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### **RATES OF MORTALITY**

#### **Post-Retirement Mortality Rates**

Since the Fund has minimal post-retirement mortality experience, we recommend that the rates of post-retirement mortality be revised to the same mortality tables used for the Employees' Retirement System of Georgia. We believe the new Pub-2010 tables would be a good choice and we recommend changing the mortality basis for JRS so that all ERS plans can share a common family of tables. We also recommend the most recent mortality improvement scale, MP-2019, be used to anticipate future mortality improvements in the valuation process through at least the next experience study.

**Therefore, our recommended mortality assumption for service retirees is based on the Pub-2010 healthy annuitant tables, with adjustments as outlined below to better fit actual experience, projected generationally with the MP-2019 scale.**

<b><u>Group</u></b>	<b><u>Membership Table</u></b>	<b><u>Set Forward (+)/ Setback (-)</u></b>	<b><u>Adjustment to Rates</u></b>
Service Retirees	General	Male: +1, Female: +1	Male: 105%, Female: 108%
Beneficiaries	General	Male: +2, Female: +2	Male: 106%, Female: 105%
Disability Retirees	General	Male: -3, Female: 0	Male: 103%, Female: 106%

#### **Pre-Retirement Mortality**

Since the Fund has minimal pre-retirement mortality experience, we recommend that the rates of mortality in active service for both males and females be changed to the same mortality table that is used for the Employees' Retirement Fund of Georgia. The recommended table is the Pub-2010 General Employee Table, with no adjustments, projected generationally with the MP-2019 scale.



**Section V – Demographic Assumptions**

**RATES OF SALARY INCREASE**

**COMPARISON OF ACTUAL AND EXPECTED RATES OF SALARY INCREASE  
OF ACTIVE MEMBERS**

<b>RATES OF SALARY INCREASE</b>			
<b>CENTRAL AGE OF GROUP</b>	<b>CURRENT RATES</b>		
	<b>Actual</b>	<b>Expected</b>	<b>Ratio of Actual to Expected</b>
30	3.39%	4.50%	0.752
35	3.35%	4.50%	0.744
40	2.66%	4.50%	0.591
45	3.51%	4.50%	0.780
50	2.80%	4.50%	0.623
55	2.28%	4.50%	0.507
60	2.59%	4.50%	0.576
65	2.59%	4.50%	0.576
68 & over	2.58%	4.50%	0.572
<b>TOTAL</b>	<b>2.70%</b>	<b>4.50%</b>	<b>0.600</b>

The current annual assumed rate of salary increases of 4.50% per year at all ages was significantly greater than the actual rates of increase averaged over the study period in all age categories. We recommend a change to the long-term current salary increase assumption.

Earlier in this report, we recommended using a 3.00% wage inflation assumption (2.50% price inflation and 0.50% real wage growth). The merit scale will be added to the applicable wage inflation assumption to develop the total individual salary increase assumption.

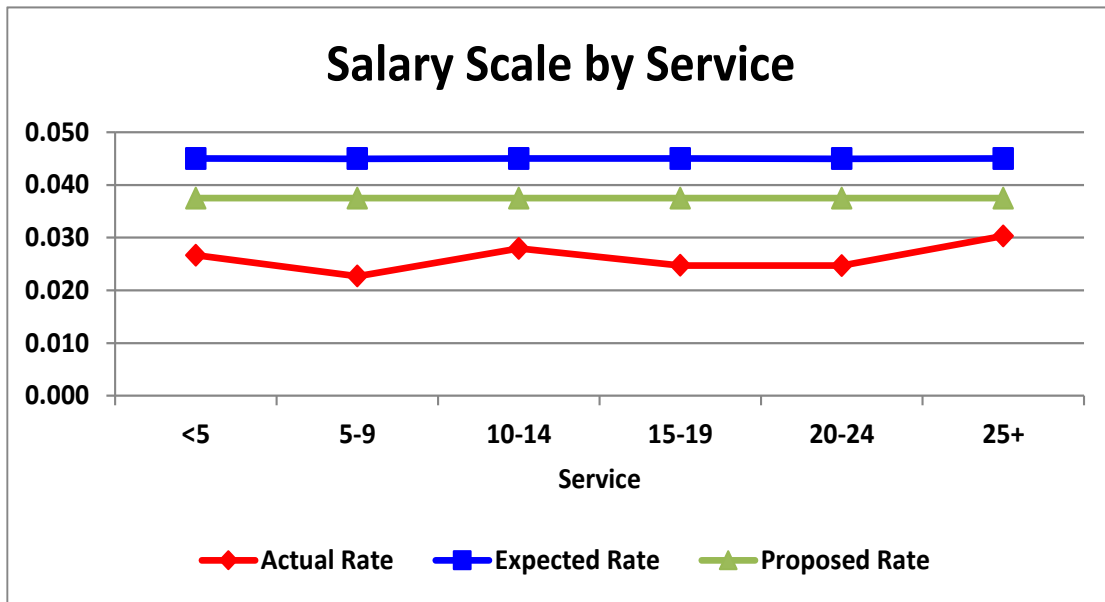
We also recommend a reduction in the merit scale for JRS from 1.25% to 0.75% to better match the experience of the Plan. Therefore, the total individual salary increase assumption will decrease from 4.50% to 3.75%. This recommended rate is still higher than the actual rates of salary increase observed in the 5-year experience study, but it leaves some margin of conservatism.

The following graph show a comparison of the present, actual, and proposed rates of salary increase.





*Section V – Demographic Assumptions*





## *Section VI – Other Assumptions and Methods*

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**ADMINISTRATIVE EXPENSES:** Currently, budgeted administrative expenses for the fiscal year are added to the normal cost. **We recommend that a rate of 1.35% of payroll be added to normal cost.**

**OPTION FACTORS:** The option factors currently used by the Retirement System are based on the mortality tables used in the valuation. **We recommend that the factors be revised to be based on the mortality table recommended for the valuation.**

**PERCENT MARRIED:** For members hired on and after July 1, 2012, 100% are assumed to be married with husbands three years older than their wives. **We recommend no change to this assumption.**



*Appendix A – Historical June CPI(U) Index*

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Year	CPI (U)	Year	CPI (U)
1961	29.8	1991	136.0
1962	30.2	1992	140.2
1963	30.6	1993	144.4
1964	31.0	1994	148.0
1965	31.6	1995	152.5
1966	32.4	1996	156.7
1967	33.3	1997	160.3
1968	35.7	1998	163.0
1969	34.7	1999	166.2
1970	38.8	2000	172.4
1971	40.6	2001	178.0
1972	41.7	2002	179.9
1973	44.2	2003	183.7
1974	49.0	2004	189.7
1975	53.6	2005	194.5
1976	56.8	2006	202.9
1977	60.7	2007	208.352
1978	65.2	2008	218.815
1979	72.3	2009	215.693
1980	82.7	2010	217.965
1981	90.6	2011	225.722
1982	97.0	2012	229.478
1983	99.5	2013	233.504
1984	103.7	2014	238.343
1985	107.6	2015	238.638
1986	109.5	2016	241.018
1987	113.5	2017	244.955
1988	118.0	2018	251.989
1989	124.1	2019	256.143
1990	129.9	2020	257.797



**Appendix B – Capital Market Assumptions and Asset Allocation**

**As Provided by the System**

**Arithmetic Rates of Return and Standard Deviations by Asset Class**

Asset Class	Expected Rate of Return*	Standard Deviation
Fixed Income	1.4%	2.3%
US Large Stocks	12.1%	19.8%
US Small Stocks	16.3%	31.5%
Int'l Developed Mkt Stocks	12.1%	21.8%
Int'l Emerging Mkt Stocks	13.3%	31.7%
Alternatives	13.5%	27.9%

\*Includes 2.90% assumed inflation

**Asset Class Correlation Coefficients**

Asset Class	Fixed Income	US Large Stocks	US Small Stocks	Int'l Dev Mkt Stocks	Int'l EM Mkt Stocks	Alts
Fixed Income	1.00					
US Large Stocks	0.01	1.00				
US Small Stocks	(0.09)	0.79	1.00			
Int'l Developed Mkt Stocks	(0.11)	0.67	0.51	1.00		
Int'l Emerging Mkt Stocks	(0.11)	0.67	0.51	0.72	1.00	
Alternatives	0.31	0.74	0.74	0.64	0.62	1.00

**Asset Allocation Targets**

Asset Class	Asset Allocation
Fixed Income	30.0%
US Large Stocks	46.4%
US Small Stocks	1.1%
Int'l Developed Mkt Stocks	11.7%
Int'l Emerging Mkt Stocks	5.8%
Alternatives	5.0%



**Appendix B – Capital Market Assumptions and Asset Allocation**

**As Determined by the 2020 Horizon Actuarial Services, LLC.  
Survey of Capital Market Assumptions (20-year Horizon)**

**Arithmetic Rates of Return and Standard Deviations by Asset Class**

<b>Asset Class</b>	<b>Expected Rate of Return*</b>	<b>Standard Deviation</b>
Fixed Income	2.28%	1.78%
US Large Stocks	8.36%	16.22%
US Small Stocks	9.54%	20.22%
Int'l Developed Mkt Stocks	9.09%	18.05%
Int'l Emerging Mkt Stocks	11.33%	24.23%
Alternatives (Private Equity)	12.54%	21.99%

\*Includes 2.17% assumed inflation

**Asset Class Correlation Coefficients**

<b>Asset Class</b>	<b>Fixed Income</b>	<b>US Large Stocks</b>	<b>US Small Stocks</b>	<b>Int'l Dev Mkt Stocks</b>	<b>Int'l EM Mkt Stocks</b>	<b>Alts</b>
Fixed Income	1.00					
US Large Stocks	(0.08)	1.00				
US Small Stocks	(0.08)	0.89	1.00			
Int'l Developed Mkt Stocks	(0.07)	0.84	0.76	1.00		
Int'l Emerging Mkt Stocks	(0.06)	0.73	0.69	0.80	1.00	
Alternatives (Private Equity)	(0.06)	0.73	0.71	0.67	0.59	1.00



## Appendix C – Social Security Administration Wage Index

Year	Wage Index	Annual Increase	Year	Wage Index	Annual Increase
1960	\$4,007.12	3.92%	1991	\$21,811.60	3.73%
1961	4,086.76	1.99	1992	22,935.42	5.15
1962	4,291.40	5.01	1993	23,132.67	0.86
1963	4,396.64	2.45	1994	23,753.53	2.68
1964	4,576.32	4.09	1995	24,705.66	4.01
1965	4,658.72	1.80	1996	25,913.90	4.89
1966	4,938.36	6.00	1997	27,426.00	5.84
1967	5,213.44	5.57	1998	28,861.44	5.23
1968	5,571.76	6.87	1999	30,469.84	5.57
1969	5,893.76	5.78	2000	32,154.82	5.53
1970	6,186.24	4.96	2001	32,921.92	2.39
1971	6,497.08	5.02	2002	33,252.09	1.00
1972	7,133.80	9.80	2003	34,064.95	2.44
1973	7,580.16	6.26	2004	35,648.55	4.65
1974	8,030.76	5.94	2005	36,952.94	3.66
1975	8,630.92	7.47	2006	38,651.41	4.60
1976	9,226.48	6.90	2007	40,405.48	4.54
1977	9,779.44	5.99	2008	41,334.97	2.30
1978	10,556.03	7.94	2009	40,711.61	-1.51
1979	11,479.46	8.75	2010	41,673.83	2.36
1980	12,513.46	9.01	2011	42,979.61	3.13
1981	13,773.10	10.07	2012	44,321.67	3.12
1982	14,531.34	5.51	2013	44,888.16	1.28
1983	15,239.24	4.87	2014	46,481.52	3.55
1984	16,135.07	5.88	2015	48,098.63	3.48
1985	16,822.51	4.26	2016	48,642.15	1.13
1986	17,321.82	2.97	2017	50,321.89	3.45
1987	18,426.51	6.38	2018	52,145.80	3.62
1988	19,334.04	4.93	2019	54,099.99	3.75
1989	20,099.55	3.96			
1990	21,027.98	4.62			



**Appendix D – Recommended Rates**

**TABLE 1  
RATES OF SEPARATION FROM ACTIVE SERVICE**

AGE	RATES OF WITHDRAWAL	RATES OF DISABILITY	RATES OF DEATH*		RATES OF SERVICE RETIREMENT
			MALES	FEMALES	
25	0.0500	0.000125	0.00028	0.00009	
26	0.0500	0.000250	0.00030	0.00010	
27	0.0500	0.000250	0.00031	0.00011	
28	0.0500	0.000250	0.00033	0.00012	
29	0.0500	0.000250	0.00034	0.00013	
30	0.0500	0.000250	0.00036	0.00015	
31	0.0500	0.000250	0.00038	0.00016	
32	0.0500	0.000250	0.00040	0.00018	
33	0.0500	0.000250	0.00042	0.00019	
34	0.0500	0.000375	0.00044	0.00021	
35	0.0500	0.000375	0.00047	0.00023	
36	0.0500	0.000375	0.00050	0.00025	
37	0.0500	0.000375	0.00053	0.00028	
38	0.0400	0.000500	0.00057	0.00030	
39	0.0400	0.000500	0.00061	0.00033	
40	0.0400	0.000500	0.00066	0.00036	
41	0.0400	0.000500	0.00071	0.00040	
42	0.0400	0.000625	0.00077	0.00043	
43	0.0350	0.000750	0.00083	0.00047	
44	0.0350	0.000750	0.00090	0.00051	
45	0.0350	0.000875	0.00098	0.00056	
46	0.0350	0.000875	0.00107	0.00061	
47	0.0350	0.001000	0.00116	0.00066	
48	0.0275	0.001125	0.00127	0.00071	
49	0.0275	0.001250	0.00138	0.00077	
50	0.0275	0.001250	0.00149	0.00083	
51	0.0275	0.001375	0.00162	0.00090	
52	0.0275	0.001500	0.00175	0.00097	
53	0.0275	0.001750	0.00189	0.00105	
54	0.0275	0.002000	0.00203	0.00113	
55	0.0275	0.002250	0.00219	0.00123	
56	0.0275	0.002500	0.00236	0.00133	
57	0.0275	0.002750	0.00255	0.00144	
58	0.0250	0.003000	0.00275	0.00156	
59	0.0250	0.003250	0.00296	0.00170	
60	0.0250	0.003625	0.00319	0.00186	0.15
61	0.0250	0.004000	0.00344	0.00203	0.10
62	0.0250	0.004375	0.00371	0.00222	0.10
63	0.0250	0.004875	0.00401	0.00244	0.10
64	0.0250	0.005375	0.00433	0.00269	0.10
65	0.0250	0.005875	0.00468	0.00296	0.13
66	0.0250	0.006375	0.00506	0.00327	0.15
67	0.0250	0.006875	0.00548	0.00362	0.15
68	0.0250	0.007375	0.00594	0.00400	0.18
69	0.0250	0.008000	0.00646	0.00442	0.18
70	0.0250	0.008000	0.00703	0.00489	0.25
71	0.0250	0.008000	0.00767	0.00541	0.25
72	0.0250	0.008000	0.00837	0.00598	0.25
73	0.0250	0.008000	0.00915	0.00661	0.25
74	0.0250	0.008000	0.01001	0.00731	0.25
75	0.0250	0.008000	0.01096	0.00808	0.25
76	0.0250	0.008000	0.01200	0.00893	0.25
77	0.0250	0.008000	0.01315	0.00986	0.25
78	0.0000	0.000000	0.01440	0.01090	1.00
79	0.0000	0.000000	0.01578	0.01204	1.00
80	0.0000	0.000000	0.01730	0.01330	1.00

\*Base mortality rates as of 2010 before application of the improvement scale



**TABLE 2**

**RATES OF SALARY INCREASES**

Assumed 3.75% annual increases at all ages.





**Appendix D – Recommended Rates**

**TABLE 3**

**RATES OF MORTALITY FOR MEMBERS RETIRED ON ACCOUNT OF SERVICE\***

AGE	MALES	FEMALES	AGE	MALES	FEMALES
19	0.000389	0.000140	71	0.019992	0.014418
20	0.000378	0.000130	72	0.022355	0.016168
21	0.000347	0.000119	73	0.025032	0.018133
22	0.000326	0.000108	74	0.028046	0.020336
23	0.000305	0.000097	75	0.031448	0.022799
24	0.000294	0.000097	76	0.035291	0.025574
25	0.000315	0.000108	77	0.039638	0.028706
26	0.000326	0.000119	78	0.044552	0.032249
27	0.000347	0.000130	79	0.050127	0.036288
28	0.000357	0.000140	80	0.056427	0.040900
29	0.000378	0.000162	81	0.063546	0.046181
30	0.000399	0.000173	82	0.071516	0.052207
31	0.000420	0.000194	83	0.080388	0.059119
32	0.000441	0.000205	84	0.090206	0.067014
33	0.000462	0.000227	85	0.100958	0.076043
34	0.000494	0.000248	86	0.112697	0.086260
35	0.000525	0.000270	87	0.125444	0.097697
36	0.000557	0.000302	88	0.139230	0.110333
37	0.000599	0.000324	89	0.154056	0.124060
38	0.000641	0.000356	90	0.169785	0.138596
39	0.000693	0.000389	91	0.186323	0.153781
40	0.000746	0.000432	92	0.203616	0.169582
41	0.000809	0.000464	93	0.221624	0.186062
42	0.000872	0.000508	94	0.240324	0.203310
43	0.000945	0.000551	95	0.259676	0.221454
44	0.001029	0.000605	96	0.279657	0.240602
45	0.001124	0.000659	97	0.300184	0.260788
46	0.001218	0.000713	98	0.321153	0.282020
47	0.001334	0.000767	99	0.342395	0.304128
48	0.001449	0.000832	100	0.363678	0.326862
49	0.003129	0.002398	101	0.384720	0.349726
50	0.003371	0.002516	102	0.405342	0.372535
51	0.003633	0.002657	103	0.425376	0.395075
52	0.003906	0.002797	104	0.444696	0.417150
53	0.004211	0.002938	105	0.463187	0.438577
54	0.004526	0.003089	106	0.480753	0.459205
55	0.004861	0.003251	107	0.497322	0.478883
56	0.005219	0.003434	108	0.512852	0.497524
57	0.005597	0.003629	109	0.525000	0.515052
58	0.006017	0.003866	110	0.525000	0.531414
59	0.006458	0.004147	111	0.525000	0.540000
60	0.006941	0.004493	112	0.525000	0.540000
61	0.007487	0.004903	113	0.525000	0.540000
62	0.008085	0.005400	114	0.525000	0.540000
63	0.008778	0.005962	115	0.525000	0.540000
64	0.009587	0.006620	116	0.525000	0.540000
65	0.010532	0.007366	117	0.525000	0.540000
66	0.011634	0.008208	118	0.525000	0.540000
67	0.012905	0.009169	119	1.000000	1.000000
68	0.014364	0.010260	120	1.000000	1.000000
69	0.016023	0.011480			
70	0.017882	0.012863			

\*Base mortality rates as of 2010 before application of the improvement scale



**Appendix D – Recommended Rates**

**TABLE 4**

**RATES OF MORTALITY FOR BENEFICIARIES OF DECEASED MEMBERS\***

AGE	MALES	FEMALES	AGE	MALES	FEMALES
19	0.000382	0.000126	71	0.029797	0.018659
20	0.000350	0.000116	72	0.032690	0.020507
21	0.000329	0.000105	73	0.035849	0.022586
22	0.000307	0.000095	74	0.039284	0.024896
23	0.000297	0.000095	75	0.043036	0.027500
24	0.000318	0.000105	76	0.047170	0.030429
25	0.000329	0.000116	77	0.051728	0.033747
26	0.000350	0.000126	78	0.056816	0.037517
27	0.000360	0.000136	79	0.062508	0.041843
28	0.000382	0.000157	80	0.068879	0.046778
29	0.000403	0.000168	81	0.075991	0.052437
30	0.000424	0.000189	82	0.083899	0.058916
31	0.000445	0.000200	83	0.092676	0.066318
32	0.000466	0.000221	84	0.102375	0.074781
33	0.000498	0.000242	85	0.113049	0.084315
34	0.000530	0.000263	86	0.124741	0.094931
35	0.000562	0.000294	87	0.137567	0.106533
36	0.000604	0.000315	88	0.152831	0.118955
37	0.000647	0.000347	89	0.169038	0.132258
38	0.000700	0.000378	90	0.186083	0.146496
39	0.000753	0.000420	91	0.203902	0.161711
40	0.000816	0.000452	92	0.222452	0.177933
41	0.000880	0.000494	93	0.241680	0.195195
42	0.000954	0.000536	94	0.261544	0.213486
43	0.005819	0.002751	95	0.281971	0.232775
44	0.006063	0.002866	96	0.302884	0.252987
45	0.006318	0.002982	97	0.324159	0.274019
46	0.006583	0.003108	98	0.345655	0.295680
47	0.006848	0.003234	99	0.367142	0.317782
48	0.007431	0.003360	100	0.388384	0.340011
49	0.007674	0.003591	101	0.409202	0.362187
50	0.007918	0.003843	102	0.429427	0.384101
51	0.008173	0.004106	103	0.448931	0.405563
52	0.008448	0.004379	104	0.467598	0.426395
53	0.008734	0.004683	105	0.485332	0.446450
54	0.009052	0.004998	106	0.502058	0.465581
55	0.009402	0.005334	107	0.517736	0.483704
56	0.009794	0.005702	108	0.530000	0.500745
57	0.010229	0.006101	109	0.530000	0.516652
58	0.010727	0.006531	110	0.530000	0.525000
59	0.011310	0.007004	111	0.530000	0.525000
60	0.011978	0.007529	112	0.530000	0.525000
61	0.012741	0.008106	113	0.530000	0.525000
62	0.013632	0.008747	114	0.530000	0.525000
63	0.014670	0.009440	115	0.530000	0.525000
64	0.015868	0.010217	116	0.530000	0.525000
65	0.017257	0.011057	117	0.530000	0.525000
66	0.018826	0.012002	118	1.000000	1.000000
67	0.020596	0.013041	119	1.000000	1.000000
68	0.022567	0.014207	120	1.000000	1.000000
69	0.024751	0.015519			
70	0.027157	0.017000			

\*Base mortality rates as of 2010 before application of the improvement scale



**Appendix D – Recommended Rates**

**TABLE 5**

**RATES OF MORTALITY FOR MEMBERS RETIRED ON ACCOUNT OF DISABILITY\***

AGE	MALES	FEMALES	AGE	MALES	FEMALES
19	0.000237	0.002597	71	0.036297	0.032213
20	0.000319	0.00247	72	0.038172	0.034333
21	0.004151	0.002279	73	0.040180	0.036718
22	0.004336	0.002056	74	0.042364	0.039411
23	0.004244	0.001866	75	0.044743	0.042432
24	0.003976	0.001738	76	0.047370	0.045813
25	0.003626	0.001738	77	0.050264	0.049587
26	0.003255	0.001897	78	0.053478	0.053795
27	0.002977	0.002078	79	0.057031	0.058480
28	0.002863	0.002279	80	0.060986	0.063674
29	0.003008	0.002491	81	0.065374	0.069430
30	0.003152	0.002724	82	0.070267	0.075790
31	0.003306	0.002979	83	0.075684	0.082797
32	0.003471	0.003254	84	0.081669	0.090482
33	0.003646	0.003562	85	0.088220	0.098909
34	0.003832	0.003890	86	0.095368	0.107728
35	0.004027	0.004251	87	0.103103	0.116748
36	0.004233	0.004643	88	0.111395	0.125907
37	0.004470	0.005077	89	0.120283	0.135224
38	0.004717	0.005554	90	0.129831	0.144849
39	0.005006	0.006084	91	0.140111	0.154940
40	0.005335	0.006667	92	0.153068	0.165731
41	0.005717	0.007303	93	0.167406	0.177444
42	0.006149	0.007992	94	0.182114	0.190323
43	0.006644	0.008745	95	0.196998	0.204559
44	0.007210	0.009561	96	0.212056	0.220310
45	0.007859	0.010441	97	0.227403	0.237906
46	0.008590	0.011374	98	0.243255	0.256796
47	0.009435	0.012370	99	0.259828	0.277031
48	0.010372	0.013430	100	0.277317	0.298496
49	0.011423	0.014554	101	0.295847	0.320809
50	0.012576	0.015720	102	0.315427	0.343249
51	0.013823	0.016271	103	0.335873	0.365636
52	0.015141	0.016822	104	0.356751	0.387759
53	0.016531	0.017384	105	0.377392	0.409425
54	0.017634	0.017935	106	0.397621	0.430455
55	0.018725	0.018465	107	0.417274	0.450701
56	0.019786	0.018963	108	0.436226	0.470015
57	0.020806	0.019430	109	0.454364	0.488310
58	0.021774	0.019864	110	0.471596	0.505514
59	0.022670	0.020288	111	0.487849	0.521573
60	0.023484	0.020734	112	0.503083	0.530000
61	0.024257	0.021200	113	0.515000	0.530000
62	0.025008	0.021741	114	0.515000	0.530000
63	0.025781	0.022366	115	0.515000	0.530000
64	0.026615	0.023087	116	0.515000	0.530000
65	0.027573	0.023914	117	0.515000	0.530000
66	0.028686	0.024868	118	0.515000	0.530000
67	0.029952	0.025970	119	0.515000	0.530000
68	0.031353	0.027231	120	1.000000	1.000000
69	0.032888	0.028684			
70	0.034536	0.030337			

\*Base mortality rates as of 2010 before application of the improvement scale