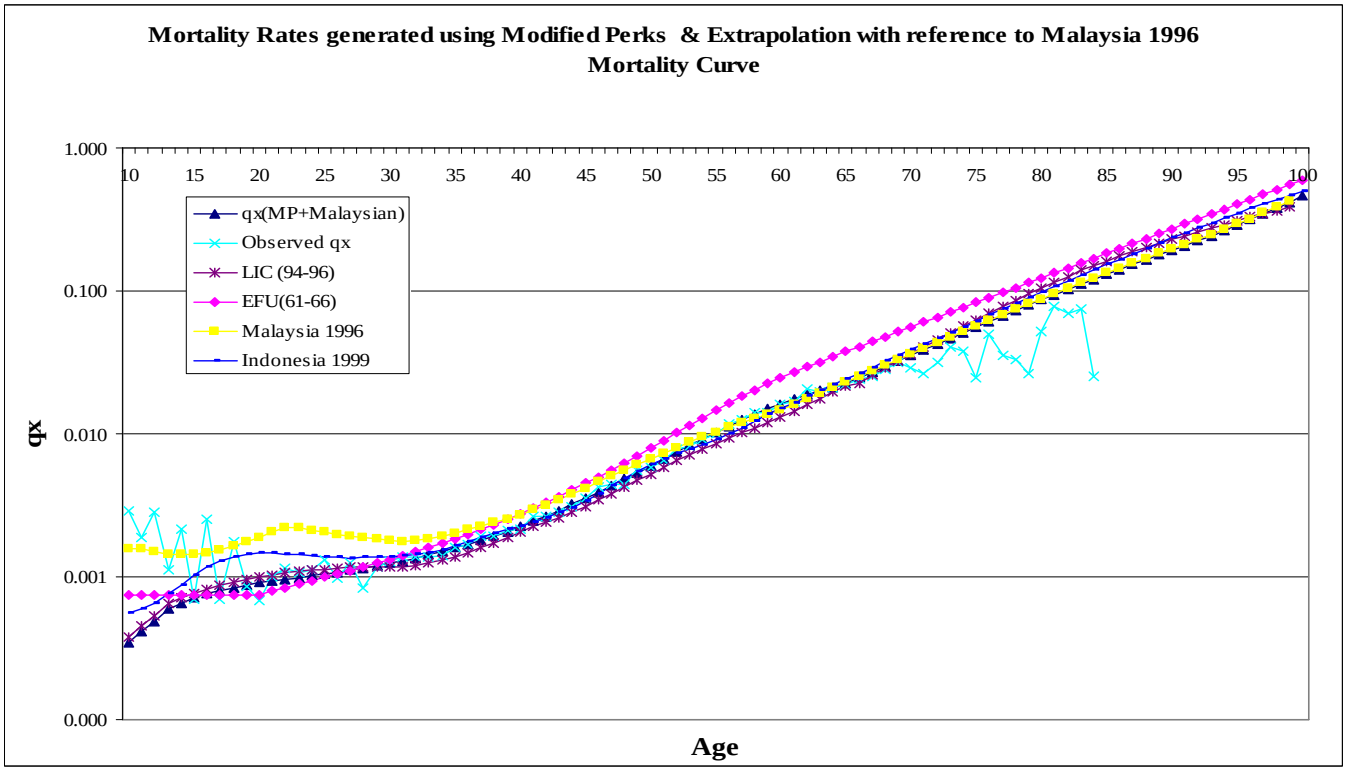


[15] Linear transformation of LIC(94-96) and EFU(61-66) using the following formula:
$q_x = aq_x^{lic} + bq_x^{efu}$; where a = 0.842457922 & b = 0.198385185.

Supplement 2: Suggestions submitted by the working group to develop a standard life table for Pakistan



The above graph on logarithmic scale is as follows:



3.11. The expectation of life $(\overset{0}{e}_x)$ corresponding to the mortality tables given in Appendix 8 is presented in **Appendix 9**.

3.12. Mortality rates at quinquennial ages $({}_nq_x)$ for the various mortality tables presented in Appendix 8 are displayed in **Appendix 10(a)**. The % comparison of mortality rates at quinquennial ages of the various options presented with the mortality rates from published tables are given in **Appendix 10(b).**

3.13. Analysis of percentage change in mortality rates over the age band 56-100 for the various options presented in Appendix 8 along with the %age change contained in the published tables are given in **Appendix 11**. A graphical comparison of these % changes is also given in the same appendix.

3.14. **Points that need to be reflected upon:**

Following points were put forward by the working group that needed to be considered by the Actuarial fraternity in Pakistan for constructing a new life table:

a) What should be the starting Age of the life table?

Although it is desirable to start a published life table at age 0, the absence of credible insured lives data at younger ages makes it difficult to determine rates over these ages. Any method adopted (e.g. rates generated with reference to a published life table) will result in somewhat artificial rates of mortality at these ages.

Keeping in view the fact that the life insurance companies in Pakistan normally do not offer policies to children younger than 10 years, the life table starting at Age 10 may be acceptable.

b) What method should be used to develop mortality rates over ages 10-19 years (in case the table starts from age 10) or over age band 0-19 years (in case the table starts at age 0)?

We need to decide on the method that should be used to generate mortality rates over younger ages. From the A/E ratios in Appendix 7 we can observe that none of the rate series presented over the ages 10-19 years represents the actual experience, which is rather limited and hence not credible. However, amongst the rates presented, the rates generated using modified perk's formula is the closest to the actual experience followed by the rates generated using Malaysian table and LIC 94-96 table respectively.

The shape of the mortality curve resulted by applying modified perk's formula over the age band 10-19 years is totally different from the shape of the curves generated from the rate series developed with reference to the three mentioned published tables. The rate series generated using Malaysian table bottoms out at age 15 and

then increases over the ages 16-20 years. On the other hand, the rates generated with reference to LIC and Indonesian table starts at the lowest rate at age 10 and then increases over 11-20 years.

By keeping the shape of the curves in view, the working group suggested to generate mortality rates with reference to LIC 94-96 table over the age band 10-19 years.

c) Should we make any adjustment for the "hump" shape in the curve over younger ages?

When we look at the graphs of the published life tables on logarithmic scale as presented in 3.10 above, we can see a visible "hump" in the Indonesian and Malaysian tables at younger ages (15-30) years, which mainly represents higher deaths due to accidents at these ages (and also may be due to possible liberal underwriting rules at younger ages). The hump is totally missing from the EFU (61-66) table and is also not visible from the SLIC's data.

We need to decide about making any adjustments in the mortality curve to reflect the "accident hump" at the younger ages. The "accident hump" is found in all populations, and appears either as a distinct hump in the mortality curve or at least as a flattening out of the mortality rates, generally between ages 10 and 40.

The working group suggested that since SLIC's experience do not support a distinct "accident hump", we should make no adjustments for this purpose. Further, when we are using mortality rates over ages 10-19 years generated from LIC table, the flattening of mortality curve is quite visible over the ages 15-30 years

d) What method should be adopted to generate mortality rates over age 65 years?

The working group suggested the following options for generating mortality rates over age 65 years:

i) If it is agreed that we should use a probability distribution to generate the rates, then it is suggested that out of the three options presented in this paper we should prefer Gompertz distribution over the Cubic Polynomial and Coale Kisker distributions as it generates comparatively higher rates, which is a preferred feature for a life table at older ages.

ii) We may also consider the method presented in 3.8(b) above, which generates rates with reference to EFU(61-66) table by assuming mortality improvement of X% at age 66 as compared to EFU 61-66 rate and then reducing mortality improvement rate by y% at each successive age. The main advantage of this method is that the rates at older ages will be in relation to a Pakistani life table which is probably based on Pakistani lives experience.

However, under both (i) and (ii) above we need to decide on the end value of the table. It is suggested that we may aim for q_{100} equal to 0.75 times q_{100}^{EFU} as over the age band 20-65, the ratio of Expected Deaths from Graduated Rates and Expected Deaths from EFU (61-66) is 0.74.

iii) If a consensus can be developed on generating rates with reference to a published mortality table, then we should prefer the Malaysian table and the Indonesian tables over EFU (61-66) and LIC (94-96) tables, which are based on decades' old experience (LIC 94-96 table retained the LIC 1975-79 rates beyond age 84 years). Though Indonesian table is used for annuitant mortality, it is still conservative as compared to the Malaysian table.

e) How to smooth the kink observed at points where the graduated and the extrapolated curves meet?

From the Appendix 11, we can observe that in all the methods presented except for the methods using Cubic Polynomial and Coale Kisker curves, there is a sharp rise in the mortality rates at age 66 where the graduated and the extrapolated curves meet. This is probably due to the fact that the shape of the graduated curve has started to change at age 60 years as mentioned in 3.1 above. We need to come up with some method to smooth this kink in the rates; probably we may sacrifice a good fit to the observed data over the ages 60-65 to remove this cusp.

Supplement 2: Suggestions submitted by the working group to develop a standard life table for Pakistan

Appendix 5

	Method	Equation	Weights
(i)	Gompertz	$\hat{p}_x = \exp\left[-\hat{A} - \frac{\hat{B}(\hat{c}-1)}{\ln \hat{c}}\hat{c}^x\right]$ $\hat{q}_x$ = 1- $\hat{p}_x$ $\hat{A}$ = 0.000554368 $\hat{B}$ = 0.000023970 $\hat{c}$ = 1.112900118	$E_x/\overset{\circ}{q}_x$
(ii)	Makeham	$-\ln p_x = \alpha + \beta e^{\gamma x}$ where α= A β= B(c-1)/lnc γ = lnc With $\hat{A}$ = 0.000591108 $\hat{B}$ = 0.000022027 $\hat{c}$ = 1.114502580	$E_x/\overset{\circ}{q}_x$
(iii)a	Heligman and Pollard (1)	$q_x/p_x = A^{(x+B)^c} + D\exp\{-E(\ln x - \ln F)^2\} + GH^x$ where $\hat{A}$ = 0.1147763 $\hat{B}$ = 0.0090051 $\hat{c}$ = 0.6169435 $\hat{D}$ = 0.0006369 $\hat{E}$ = 6.3867615 $\hat{F}$ = 22.6190244 $\hat{G}$ = 0.0000423 $\hat{H}$ = 1.1041380	$E_x/\overset{\circ}{q}_x$
(iii)b	Heligman and Pollard (2)	The equation is the same as (iii)a. The graduation parameters are as follows: $\hat{A}$ = 0.190853988 $\hat{B}$ = 1.135327424 $\hat{c}$ = 0.557086805	$E_x/\overset{lici}{q}_x$

Supplement 2: Suggestions submitted by the working group to develop a standard life table for Pakistan

		$\hat{D}$ = 0.000598847 $\hat{E}$ = 7.356833715 $\hat{F}$ = 23.598878299 $\hat{G}$ = 0.000041986 $\hat{H}$ = 1.104343341	
(iv)	Linear transformation of LIC 94-96 ultimate mortality table	$\hat{q}_x = a\, {}^{lici}q_x + b$ Where $\hat{a}$ = 1.190749465 $\hat{b}$ = (0.000148923)	$E_x / {}^{lici}q_x$
(v)	Linear transformation of LIC 94-96 and EFU 61-66 ultimate mortality tables	$\hat{q}_x = a\, {}^{lici}q_x + b\, {}^{efu}q_x$ Where $\hat{a}$ = 0.842457922 $\hat{b}$ = 0.198385185	$2E_x / [{}^{lici}q_x + {}^{efu}q_x]$
(vi)	Modified Perks formula	$\hat{q}_x = \frac{a + bc^x}{kc^{-ex} + f + dc^x}$ Where $\hat{a}$ = 0.0006503 $\hat{b}$ = 0.00000231 $\hat{c}$ = 1.14832328 $\hat{d}$ = 0.00007307 $\hat{e}$ = 0.0171780 $\hat{f}$ = (3.9643778) $\hat{k}$ = 4.942316523	$E_x / \mathring{q}_x$

Appendix 6

Results of Chi-Squared Test (ages 20 – 65):

Graduation method	Degrees of freedom	Observed Value	Chi-squared test statistic at 10% significance level	Chi-squared test statistic at 5% significance level	Chi-squared test statistic at 1% significance level	Result
Gompertz	42	97.99	54.09	58.12	66.21	Fails
Makeham	42	96.94	54.09	58.12	66.21	Fails
Heligman and Pollard (1)	37	67.77	48.36	52.19	59.89	Fails
Heligman and Pollard (2)	37	66.90	48.36	52.19	59.89	Fails
Linear transformation of LIC 94-96	43	62.39	55.23	59.30	67.46	Fails at 10% & 5%; Passes at 1% significance level
Linear transformation of EFU 61-66 and LIC 94-96	43	53.44	55.23	59.30	67.46	**Passes**
Modified Perks formula	38	41.50	49.51	53.38	61.16	**Passes**

Results of Other Tests (ages 20 – 65):

	Graduation Method						
Test	Gompertz	Makeham	Heligman and Pollard (1)	Heligman and Pollard (2)	Linear transformation of LIC 94-96	Linear transformation of EFU 61-66 and LIC 94-96	Modified Perks formula
[16] Individualized Standard Deviation	12.29 (fails)	9.69 (fails)	3.46 **(passes)**	2.50 **(passes)**	0.62 **(passes)**	0.05 **(passes)**	3.65 **(passes)**
[17] Maximum likelihood test	(113,545)	(113,545)	(113,531)	(113,531)	(113,528)	(113,524)	**(113,517)**
Test of smoothness	0.000257	0.000266	0.000228	0.000227	0.000851	0.000678	**0.000214**
[18] Test of Signs of Deviation	(0.88) **(passes)**	(0.59) **(passes)**	(1.18) **(passes)**	(0.59) **(passes)**	0 **(passes)**	0 **(passes)**	0 **(passes)**
[19] Test of changes of sign	(1.34) **(passes)**	(0.75) **(passes)**	(0.15) **(passes)**	0.45 **(passes)**	(0.15) **(passes)**	0.45 **(passes)**	0.45 **(passes)**

[16] Chi-squared test at 95% confidence interval; Degrees of freedom 3; Test Statistics 7.8147.

[17] $\Lambda = \sum_x \theta_x \ln q_x + (E_x - \theta_x) \ln p_x$

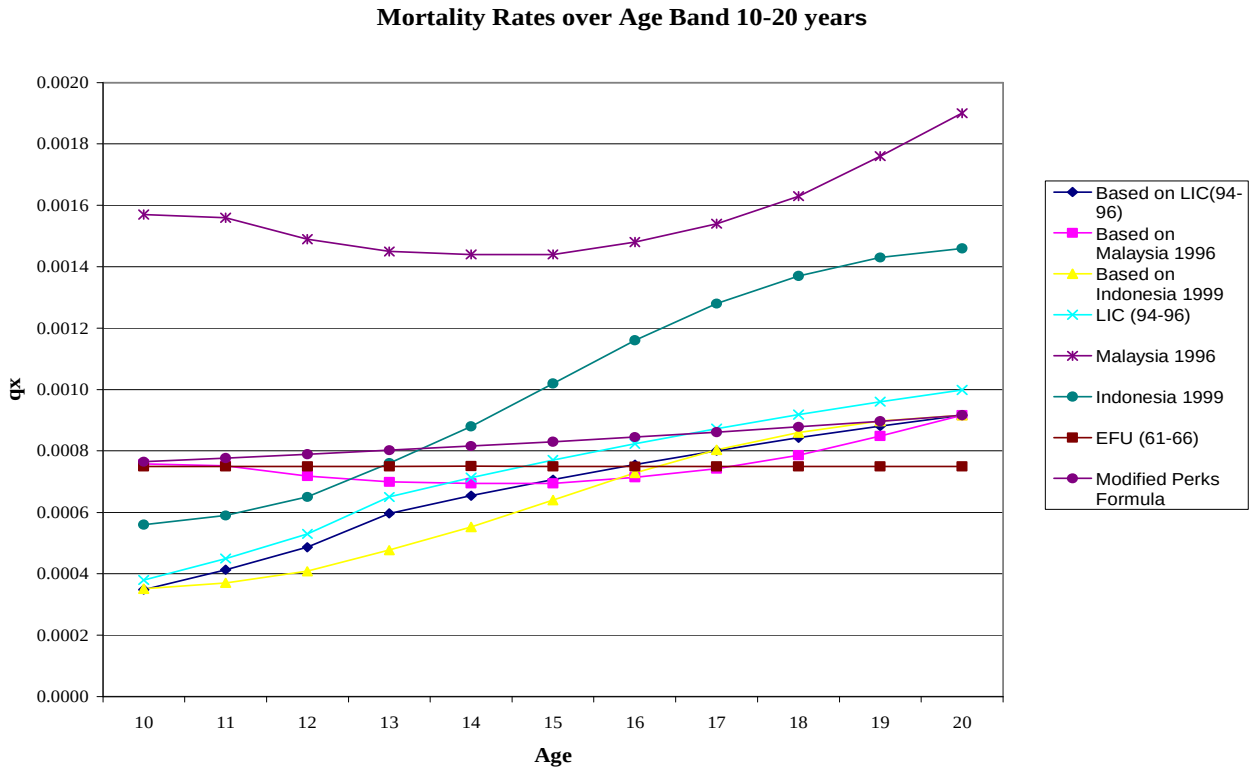
[18] Test statistics of unit normal distribution at upper and lower 2.5% regions = 1.96, -1.96.

[19] Test statistic of unit normal distribution at lower 5% regions = -1.645

Supplement 2: Suggestions submitted by the working group to develop a standard life table for Pakistan

Appendix 7

Age	Mortality Rates (q_x)			
	Based on LIC(94-96)	**Based on Malaysia 1996**	**Based on Indonesia 1999**	**Based on Modified Perks Formula**
10	0.000349	0.000757	0.000351	0.000765
11	0.000413	0.000752	0.000370	0.000777
12	0.000486	0.000719	0.000408	0.000789
13	0.000596	0.000699	0.000477	0.000802
14	0.000654	0.000694	0.000552	0.000816
15	0.000707	0.000694	0.000640	0.000830
16	0.000756	0.000714	0.000728	0.000845
17	0.000801	0.000743	0.000803	0.000861
18	0.000843	0.000786	0.000860	0.000879
19	0.000881	0.000849	0.000898	0.000897
20	0.000916	0.000916	0.000916	0.000916



Supplement 2: Suggestions submitted by the working group to develop a standard life table for Pakistan

Age	Actual / Expected Deaths (Durations 2 & Over)				Actual / Expected (Durations 0,1,2 & Over)			
	qx based on LIC (94-96)	qx based on Malaysia 1996	qx based on Indonesia 1999	qx based on Modified Perks Formula	qx based on LIC(94-96)	qx based on Malaysia 1996	qx based on Indonesia 1999	qx based on Modified Perks Formula
10	8.29	3.82	8.22	3.78	9.36	4.31	9.29	4.27
11	4.59	2.52	5.12	2.44	2.58	1.42	2.88	1.37
12	5.83	3.95	6.95	3.59	4.55	3.08	5.42	2.80
13	1.88	1.60	2.35	1.40	1.88	1.61	2.36	1.40
14	3.33	3.13	3.94	2.67	2.36	2.22	2.79	1.89
15	0.98	1.00	1.08	0.84	0.74	0.75	0.82	0.63
16	3.33	3.53	3.46	2.98	2.62	2.77	2.71	2.34
17	0.87	0.94	0.87	0.81	0.94	1.01	0.93	0.87
18	2.11	2.26	2.07	2.02	1.49	1.60	1.46	1.43
19	0.98	1.01	0.96	0.96	1.34	1.39	1.31	1.31
20	0.75	0.75	0.75	0.75	1.10	1.10	1.10	1.10
(10-19) yr Band	**2.04**	**1.99**	**2.10**	**1.77**	**1.71**	**1.68**	**1.75**	**1.52**

Supplement 2: Suggestions submitted by the working group to develop a standard life table for Pakistan

Appendix 8

x	Modified Perks & Gompertz	Modified Perks & Cubic Polynomial	Modified Perks & Coale-Kisker	Modified Perks & Mortality Improvement	Modified Perks & Linear Transformation	Modified Perks & Extrapolation w.r.t. Malaysian Table	Crude Mortality Rates (State Life)	EFU (1961-66)	LIC (1994-96)	Malaysia 1996	Indonesia 1999
10	0.000349	0.000349	0.000349	0.000349	0.000349	0.000349	0.002889	0.000750	0.000380	0.00157	0.00056
11	0.000413	0.000413	0.000413	0.000413	0.000413	0.000413	0.001897	0.000750	0.000450	0.00156	0.00059
12	0.000486	0.000486	0.000486	0.000486	0.000486	0.000486	0.002836	0.000750	0.000530	0.00149	0.00065
13	0.000596	0.000596	0.000596	0.000596	0.000596	0.000596	0.001121	0.000750	0.000650	0.00145	0.00076
14	0.000654	0.000654	0.000654	0.000654	0.000654	0.000654	0.002177	0.000750	0.000713	0.00144	0.00088
15	0.000707	0.000707	0.000707	0.000707	0.000707	0.000707	0.000693	0.000750	0.000770	0.00144	0.00102
16	0.000756	0.000756	0.000756	0.000756	0.000756	0.000756	0.002519	0.000750	0.000823	0.00148	0.00116
17	0.000801	0.000801	0.000801	0.000801	0.000801	0.000801	0.000699	0.000750	0.000873	0.00154	0.00128
18	0.000843	0.000843	0.000843	0.000843	0.000843	0.000843	0.001777	0.000750	0.000919	0.00163	0.00137
19	0.000881	0.000881	0.000881	0.000881	0.000881	0.000881	0.000860	0.000750	0.000960	0.00176	0.00143
20	0.000916	0.000916	0.000916	0.000916	0.000916	0.000916	0.000688	0.000750	0.000999	0.0019	0.00146
21	0.000937	0.000937	0.000937	0.000937	0.000937	0.000937	0.001004	0.000800	0.001033	0.00207	0.00147
22	0.000960	0.000960	0.000960	0.000960	0.000960	0.000960	0.001155	0.000840	0.001063	0.00219	0.00145
23	0.000985	0.000985	0.000985	0.000985	0.000985	0.000985	0.001063	0.000890	0.001090	0.00218	0.00143
24	0.001012	0.001012	0.001012	0.001012	0.001012	0.001012	0.001129	0.000940	0.001113	0.00211	0.00139
25	0.001041	0.001041	0.001041	0.001041	0.001041	0.001041	0.001297	0.000990	0.001132	0.00204	0.00137
26	0.001073	0.001073	0.001073	0.001073	0.001073	0.001073	0.000972	0.001040	0.001147	0.00198	0.00136
27	0.001108	0.001108	0.001108	0.001108	0.001108	0.001108	0.001252	0.001100	0.001159	0.00192	0.00135
28	0.001148	0.001148	0.001148	0.001148	0.001148	0.001148	0.000844	0.001170	0.001166	0.00187	0.00136
29	0.001191	0.001191	0.001191	0.001191	0.001191	0.001191	0.001164	0.001240	0.001170	0.00182	0.00137
30	0.001240	0.001240	0.001240	0.001240	0.001240	0.001240	0.001281	0.001320	0.001170	0.00178	0.00137
31	0.001294	0.001294	0.001294	0.001294	0.001294	0.001294	0.001374	0.001400	0.001171	0.00177	0.00139
32	0.001355	0.001355	0.001355	0.001355	0.001355	0.001355	0.001384	0.001490	0.001201	0.00179	0.00142
33	0.001424	0.001424	0.001424	0.001424	0.001424	0.001424	0.001363	0.001590	0.001246	0.00185	0.00147
34	0.001502	0.001502	0.001502	0.001502	0.001502	0.001502	0.001410	0.001710	0.001308	0.00193	0.00155
35	0.001590	0.001590	0.001590	0.001590	0.001590	0.001590	0.001601	0.001840	0.001387	0.00202	0.00164
36	0.001690	0.001690	0.001690	0.001690	0.001690	0.001690	0.001696	0.001980	0.001482	0.00214	0.00175
37	0.001804	0.001804	0.001804	0.001804	0.001804	0.001804	0.001916	0.002140	0.001593	0.00226	0.00188
38	0.001934	0.001934	0.001934	0.001934	0.001934	0.001934	0.001920	0.002320	0.001721	0.00239	0.00201
39	0.002082	0.002082	0.002082	0.002082	0.002082	0.002082	0.002119	0.002520	0.001865	0.00254	0.00214

Supplement 2: Suggestions submitted by the working group to develop a standard life table for Pakistan

x	Modified Perks & Gompertz	Modified Perks & Cubic Polynomial	Modified Perks & Coale-Kisker	Modified Perks & Mortality Improvement	Modified Perks & Linear Transformation	Modified Perks & Extrapolation w.r.t. Malaysian Table	Crude Mortality Rates (State Life)	EFU (1961-66)	LIC (1994-96)	Malaysia 1996	Indonesia 1999
40	0.002251	0.002251	0.002251	0.002251	0.002251	0.002251	0.002178	0.002750	0.002053	0.00272	0.00227
41	0.002444	0.002444	0.002444	0.002444	0.002444	0.002444	0.002645	0.003010	0.002247	0.00293	0.00242
42	0.002665	0.002665	0.002665	0.002665	0.002665	0.002665	0.002660	0.003310	0.002418	0.00319	0.00259
43	0.002918	0.002918	0.002918	0.002918	0.002918	0.002918	0.002796	0.003650	0.002602	0.00349	0.0028
44	0.003206	0.003206	0.003206	0.003206	0.003206	0.003206	0.003089	0.004040	0.002832	0.00383	0.00305
45	0.003535	0.003535	0.003535	0.003535	0.003535	0.003535	0.003523	0.004490	0.003110	0.00419	0.00338
46	0.003911	0.003911	0.003911	0.003911	0.003911	0.003911	0.004200	0.005000	0.003438	0.0046	0.00379
47	0.004337	0.004337	0.004337	0.004337	0.004337	0.004337	0.004473	0.005580	0.003816	0.00505	0.00429
48	0.004821	0.004821	0.004821	0.004821	0.004821	0.004821	0.004466	0.006260	0.004243	0.00552	0.00485
49	0.005367	0.005367	0.005367	0.005367	0.005367	0.005367	0.005561	0.007030	0.004719	0.00603	0.00546
50	0.005980	0.005980	0.005980	0.005980	0.005980	0.005980	0.005802	0.007919	0.005244	0.0066	0.00609
51	0.006667	0.006667	0.006667	0.006667	0.006667	0.006667	0.006581	0.008960	0.005819	0.00721	0.00672
52	0.007430	0.007430	0.007430	0.007430	0.007430	0.007430	0.007730	0.010140	0.006443	0.0079	0.0073
53	0.008273	0.008273	0.008273	0.008273	0.008273	0.008273	0.008146	0.011470	0.007116	0.00866	0.00784
54	0.009196	0.009196	0.009196	0.009196	0.009196	0.009196	0.009043	0.012949	0.007839	0.00946	0.00841
55	0.010198	0.010198	0.010198	0.010198	0.010198	0.010198	0.010039	0.014580	0.008611	0.01033	0.00908
56	0.011276	0.011276	0.011276	0.011276	0.011276	0.011276	0.011687	0.016350	0.009433	0.01122	0.00993
57	0.012421	0.012421	0.012421	0.012421	0.012421	0.012421	0.012598	0.018250	0.010294	0.0121	0.011
58	0.013625	0.013625	0.013625	0.013625	0.013625	0.013625	0.014184	0.020260	0.011025	0.01295	0.01229
59	0.014874	0.014874	0.014874	0.014874	0.014874	0.014874	0.013981	0.022360	0.011951	0.01381	0.01369
60	0.016153	0.016153	0.016153	0.016153	0.016153	0.016153	0.016195	0.024550	0.013073	0.01479	0.01505
61	0.017445	0.017445	0.017445	0.017445	0.017445	0.017445	0.016688	0.026850	0.014391	0.01597	0.01655
62	0.018733	0.018733	0.018733	0.018733	0.018733	0.018733	0.020405	0.029280	0.015904	0.01741	0.01819
63	0.019997	0.019997	0.019997	0.019997	0.019997	0.019997	0.019631	0.031860	0.017612	0.01903	0.01999
64	0.021221	0.021221	0.021221	0.021221	0.021221	0.021221	0.021208	0.034600	0.019516	0.02084	0.02197
65	0.022389	0.022389	0.022389	0.022389	0.022389	0.022389	0.022055	0.037540	0.021615	0.02286	0.02415
66	0.024555	0.023554	0.023664	0.024426	0.027220	0.024573	0.023894	0.040709	0.022724	0.02509	0.02653
67	0.026928	0.024771	0.025056	0.026673	0.030336	0.026983	0.025259	0.044130	0.025617	0.02755	0.02915
68	0.029526	0.026095	0.026578	0.029114	0.033769	0.029568	0.028381	0.047820	0.028823	0.03019	0.03203
69	0.032372	0.027579	0.028242	0.031766	0.037549	0.032350	0.031534	0.051800	0.032372	0.03303	0.03518

Supplement 2: Suggestions submitted by the working group to develop a standard life table for Pakistan

x	Modified Perks & Gompertz	Modified Perks & Cubic Polynomial	Modified Perks & Coale-Kisker	Modified Perks & Mortality Improvement	Modified Perks & Linear Transformation	Modified Perks & Extrapolation w.r.t. Malaysian Table	Crude Mortality Rates (State Life)	EFU (1961-66)	LIC (1994-96)	Malaysia 1996	Indonesia 1999
70	0.035486	0.029279	0.030064	0.034644	0.041704	0.035406	0.028599	0.056091	0.036294	0.03615	0.03863
71	0.038893	0.031247	0.032060	0.037772	0.046269	0.038794	0.026516	0.060720	0.040623	0.03961	0.04242
72	0.042621	0.033538	0.034250	0.041165	0.051277	0.042555	0.031682	0.065710	0.045392	0.04345	0.04657
73	0.046697	0.036207	0.036655	0.044863	0.056769	0.046581	0.040329	0.071111	0.050639	0.04756	0.05112
74	0.051152	0.039308	0.039299	0.048892	0.062786	0.050929	0.037530	0.076959	0.056404	0.052	0.05609
75	0.056020	0.042894	0.042208	0.053275	0.069368	0.055670	0.024450	0.083281	0.062728	0.05684	0.06154
76	0.061336	0.047021	0.045414	0.058055	0.076562	0.060870	0.049724	0.090131	0.069655	0.06215	0.06749
77	0.067138	0.051743	0.048950	0.063258	0.084414	0.066590	0.035714	0.097540	0.077231	0.06799	0.074
78	0.073467	0.057112	0.052856	0.068917	0.092971	0.072721	0.033149	0.105549	0.085502	0.07425	0.08111
79	0.080367	0.063185	0.057175	0.075090	0.102290	0.079312	0.026608	0.114231	0.094519	0.08098	0.08887
80	0.087883	0.070015	0.061958	0.081809	0.112420	0.086423	0.051576	0.123622	0.104331	0.08824	0.09733
81	0.096065	0.077656	0.067260	0.089121	0.123416	0.094111	0.078853	0.133780	0.114992	0.09609	0.10655
82	0.104964	0.086163	0.073147	0.097081	0.135336	0.102426	0.069565	0.144770	0.126553	0.10458	0.11658
83	0.114634	0.095590	0.079690	0.105754	0.148240	0.111329	0.074074	0.156672	0.139067	0.11367	0.12749
84	0.125130	0.105991	0.086974	0.115192	0.160912	0.120839	0.025157	0.169547	0.151077	0.12338	0.13934
85	0.136512	0.117420	0.095092	0.125470	0.173130	0.130947		0.183483	0.162298	0.1337	0.15219
86	0.148838	0.129931	0.104154	0.136654	0.186104	0.141681		0.198557	0.174149	0.14466	0.1661
87	0.162169	0.143580	0.114283	0.148836	0.199864	0.153081		0.214879	0.186638	0.1563	0.18115
88	0.176565	0.158419	0.125620	0.162094	0.214435	0.165422		0.232541	0.199775	0.1689	0.19739
89	0.192087	0.174503	0.138329	0.176531	0.229841	0.178546		0.251658	0.213560	0.1823	0.21489
90	0.208793	0.191887	0.152595	0.192248	0.246107	0.192503		0.272352	0.227995	0.19655	0.23371
91	0.226737	0.210625	0.168632	0.209349	0.263249	0.207507		0.294736	0.243072	0.21187	0.25389
92	0.245971	0.230771	0.186687	0.227955	0.281288	0.223961		0.318950	0.258782	0.22867	0.27548
93	0.266539	0.252378	0.207044	0.248221	0.300245	0.242227		0.345175	0.275109	0.24732	0.29851
94	0.288475	0.275502	0.230030	0.270211	0.320113	0.262942		0.373462	0.292031	0.26847	0.32301
95	0.311806	0.300197	0.256024	0.294198	0.340937	0.286398		0.404151	0.309522	0.29242	0.34897
96	0.336542	0.326517	0.285464	0.320370	0.362730	0.312891		0.437453	0.327549	0.31947	0.37639
97	0.362678	0.354515	0.318856	0.348761	0.385461	0.342959		0.473369	0.346073	0.35017	0.40523
98	0.390190	0.384247	0.356790	0.379490	0.409116	0.377336		0.512010	0.365052	0.38527	0.43542
99	0.419031	0.415767	0.399949	0.413357	0.433857	0.416376		0.554404	0.384436	0.42513	0.46687

Supplement 2: Suggestions submitted by the working group to develop a standard life table for Pakistan

x	Modified Perks & Gompertz	Modified Perks & Cubic Polynomial	Modified Perks & Coale-Kisker	Modified Perks & Mortality Improvement	Modified Perks & Linear Transformation	Modified Perks & Extrapolation w.r.t. Malaysian Table	Crude Mortality Rates (State Life)	EFU (1961-66)	LIC (1994-96)	Malaysia 1996	Indonesia 1999
100	0.449128	0.449128	0.449128	0.449128	0.468628	0.460800		0.598837			0.49945

Supplement 2: Suggestions submitted by the working group to develop a standard life table for Pakistan

Appendix 9

X	Modified Perks & Gompertz	Modified Perks & Cubic Polynomial	Modified Perks & Coale-Kisker	Modified Perks & Mortality Improvement	Modified Perks & Linear Transformation	Modified Perks & Extrapolation w.r.t. Malaysian Table	EFU (1961-66)	LIC (1994-96)	Malaysia 1996	Indonesia 1999
	Expectation of Life $({}^{0}e_x)$ [20]									
10	63.6	64.7	65.1	63.9	62.6	63.7	59.7	63.7	62.3	62.9
11	62.6	63.7	64.1	62.9	61.6	62.7	58.8	62.8	61.4	61.9
12	61.7	62.7	63.1	61.9	60.6	61.8	57.8	61.8	60.5	60.9
13	60.7	61.7	62.2	61.0	59.6	60.8	56.8	60.8	59.6	60.0
14	59.7	60.8	61.2	60.0	58.7	59.8	55.9	59.9	58.7	59.0
15	58.8	59.8	60.3	59.1	57.7	58.9	54.9	58.9	57.8	58.1
16	57.8	58.9	59.3	58.1	56.8	57.9	54.0	57.9	56.8	57.1
17	56.9	57.9	58.3	57.1	55.8	56.9	53.0	57.0	55.9	56.2
18	55.9	56.9	57.4	56.2	54.8	56.0	52.1	56.0	55.0	55.3
19	54.9	56.0	56.4	55.2	53.9	55.0	51.1	55.1	54.1	54.3
20	54.0	55.0	55.5	54.3	52.9	54.1	50.1	54.1	53.2	53.4
21	53.0	54.1	54.5	53.3	52.0	53.1	49.2	53.2	52.3	52.5
22	52.1	53.1	53.6	52.4	51.0	52.2	48.2	52.2	51.4	51.6
23	51.1	52.2	52.6	51.4	50.1	51.2	47.2	51.3	50.5	50.7
24	50.2	51.2	51.7	50.5	49.1	50.3	46.3	50.4	49.6	49.7
25	49.2	50.3	50.7	49.5	48.2	49.3	45.3	49.4	48.7	48.8
26	48.3	49.3	49.8	48.6	47.2	48.4	44.4	48.5	47.8	47.9
27	47.3	48.4	48.8	47.6	46.3	47.4	43.4	47.5	46.9	46.9
28	46.4	47.4	47.9	46.7	45.3	46.5	42.5	46.6	46.0	46.0
29	45.4	46.5	47.0	45.7	44.4	45.5	41.5	45.6	45.1	45.0
30	44.5	45.6	46.0	44.8	43.4	44.6	40.6	44.7	44.2	44.1
31	43.6	44.6	45.1	43.8	42.5	43.7	39.6	43.7	43.2	43.2
32	42.6	43.7	44.1	42.9	41.5	42.7	38.7	42.8	42.3	42.2
33	41.7	42.7	43.2	42.0	40.6	41.8	37.7	41.8	41.4	41.3
34	40.7	41.8	42.2	41.0	39.7	40.8	36.8	40.9	40.5	40.3
35	39.8	40.9	41.3	40.1	38.7	39.9	35.9	39.9	39.6	39.4
36	38.8	39.9	40.4	39.1	37.8	38.9	34.9	39.0	38.6	38.5
37	37.9	39.0	39.4	38.2	36.8	38.0	34.0	38.1	37.7	37.5
38	37.0	38.1	38.5	37.3	35.9	37.1	33.1	37.1	36.8	36.6
39	36.1	37.1	37.6	36.3	35.0	36.1	32.1	36.2	35.9	35.7
40	35.1	36.2	36.7	35.4	34.0	35.2	31.2	35.2	35.0	34.8

[20] $e_x = T_x / l_x$; $\sum_{x}^{100} L_x$; $L_x = (l_x + l_{x+1})/2$

Supplement 2: Suggestions submitted by the working group to develop a standard life table for Pakistan

X	Modified Perks & Gompertz	Modified Perks & Cubic Polynomial	Modified Perks & Coale-Kisker	Modified Perks & Mortality Improvement	Modified Perks & Linear Transformation	Modified Perks & Extrapolation w.r.t. Malaysian Table	EFU (1961-66)	LIC (1994-96)	Malaysia 1996	Indonesia 1999
	Expectation of Life $(e_x^0)^{20}$									
41	34.2	35.3	35.7	34.5	33.1	34.3	30.3	34.3	34.1	33.8
42	33.3	34.4	34.8	33.6	32.2	33.4	29.4	33.4	33.2	32.9
43	32.4	33.5	33.9	32.7	31.3	32.5	28.5	32.5	32.3	32.0
44	31.5	32.6	33.0	31.8	30.4	31.6	27.6	31.6	31.4	31.1
45	30.6	31.7	32.1	30.9	29.5	30.7	26.7	30.6	30.5	30.2
46	29.7	30.8	31.2	30.0	28.6	29.8	25.8	29.7	29.6	29.3
47	28.8	29.9	30.4	29.1	27.7	28.9	24.9	28.8	28.8	28.4
48	27.9	29.0	29.5	28.2	26.8	28.0	24.1	27.9	27.9	27.5
49	27.0	28.2	28.6	27.3	25.9	27.1	23.2	27.1	27.1	26.6
50	26.2	27.3	27.8	26.5	25.1	26.3	22.4	26.2	26.2	25.8
51	25.3	26.5	26.9	25.6	24.2	25.4	21.6	25.3	25.4	24.9
52	24.5	25.6	26.1	24.8	23.4	24.6	20.8	24.5	24.6	24.1
53	23.7	24.8	25.3	24.0	22.5	23.8	20.0	23.6	23.8	23.3
54	22.9	24.0	24.5	23.2	21.7	23.0	19.2	22.8	23.0	22.5
55	22.1	23.2	23.7	22.4	20.9	22.2	18.4	22.0	22.2	21.6
56	21.3	22.5	23.0	21.6	20.1	21.4	17.7	21.2	21.4	20.8
57	20.6	21.7	22.2	20.9	19.4	20.7	17.0	20.4	20.6	20.0
58	19.8	21.0	21.5	20.1	18.6	19.9	16.3	19.6	19.9	19.3
59	19.1	20.3	20.8	19.4	17.8	19.2	15.6	18.8	19.1	18.5
60	18.4	19.6	20.1	18.7	17.1	18.5	15.0	18.0	18.4	17.7
61	17.6	18.9	19.4	18.0	16.4	17.8	14.3	17.2	17.7	17.0
62	16.9	18.2	18.8	17.3	15.7	17.1	13.7	16.5	17.0	16.3
63	16.3	17.6	18.1	16.6	15.0	16.4	13.1	15.7	16.2	15.6
64	15.6	16.9	17.5	15.9	14.2	15.7	12.5	15.0	15.6	14.9
65	14.9	16.3	16.8	15.3	13.5	15.0	12.0	14.3	14.9	14.2
66	14.2	15.6	16.2	14.6	12.8	14.4	11.4	13.6	14.2	13.6
67	13.6	15.0	15.6	14.0	12.2	13.7	10.9	12.9	13.6	12.9
68	12.9	14.4	15.0	13.3	11.6	13.1	10.3	12.2	12.9	12.3
69	12.3	13.7	14.4	12.7	10.9	12.5	9.8	11.6	12.3	11.7
70	11.7	13.1	13.8	12.1	10.4	11.9	9.3	10.9	11.7	11.1
71	11.1	12.5	13.2	11.5	9.8	11.3	8.9	10.3	11.1	10.5
72	10.6	11.9	12.6	11.0	9.2	10.7	8.4	9.7	10.6	9.9
73	10.0	11.3	12.0	10.4	8.7	10.2	8.0	9.2	10.0	9.4
74	9.5	10.7	11.5	9.9	8.2	9.6	7.5	8.7	9.5	8.9
75	9.0	10.1	10.9	9.4	7.7	9.1	7.1	8.1	9.0	8.4

Supplement 2: Suggestions submitted by the working group to develop a standard life table for Pakistan

X	Modified Perks & Gompertz	Modified Perks & Cubic Polynomial	Modified Perks & Coale-Kisker	Modified Perks & Mortality Improvement	Modified Perks & Linear Transformation	Modified Perks & Extrapolation w.r.t. Malaysian Table	EFU (1961-66)	LIC (1994-96)	Malaysia 1996	Indonesia 1999
	Expectation of Life $(\overset{0}{e}_x)^{20}$									
76	8.5	9.5	10.4	8.9	7.2	8.6	6.7	7.6	8.5	7.9
77	8.0	9.0	9.9	8.4	6.8	8.2	6.3	7.2	8.1	7.4
78	7.5	8.4	9.3	7.9	6.4	7.7	6.0	6.7	7.6	7.0
79	7.1	7.9	8.8	7.5	6.0	7.3	5.6	6.3	7.2	6.6
80	6.7	7.4	8.3	7.0	5.6	6.9	5.3	5.9	6.8	6.2
81	6.3	6.9	7.9	6.6	5.3	6.5	5.0	5.6	6.4	5.8
82	5.9	6.5	7.4	6.2	4.9	6.1	4.7	5.2	6.0	5.4
83	5.5	6.0	6.9	5.8	4.6	5.7	4.4	4.9	5.6	5.0
84	5.1	5.6	6.5	5.5	4.4	5.4	4.1	4.6	5.3	4.7
85	4.8	5.2	6.1	5.1	4.1	5.1	3.8	4.4	5.0	4.4
86	4.5	4.8	5.7	4.8	3.8	4.7	3.5	4.1	4.7	4.1
87	4.2	4.5	5.3	4.5	3.6	4.4	3.3	3.9	4.4	3.8
88	3.9	4.1	4.9	4.1	3.4	4.2	3.1	3.6	4.1	3.5
89	3.6	3.8	4.5	3.9	3.2	3.9	2.8	3.4	3.8	3.3
90	3.4	3.5	4.1	3.6	3.0	3.6	2.6	3.2	3.5	3.0
91	3.1	3.3	3.8	3.3	2.8	3.4	2.4	3.0	3.3	2.8
92	2.9	3.0	3.5	3.0	2.6	3.1	2.3	2.8	3.0	2.6
93	2.7	2.7	3.1	2.8	2.4	2.8	2.1	2.6	2.8	2.4
94	2.4	2.5	2.8	2.5	2.3	2.6	1.9	2.5	2.6	2.2
95	2.2	2.3	2.5	2.3	2.1	2.3	1.7	2.3	2.3	2.0
96	2.0	2.0	2.2	2.1	1.9	2.1	1.6	2.1	2.1	1.8
97	1.8	1.8	1.9	1.8	1.7	1.8	1.4	1.8	1.8	1.6
98	1.5	1.5	1.5	1.5	1.4	1.5	1.2	1.5	1.5	1.4
99	1.1	1.1	1.1	1.1	1.1	1.1	0.9	1.1	1.1	1.0
100	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

Supplement 2: Suggestions submitted by the working group to develop a standard life table for Pakistan

Appendix 10(a)

Ages	${}_nq_x$									
	Modified Perks & Gompertz	**Modified Perks & Cubic Polynomial**	**Modified Perks & Coale-Kisker**	**Modified Perks & Mortality Improvement**	**Modified Perks & Linear Transformation**	**Modified Perks & Extrapolation w.r.t. Malaysian Table**	**EFU (1961-66)**	**LIC (1994-96)**	**Malaysia 1996**	**Indonesia 1999**
0-4							0.002997	0.003875		0.005531
5-9							0.002996	0.001599		0.002548
10-14	0.001843	0.001843	0.001843	0.001843	0.001843	0.001843	0.002997	0.002009	0.006056	0.002558
15-19	0.003103	0.003103	0.003103	0.003103	0.003103	0.003103	0.002996	0.003381	0.006076	0.004821
20-24	0.003793	0.003793	0.003793	0.003793	0.003793	0.003793	0.003276	0.004178	0.008314	0.005797
25-29	0.004363	0.004363	0.004363	0.004363	0.004363	0.004363	0.004293	0.004597	0.007787	0.005429
30-34	0.005303	0.005303	0.005303	0.005303	0.005303	0.005303	0.005787	0.004780	0.007171	0.005638
35-39	0.007000	0.007000	0.007000	0.007000	0.007000	0.007000	0.008254	0.006169	0.008781	0.007260
40-44	0.010238	0.010238	0.010238	0.010238	0.010238	0.010238	0.012661	0.009288	0.012273	0.010042
45-49	0.016501	0.016501	0.016501	0.016501	0.016501	0.016501	0.021160	0.014528	0.019220	0.016211
50-54	0.028052	0.028052	0.028052	0.028052	0.028052	0.028052	0.037942	0.024397	0.030027	0.027659
55-59	0.046683	0.046683	0.046683	0.046683	0.046683	0.046683	0.067661	0.038787	0.045794	0.041637
60-64	0.070394	0.070394	0.070394	0.070394	0.070394	0.070394	0.107893	0.059605	0.065530	0.067982
65-69	0.099472	0.093354	0.094172	0.098733	0.108989	0.099578	0.159668	0.095194	0.101589	0.107271
70-74	0.153951	0.124056	0.126551	0.149303	0.182131	0.153633	0.230567	0.162104	0.156661	0.167152
75-79	0.234136	0.184490	0.176421	0.222218	0.286316	0.232404	0.326714	0.264157	0.236809	0.255364
80-84	0.346642	0.291071	0.253675	0.324696	0.426985	0.339868	0.452482	0.403925	0.345924	0.378363
85-89	0.492946	0.446534	0.372183	0.461522	0.576988	0.472766	0.605698	0.549715	0.480425	0.535355
90-94	0.661638	0.633146	0.545649	0.629324	0.720661	0.623678	0.771136	0.686026	0.632373	0.709419
95-99	0.822549	0.812675	0.767097	0.806160	0.847489	0.799402	0.913859	0.807213	0.807643	0.863671

Supplement 2: Suggestions submitted by the working group to develop a standard life table for Pakistan

Appendix 10(b)

Ages	Modified Perks + Gompertz Curve				Modified Perks + Cubic Polynomial Curve				Modified Perks + Coale KiskerCurve			
	$_nq_x$ as % of EFU(61-66)	$_nq_x$ as % of LIC (94-96)	$_nq_x$ as % of Malaysia 1996	$_nq_x$ as % of Indonesia 1999	$_nq_x$ as % of EFU(61-66)	$_nq_x$ as % of LIC (94-96)	$_nq_x$ as % of Malaysia 1996	$_nq_x$ as % of Indonesia 1999	$_nq_x$ as % of EFU(61-66)	$_nq_x$ as % of LIC (94-96)	$_nq_x$ as % of Malaysia 1996	$_nq_x$ as % of Indonesia 1999
10-14	61.5	91.8	30.4	72.1	61.5	91.8	30.4	72.1	61.5	91.8	30.4	72.1
15-19	103.6	91.8	51.1	64.4	103.6	91.8	51.1	64.4	103.6	91.8	51.1	64.4
20-24	115.8	90.8	45.6	65.4	115.8	90.8	45.6	65.4	115.8	90.8	45.6	65.4
25-29	101.6	94.9	56.0	80.4	101.6	94.9	56.0	80.4	101.6	94.9	56.0	80.4
30-34	91.6	111.0	74.0	94.1	91.6	111.0	74.0	94.1	91.6	111.0	74.0	94.1
35-39	84.8	113.5	79.7	96.4	84.8	113.5	79.7	96.4	84.8	113.5	79.7	96.4
40-44	80.9	110.2	83.4	101.9	80.9	110.2	83.4	101.9	80.9	110.2	83.4	101.9
45-49	78.0	113.6	85.9	101.8	78.0	113.6	85.9	101.8	78.0	113.6	85.9	101.8
50-54	73.9	115.0	93.4	101.4	73.9	115.0	93.4	101.4	73.9	115.0	93.4	101.4
55-59	69.0	120.4	101.9	112.1	69.0	120.4	101.9	112.1	69.0	120.4	101.9	112.1
60-64	65.2	118.1	107.4	103.5	65.2	118.1	107.4	103.5	65.2	118.1	107.4	103.5
65-69	62.3	104.5	97.9	92.7	58.5	98.1	91.9	87.0	59.0	98.9	92.7	87.8
70-74	66.8	95.0	98.3	92.1	53.8	76.5	79.2	74.2	54.9	78.1	80.8	75.7
75-79	71.7	88.6	98.9	91.7	56.5	69.8	77.9	72.2	54.0	66.8	74.5	69.1
80-84	76.6	85.8	100.2	91.6	64.3	72.1	84.1	76.9	56.1	62.8	73.3	67.0
85-89	81.4	89.7	102.6	92.1	73.7	81.2	92.9	83.4	61.4	67.7	77.5	69.5
90-94	85.8	96.4	104.6	93.3	82.1	92.3	100.1	89.2	70.8	79.5	86.3	76.9
95-99	90.0	101.9	101.8	95.2	88.9	100.7	100.6	94.1	83.9	95.0	95.0	88.8

Supplement 2: Suggestions submitted by the working group to develop a standard life table for Pakistan

Ages	Modified Perks + Mortality Improvement				Modified Perks + Linear Transformation				Modified Perks + Extrapolation w.r.t. Malaysian Table			
	$_nq_x$ as % of EFU(61-66)	**$_nq_x$ as % of LIC (94-96)**	**$_nq_x$ as % of Malaysia 1996**	**$_nq_x$ as % of Indonesia 1999**	**$_nq_x$ as % of EFU(61-66)**	**$_nq_x$ as % of LIC (94-96)**	**$_nq_x$ as % of Malaysia 1996**	**$_nq_x$ as % of Indonesia 1999**	**$_nq_x$ as % of EFU(61-66)**	**$_nq_x$ as % of LIC (94-96)**	**$_nq_x$ as % of Malaysia 1996**	**$_nq_x$ as % of Indonesia 1999**
10-14	61.5	91.8	30.4	72.1	61.5	91.8	30.4	72.1	61.5	91.8	30.4	72.1
15-19	103.6	91.8	51.1	64.4	103.6	91.8	51.1	64.4	103.6	91.8	51.1	64.4
20-24	115.8	90.8	45.6	65.4	115.8	90.8	45.6	65.4	115.8	90.8	45.6	65.4
25-29	101.6	94.9	56.0	80.4	101.6	94.9	56.0	80.4	101.6	94.9	56.0	80.4
30-34	91.6	111.0	74.0	94.1	91.6	111.0	74.0	94.1	91.6	111.0	74.0	94.1
35-39	84.8	113.5	79.7	96.4	84.8	113.5	79.7	96.4	84.8	113.5	79.7	96.4
40-44	80.9	110.2	83.4	101.9	80.9	110.2	83.4	101.9	80.9	110.2	83.4	101.9
45-49	78.0	113.6	85.9	101.8	78.0	113.6	85.9	101.8	78.0	113.6	85.9	101.8
50-54	73.9	115.0	93.4	101.4	73.9	115.0	93.4	101.4	73.9	115.0	93.4	101.4
55-59	69.0	120.4	101.9	112.1	69.0	120.4	101.9	112.1	69.0	120.4	101.9	112.1
60-64	65.2	118.1	107.4	103.5	65.2	118.1	107.4	103.5	65.2	118.1	107.4	103.5
65-69	61.8	103.7	97.2	92.0	68.3	114.5	107.3	101.6	62.4	104.6	98.0	92.8
70-74	64.8	92.1	95.3	89.3	79.0	112.4	116.3	109.0	66.6	94.8	98.1	91.9
75-79	68.0	84.1	93.8	87.0	87.6	108.4	120.9	112.1	71.1	88.0	98.1	91.0
80-84	71.8	80.4	93.9	85.8	94.4	105.7	123.4	112.9	75.1	84.1	98.2	89.8
85-89	76.2	84.0	96.1	86.2	95.3	105.0	120.1	107.8	78.1	86.0	98.4	88.3
90-94	81.6	91.7	99.5	88.7	93.5	105.0	114.0	101.6	80.9	90.9	98.6	87.9
95-99	88.2	99.9	99.8	93.3	92.7	105.0	104.9	98.1	87.5	99.0	99.0	92.6

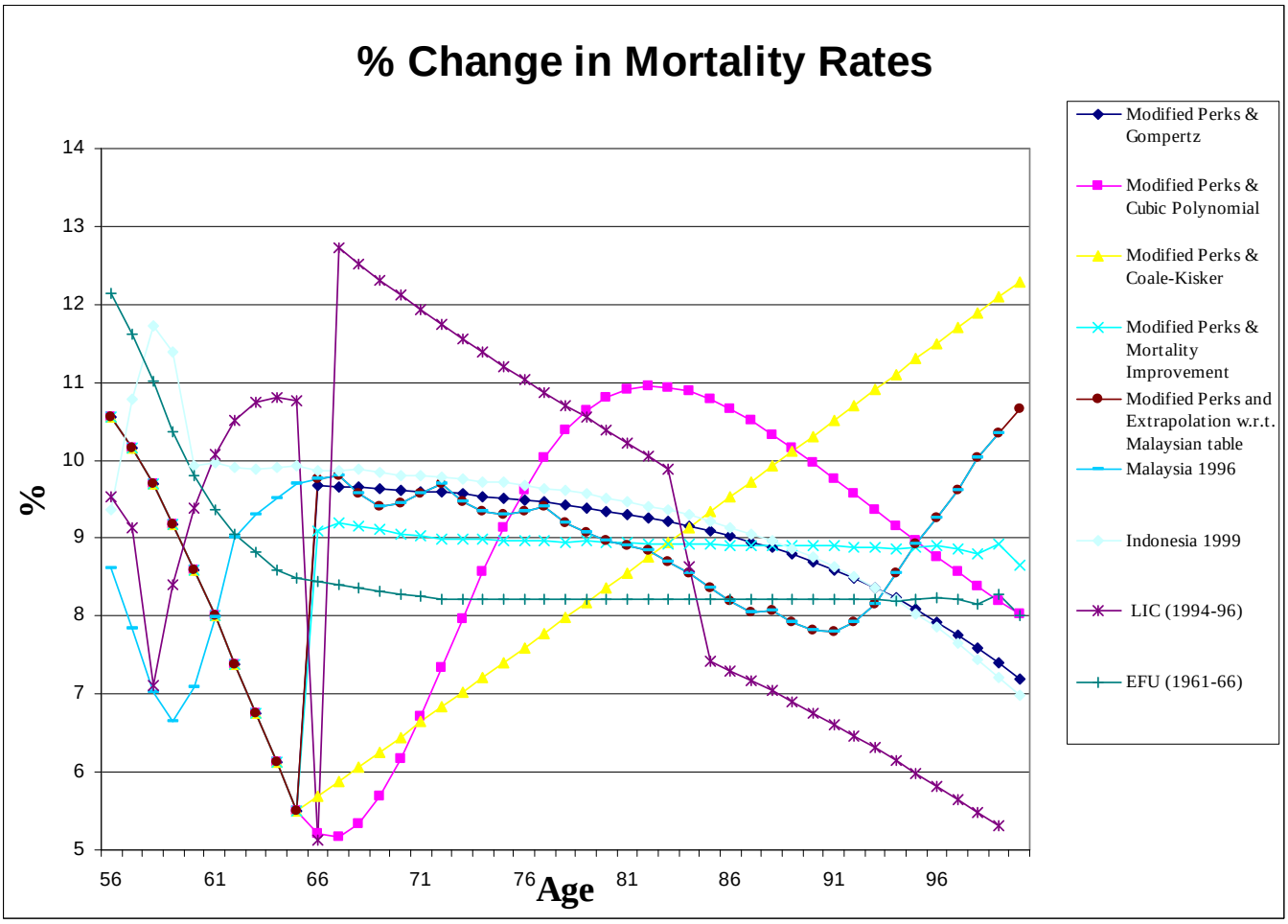
Supplement 2: Suggestions submitted by the working group to develop a standard life table for Pakistan

Appendix 11

Age	% Change									
	Modified Perks & Gompertz	**Modified Perks & Cubic Polynomial**	**Modified Perks & Coale-Kisker**	**Modified Perks & Mortality Improvement**	**Modified Perks & Linear Transformation**	**Modified Perks & Extrapolation w.r.t. Malaysian Table**	**EFU (1961-66)**	**LIC (1994-96)**	**Malaysia 1996**	**Indonesia 1999**
56	10.56	10.56	10.56	10.56	10.56	10.56	12.14	9.54	8.62	9.36
57	10.16	10.16	10.16	10.16	10.16	10.16	11.62	9.12	7.84	10.78
58	9.69	9.69	9.69	9.69	9.69	9.69	11.02	7.10	7.02	11.73
59	9.17	9.17	9.17	9.17	9.17	9.17	10.37	8.40	6.64	11.39
60	8.60	8.60	8.60	8.60	8.60	8.60	9.79	9.39	7.10	9.93
61	8.00	8.00	8.00	8.00	8.00	8.00	9.37	10.08	7.98	9.97
62	7.38	7.38	7.38	7.38	7.38	7.38	9.05	10.51	9.02	9.91
63	6.75	6.75	6.75	6.75	6.75	6.75	8.81	10.74	9.30	9.90
64	6.12	6.12	6.12	6.12	6.12	6.12	8.60	10.81	9.51	9.90
65	5.51	5.51	5.51	5.51	5.51	5.51	8.50	10.76	9.69	9.92
66	**9.67**	**5.20**	**5.69**	**9.10**	**21.58**	**9.76**	8.44	5.13	9.76	9.86
67	9.66	5.17	5.88	9.20	11.45	9.80	8.40	12.73	9.80	9.88
68	9.65	5.34	6.07	9.15	11.32	9.58	8.36	12.52	9.58	9.88
69	9.64	5.69	6.26	9.11	11.19	9.41	8.32	12.31	9.41	9.83
70	9.62	6.16	6.45	9.06	11.07	9.45	8.28	12.12	9.45	9.81
71	9.60	6.72	6.64	9.03	10.95	9.57	8.25	11.93	9.57	9.81
72	9.58	7.33	6.83	8.99	10.82	9.69	8.22	11.74	9.69	9.78
73	9.56	7.96	7.02	8.98	10.71	9.46	8.22	11.56	9.46	9.77
74	9.54	8.56	7.21	8.98	10.60	9.34	8.22	11.38	9.34	9.72
75	9.52	9.12	7.40	8.97	10.48	9.31	8.21	11.21	9.31	9.72
76	9.49	9.62	7.60	8.97	10.37	9.34	8.23	11.04	9.34	9.67
77	9.46	10.04	7.79	8.96	10.26	9.40	8.22	10.88	9.40	9.65
78	9.43	10.38	7.98	8.95	10.14	9.21	8.21	10.71	9.21	9.61
79	9.39	10.63	8.17	8.96	10.02	9.06	8.23	10.55	9.06	9.57
80	9.35	10.81	8.36	8.95	9.90	8.97	8.22	10.38	8.97	9.52
81	9.31	10.91	8.56	8.94	9.78	8.90	8.22	10.22	8.90	9.47
82	9.26	10.95	8.75	8.93	9.66	8.84	8.21	10.05	8.84	9.41
83	9.21	10.94	8.95	8.93	9.53	8.69	8.22	9.89	8.69	9.36
84	9.16	10.88	9.14	8.92	8.55	8.54	8.22	8.64	8.54	9.29
85	9.10	10.78	9.33	8.92	7.59	8.36	8.22	7.43	8.36	9.22
86	9.03	10.66	9.53	8.91	7.49	8.20	8.22	7.30	8.20	9.14
87	8.96	10.50	9.72	8.91	7.39	8.05	8.22	7.17	8.05	9.06
88	8.88	10.34	9.92	8.91	7.29	8.06	8.22	7.04	8.06	8.96
89	8.79	10.15	10.12	8.91	7.18	7.93	8.22	6.90	7.93	8.87

Supplement 2: Suggestions submitted by the working group to develop a standard life table for Pakistan

Age	% Change									
	Modified Perks & Gompertz	Modified Perks & Cubic Polynomial	Modified Perks & Coale-Kisker	Modified Perks & Mortality Improvement	Modified Perks & Linear Transformation	Modified Perks & Extrapolation w.r.t. Malaysian Table	EFU (1961-66)	LIC (1994-96)	Malaysia 1996	Indonesia 1999
90	8.70	9.96	10.31	8.90	7.08	7.82	8.22	6.76	7.82	8.76
91	8.59	9.76	10.51	8.90	6.97	7.79	8.22	6.61	7.79	8.63
92	8.48	9.56	10.71	8.89	6.85	7.93	8.22	6.46	7.93	8.50
93	8.36	9.36	10.90	8.89	6.74	8.16	8.22	6.31	8.16	8.36
94	8.23	9.16	11.10	8.86	6.62	8.55	8.19	6.15	8.55	8.21
95	8.09	8.96	11.30	8.88	6.51	8.92	8.22	5.99	8.92	8.04
96	7.93	8.77	11.50	8.90	6.39	9.25	8.24	5.82	9.25	7.86
97	7.77	8.57	11.70	8.86	6.27	9.61	8.21	5.66	9.61	7.66
98	7.59	8.39	11.90	8.81	6.14	10.02	8.16	5.48	10.02	7.45
99	7.39	8.20	12.10	8.92	6.05	10.35	8.28	5.31	10.35	7.22
100	7.18	8.02	12.30	8.65	8.01	10.67	8.01			6.98



Supplement 3: Decisions taken at PSoA Seminar

Decisions taken at the PSoA Seminar

1. Pakistan Society of Actuaries conducted a seminar on July 12, 2010 in order to establish a consensus among actuaries on the development of a new life table for Pakistan. The suggestions and the points put forth by the working group were discussed in detail in the seminar.

2. Following were the decisions taken in the seminar:

   - The starting age of the life table should be **'0'** (zero) years.
   - To develop mortality rates over the ages 0-19 years, table based method should be used instead of formula based method. For this Indonesian Table should be preferred over LIC.
   - We should not make any adjustment for the hump shape in the mortality curve over younger ages.
   - It was felt that we should focus on the shape of the curve and not on rates. After a lot of discussions on the financial consequence of ignoring the data over 65-68 years, it was agreed that we should:
     - ✓ Extend original data to age 20-68 years instead of 65 years and use Modified Perk's formula to generate mortality rates over these ages.
     - ✓ Follow Table-based approach to generate mortality rates over age 68 years. For this either Malaysian or Indonesian Table should be used.
   - It was agreed that PSoA would publish the final Life Table. Any adjustments for reserving/pricing could be prescribed by the Securities and Exchange Commission of Pakistan.
   - It was agreed that we could use 2-3 years age setback for the female lives.

3. In light of the discussions and decisions taken at the seminar, three life tables were submitted to the PSoA council, the bases of which are given below. The tables are presented in **Appendix 12**.

Mortality Table	**Ages < 20 yrs** ***(Mortality rates determined w.r.t.)***	**20 yrs ≤ Ages ≤ 68 yrs**	**Ages > 68 years** ***(Mortality rates determined w.r.t.)***
Table I	1999 Indonesia TMI II Male Table	Modified Perk's	1999 Indonesia TMI II Male Table
Table II	1999 Indonesia TMI II Male Table	Modified Perk's	Malaysia 1996 Statutory Valuation Mortality Table
Table III	LIC (94-96) Ultimate Mortality Table	Modified Perk's	LIC (94-96) Ultimate Mortality Table

Mortality rates for ages 20 years to 68 years were determined by graduating the State Life data for ages 20 years to 68 years using the following Modified Perk's Formula

$$q_x = \frac{a + bc^x}{kc^{-ex} + f + dc^x}$$

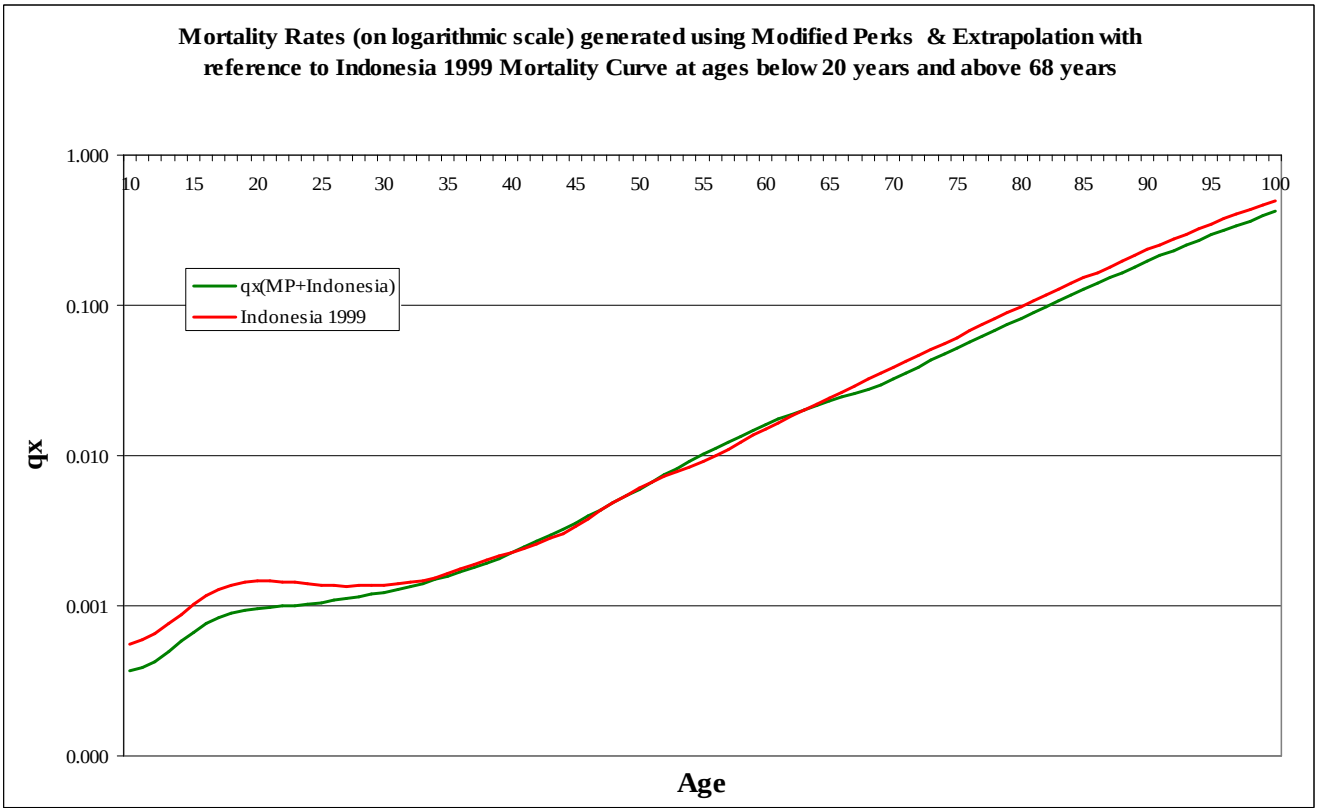
where

a =	0.001069265
b =	0.000004779
c =	1.152905077
d =	0.000123285
e =	0.027100246
f =	(0.560532521)
k =	1.901522309

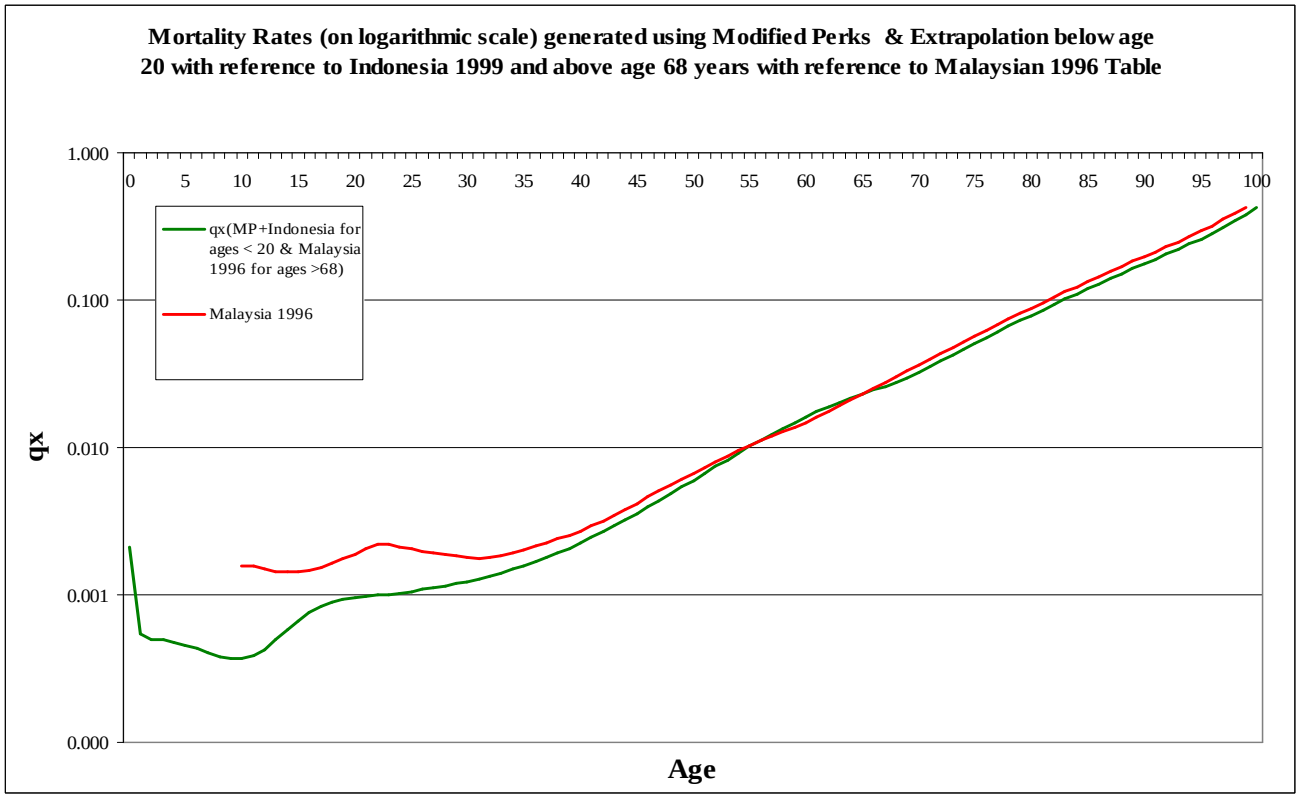
In all the three methods, the reference rates q_{20} and q_{68} were determined using the above mentioned Modified Perk's formula. Then in order to smooth out the kink developed at the point (ages 68-69) where Modified Perk's Curve meets the extrapolated curve, the rate at age 67 was increased by a uniform percentage to arrive at age 69 rate.

4. The Graphical comparison of Tables I, II & III with published tables is given below:

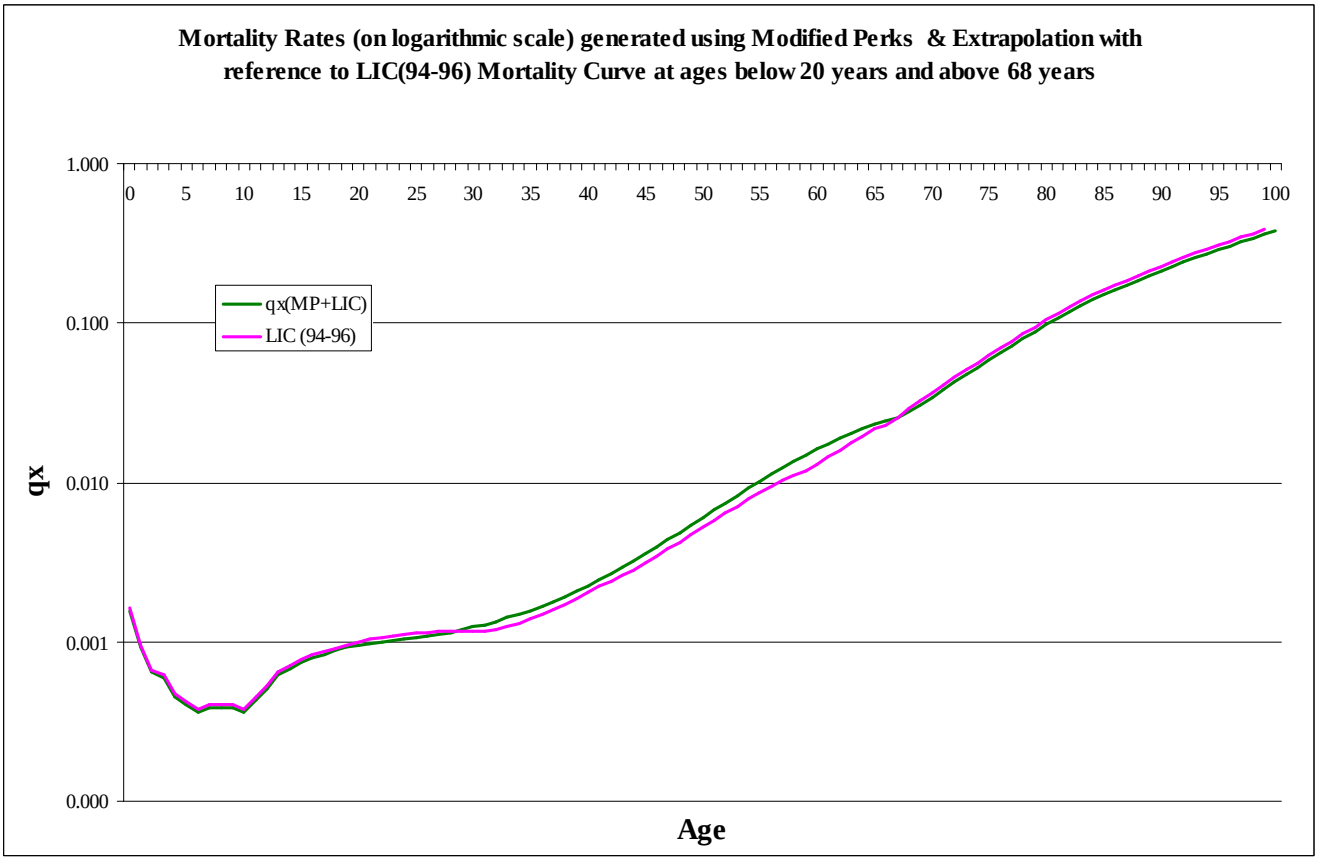
a) Table I vs 1999 Indonesia TMI II Male Table:


Mortality Rates (on logarithmic scale) generated using Modified Perks & Extrapolation with reference to Indonesia 1999 Mortality Curve at ages below 20 years and above 68 years
1.000
0.100
0.010
0.001
0.000
qx
10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
Age
qx(MP+Indonesia)
Indonesia 1999

b) Table II vs Malaysia 1996 Statutory Valuation Mortality Table:



c) Table III vs LIC (94-96) Ultimate Mortality Table



Conclusion

1. The PSoA council members reviewed the final three mortality tables submitted to it. Finally the members selected Table II presented under para 3 above and decided to publish it.

2. Securities and Exchange Commission of Pakistan may prescribe margins to be added in the rates for Statutory Valuation purpose.

3. Since the mortality rates were based on the data containing both male and female lives, it was agreed that 2-3 years age setback should be used for female lives.

4. It was resolved to develop a mechanism at PSoA level to collect required data from life insurance companies on regular basis. Using this data, PSoA would carry out the mortality investigations and keep monitoring changes in the rates as compared to the published rates.

5. The new mortality table **SLIC (2001-05) Individual Life Ultimate Mortality Table** is presented in **Appendix 13**.

Appendix 12

SLIC (2001-05) Ultimate Mortality Table

	Table I		Table II		Table III	
Age (x)	q_x	l_x	q_x	l_x	q_x	l_x
0	0.0021064	1,000,000	0.0021064	1,000,000	0.0015637	1,000,000
1	0.0005381	997,894	0.0005381	997,894	0.0009209	998,436
2	0.0004987	997,357	0.0004987	997,357	0.0006427	997,517
3	0.0004921	996,859	0.0004921	996,859	0.0005948	996,876
4	0.0004790	996,369	0.0004790	996,369	0.0004509	996,283
5	0.0004528	995,891	0.0004528	995,891	0.0004029	995,834
6	0.0004331	995,441	0.0004331	995,441	0.0003645	995,432
7	0.0004068	995,009	0.0004068	995,009	0.0003837	995,069
8	0.0003806	994,605	0.0003806	994,605	0.0003837	994,688
9	0.0003740	994,226	0.0003740	994,226	0.0003837	994,306
10	0.0003675	993,854	0.0003675	993,854	0.0003645	993,924
11	0.0003871	993,489	0.0003871	993,489	0.0004317	993,562
12	0.0004265	993,104	0.0004265	993,104	0.0005084	993,133
13	0.0004987	992,681	0.0004987	992,681	0.0006236	992,628
14	0.0005774	992,186	0.0005774	992,186	0.0006841	992,009
15	0.0006693	991,613	0.0006693	991,613	0.0007389	991,331
16	0.0007612	990,949	0.0007612	990,949	0.0007900	990,598
17	0.0008399	990,195	0.0008399	990,195	0.0008374	989,816
18	0.0008990	989,363	0.0008990	989,363	0.0008813	988,987
19	0.0009383	988,474	0.0009383	988,474	0.0009214	988,115
20	0.0009580	987,546	0.0009580	987,546	0.0009580	987,205
21	0.0009737	986,600	0.0009737	986,600	0.0009737	986,259
22	0.0009911	985,639	0.0009911	985,639	0.0009911	985,299
23	0.0010105	984,663	0.0010105	984,663	0.0010105	984,322
24	0.0010322	983,668	0.0010322	983,668	0.0010322	983,327
25	0.0010566	982,652	0.0010566	982,652	0.0010566	982,312
26	0.0010840	981,614	0.0010840	981,614	0.0010840	981,274
27	0.0011150	980,550	0.0011150	980,550	0.0011150	980,211
28	0.0011501	979,456	0.0011501	979,456	0.0011501	979,118
29	0.0011899	978,330	0.0011899	978,330	0.0011899	977,992
30	0.0012351	977,166	0.0012351	977,166	0.0012351	976,828
31	0.0012866	975,959	0.0012866	975,959	0.0012866	975,621
32	0.0013454	974,703	0.0013454	974,703	0.0013454	974,366
33	0.0014125	973,392	0.0014125	973,392	0.0014125	973,055
34	0.0014893	972,017	0.0014893	972,017	0.0014893	971,681
35	0.0015770	970,569	0.0015770	970,569	0.0015770	970,234
36	0.0016775	969,039	0.0016775	969,039	0.0016775	968,704
37	0.0017926	967,413	0.0017926	967,413	0.0017926	967,079
38	0.0019243	965,679	0.0019243	965,679	0.0019243	965,345
39	0.0020751	963,821	0.0020751	963,821	0.0020751	963,487
40	0.0022477	961,821	0.0022477	961,821	0.0022477	961,488
41	0.0024451	959,659	0.0024451	959,659	0.0024451	959,327
42	0.0026705	957,312	0.0026705	957,312	0.0026705	956,981
43	0.0029277	954,756	0.0029277	954,756	0.0029277	954,426
44	0.0032208	951,961	0.0032208	951,961	0.0032208	951,631

Supplement 3: Decisions taken at the PSoA Seminar

Age (x)	Table I		Table II		Table III	
	q_x	l_x	q_x	l_x	q_x	l_x
45	0.0035539	948,895	0.0035539	948,895	0.0035539	948,566
46	0.0039319	945,522	0.0039319	945,522	0.0039319	945,195
47	0.0043596	941,804	0.0043596	941,804	0.0043596	941,479
48	0.0048420	937,699	0.0048420	937,699	0.0048420	937,374
49	0.0053843	933,158	0.0053843	933,158	0.0053843	932,836
50	0.0059913	928,134	0.0059913	928,134	0.0059913	927,813
51	0.0066677	922,573	0.0066677	922,573	0.0066677	922,254
52	0.0074177	916,422	0.0074177	916,422	0.0074177	916,105
53	0.0082444	909,624	0.0082444	909,624	0.0082444	909,309
54	0.0091499	902,125	0.0091499	902,125	0.0091499	901,813
55	0.0101348	893,870	0.0101348	893,870	0.0101348	893,561
56	0.0111980	884,811	0.0111980	884,811	0.0111980	884,505
57	0.0123361	874,903	0.0123361	874,903	0.0123361	874,601
58	0.0135439	864,110	0.0135439	864,110	0.0135439	863,811
59	0.0148134	852,407	0.0148134	852,407	0.0148134	852,112
60	0.0161348	839,780	0.0161348	839,780	0.0161348	839,489
61	0.0174960	826,230	0.0174960	826,230	0.0174960	825,944
62	0.0188832	811,774	0.0188832	811,774	0.0188832	811,494
63	0.0202819	796,445	0.0202819	796,445	0.0202819	796,170
64	0.0216766	780,292	0.0216766	780,292	0.0216766	780,022
65	0.0230523	763,378	0.0230523	763,378	0.0230523	763,114
66	0.0243946	745,780	0.0243946	745,780	0.0243946	745,522
67	0.0256905	727,587	0.0256905	727,587	0.0256905	727,336
68	0.0275656	708,895	0.0275119	708,895	0.0278749	708,650
69	0.0295775	689,354	0.0294624	689,392	0.0302449	688,897
70	0.0324780	668,965	0.0322454	669,081	0.0339094	668,061
71	0.0356645	647,238	0.0353316	647,506	0.0379532	645,407
72	0.0391536	624,155	0.0387569	624,629	0.0424090	620,912
73	0.0429790	599,717	0.0424229	600,420	0.0473116	594,580
74	0.0471575	573,942	0.0463834	574,949	0.0526978	566,449
75	0.0517395	546,876	0.0507006	548,281	0.0586064	536,599
76	0.0567420	518,581	0.0554370	520,482	0.0650781	505,151
77	0.0622152	489,156	0.0606463	491,628	0.0721557	472,276
78	0.0681930	458,723	0.0662301	461,813	0.0798836	438,199
79	0.0747171	427,441	0.0722332	431,227	0.0883078	403,194
80	0.0818299	395,504	0.0787090	400,078	0.0974756	367,589
81	0.0895815	363,140	0.0857111	368,588	0.1074355	331,758
82	0.0980142	330,609	0.0932841	336,996	0.1182367	296,115
83	0.1071868	298,205	0.1013923	305,560	0.1299288	261,104
84	0.1171496	266,241	0.1100535	274,578	0.1411497	227,179
85	0.1279532	235,051	0.1192588	244,360	0.1516331	195,113
86	0.1396480	204,976	0.1290350	215,218	0.1627053	165,527
87	0.1523012	176,351	0.1394177	187,447	0.1743737	138,595
88	0.1659550	149,493	0.1506567	161,314	0.1866474	114,428
89	0.1806680	124,684	0.1626094	137,011	0.1995266	93,070
90	0.1964909	102,157	0.1753202	114,732	0.2130130	74,500
91	0.2134572	82,084	0.1889855	94,617	0.2270993	58,631
92	0.2316089	64,563	0.2039709	76,736	0.2417769	45,316

Supplement 3: Decisions taken at the PSoA Seminar

Age (x)	Table I		Table II		Table III	
	q_x	l_x	q_x	l_x	q_x	l_x
93	0.2509713	49,609	0.2206064	61,084	0.2570310	34,359
94	0.2715696	37,159	0.2394720	47,608	0.2728411	25,528
95	0.2933953	27,068	0.2608351	36,207	0.2891827	18,563
96	0.3164486	19,126	0.2849634	26,763	0.3060251	13,195
97	0.3406957	13,074	0.3123474	19,137	0.3233319	9,157
98	0.3660779	8,620	0.3436562	13,159	0.3410637	6,196
99	0.3925194	5,464	0.3792108	8,637	0.3591740	4,083
100	0.4199109	3,319	0.4196696	5,362	0.3782458	2,616

Appendix 13

SLIC (2001-05) Individual Life Ultimate Mortality Table

Age (x)	q_x	l_x
0	0.0021064	1,000,000
1	0.0005381	997,894
2	0.0004987	997,357
3	0.0004921	996,859
4	0.0004790	996,369
5	0.0004528	995,891
6	0.0004331	995,441
7	0.0004068	995,009
8	0.0003806	994,605
9	0.0003740	994,226
10	0.0003675	993,854
11	0.0003871	993,489
12	0.0004265	993,104
13	0.0004987	992,681
14	0.0005774	992,186
15	0.0006693	991,613
16	0.0007612	990,949
17	0.0008399	990,195
18	0.0008990	989,363
19	0.0009383	988,474
20	0.0009580	987,546
21	0.0009737	986,600
22	0.0009911	985,639
23	0.0010105	984,663
24	0.0010322	983,668
25	0.0010566	982,652
26	0.0010840	981,614
27	0.0011150	980,550
28	0.0011501	979,456
29	0.0011899	978,330
30	0.0012351	977,166
31	0.0012866	975,959
32	0.0013454	974,703
33	0.0014125	973,392
34	0.0014893	972,017
35	0.0015770	970,569
36	0.0016775	969,039
37	0.0017926	967,413
38	0.0019243	965,679
39	0.0020751	963,821
40	0.0022477	961,821
41	0.0024451	959,659
42	0.0026705	957,312
43	0.0029277	954,756
44	0.0032208	951,961
45	0.0035539	948,895

Age (x)	q_x	l_x
46	0.0039319	945,522
47	0.0043596	941,804
48	0.0048420	937,699
49	0.0053843	933,158
50	0.0059913	928,134
51	0.0066677	922,573
52	0.0074177	916,422
53	0.0082444	909,624
54	0.0091499	902,125
55	0.0101348	893,870
56	0.0111980	884,811
57	0.0123361	874,903
58	0.0135439	864,110
59	0.0148134	852,407
60	0.0161348	839,780
61	0.0174960	826,230
62	0.0188832	811,774
63	0.0202819	796,445
64	0.0216766	780,292
65	0.0230523	763,378
66	0.0243946	745,780
67	0.0256905	727,587
68	0.0275119	708,895
69	0.0294624	689,392
70	0.0322454	669,081
71	0.0353316	647,506
72	0.0387569	624,629
73	0.0424229	600,420
74	0.0463834	574,949
75	0.0507006	548,281
76	0.0554370	520,482
77	0.0606463	491,628
78	0.0662301	461,813
79	0.0722332	431,227
80	0.0787090	400,078
81	0.0857111	368,588
82	0.0932841	336,996
83	0.1013923	305,560
84	0.1100535	274,578
85	0.1192588	244,360
86	0.1290350	215,218
87	0.1394177	187,447
88	0.1506567	161,314
89	0.1626094	137,011
90	0.1753202	114,732
91	0.1889855	94,617
92	0.2039709	76,736
93	0.2206064	61,084
94	0.2394720	47,608

Supplement 3: Decisions taken at the PSoA Seminar

Age (x)	q_x	l_x
95	0.2608351	36,207
96	0.2849634	26,763
97	0.3123474	19,137
98	0.3436562	13,159
99	0.3792108	8,637
100	0.4196696	5,362