



Singapore Mortality Experience 2004 – 2008 Mortality Work Group

Singapore, 25 March 2011

Agenda

- **Exposure**
- **Population Experience**
- **Mortality - Adults**
- **Mortality – Juveniles**
- **Mortality – Over 65s**
- **Comparison other markets**
- **TPD**
- **Critical Illness**



Data – Years 2003 - 2008

- We received exposure and claims data split:
 - Age
 - Duration 0,1,2,3,4 and 5+
 - Gender
 - Investment Linked /Non Investment Linked
 - WoL and Endowment/Term
 - Benefit Type (Mortality, CI 100% acceleration, CI not 100% acceleration, TPD)
 - Medical / Non Medical



Data – Exposure

DEATH COVER Exposure in Years					
Females					
	Non IL		Non Medical	Medical	Total
		WOL	8,869,220	741,060	9,610,280
		Term	406,780	89,705	496,485
			9,276,000	830,765	10,106,765
	Investment Linked				
		WOL	2,767,630	60,905	2,828,535
		Term	320	25	345
			2,767,950	60,930	2,828,880
Males					
	Non IL		Non Medical	Medical	Total
		WOL	7,674,420	829,485	8,503,905
		Term	524,020	171,760	695,780
			8,198,440	1,001,245	9,199,685
	Investment Linked				
		WOL	3,048,480	89,920	3,138,400
		Term	265	30	295
			3,048,745	89,950	3,138,695
TOTAL			23,291,135	1,982,890	25,274,025



Data – Exposure

CRITICAL ILLNESS WITH 100% acceleration Exposure in Years					
Females					
	Non IL		Non Medical	Medical	Total
		WOL	2,423,215	238,215	2,661,430
		Term	11,373	1,087	12,460
			2,434,588	239,302	2,673,890
	Investment Linked				
		WOL	416,980	15,095	432,075
		Term	-	-	-
			416,980	15,095	432,075
Males					
	Non IL		Non Medical	Medical	Total
		WOL	1,901,700	205,295	2,106,995
		Term	15,083	3,595	18,678
			1,916,783	208,890	2,125,673
	Investment Linked				
		WOL	366,600	18,445	385,045
		Term	-	-	-
			366,600	18,445	385,045
TOTAL			5,134,951	481,732	5,616,683



Data – Exposure

DEATH COVER EXCLUDING 100% CI Business Exposure in Years					
Females					
	Non IL		Non Medical	Medical	Total
		WOL	6,446,005	502,845	6,948,850
		Term	395,407	88,618	484,025
			6,841,412	591,463	7,432,875
	Investment Linked				
		WOL	2,350,650	45,810	2,396,460
		Term	320	25	345
			2,350,970	45,835	2,396,805
Males					
	Non IL		Non Medical	Medical	Total
		WOL	5,772,720	624,190	6,396,910
		Term	508,937	168,165	677,102
			6,281,657	792,355	7,074,012
	Investment Linked				
		WOL	2,681,880	71,475	2,753,355
		Term	265	30	295
			2,682,145	71,505	2,753,650
TOTAL			18,156,184	1,501,158	19,657,342



Issues with the Mortality Data

- We followed the previous decision to combine the Medical and Non Medical experience.
- We also looked at the selection effect on mortality and initially agreed on a 2 year effect:



Issues with the Mortality Data

Actual vs Expected Mortality as a Percentage of A/E at 5+, Med and Non-Med								
		Dur 0	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5+	Dur 2+
Males	2004-08	56%	80%	97%	92%	88%	100%	98%
	1997-02	67%	88%	102%	91%	94%	100%	99%
Females	2004-08	34%	66%	72%	76%	69%	100%	91%
	1997-02	37%	73%	77%	83%	89%	100%	95%



Issues with the Mortality Data

- The investigation is on a policy basis. Thus multiple policies are not eliminated.
- The investigation covers lives on the Singaporean Registers of participating companies. Not necessarily Singaporean Lives.
- Acceleration of Critical Illness effect eliminated by amending data.
- Acceleration of TPD effect eliminated by adjusting data.



Population Mortality Improvement

Singapore Population Mortality Improvement : Annual Geometric Average

Age Last	1997-02 to 2003-08		1989-93 to 2003-08	
	Male	Female	Male	Female
15 - 19	-3.29%	-6.05%	-3.72%	-2.88%
20 - 24	-2.14%	2.11%	-1.62%	-2.00%
25 - 29	-2.39%	-2.99%	-0.81%	-3.51%
30 - 34	-2.85%	-4.88%	-2.57%	-3.51%
35 - 39	-2.75%	-4.28%	-1.95%	-3.51%
40 - 44	-1.86%	-1.18%	-2.15%	-3.28%
45 - 49	-1.42%	-3.03%	-2.79%	-3.01%
50 - 54	-1.99%	-2.71%	-3.31%	-3.31%
55 - 59	-3.18%	-3.05%	-3.67%	-3.69%
60 - 64	-3.84%	-4.18%	-3.71%	-3.64%
65 - 69	-3.37%	-4.89%	-2.84%	-3.57%
Weighted Avg	-2.51%	-3.14%	-2.59%	-3.25%



Mortality Exposure – Adults (15 – 64)

Age Last	Male				Female			
	Life years exposed		Claims		Life years exposed		Claims	
	WL and End	IL	WL and End	IL	WL and End	IL	WL and End	IL
15-19	344,272	14,753	168	1	291,774	12,807	102	3
20-24	276,332	25,335	145	14	222,218	26,761	85	6
25-29	385,430	150,450	128	61	408,064	169,610	66	27
30-34	545,309	302,903	168	112	666,737	293,478	121	60
35-39	689,725	361,494	319	199	824,246	300,405	222	78
40-44	831,198	355,552	550	330	893,365	265,434	480	178
45-49	820,304	291,724	839	437	840,288	215,026	610	195
50-54	657,261	196,777	1,326	490	656,724	146,197	799	180
55-59	355,509	65,073	954	215	377,892	62,562	699	126
60-64	120,266	15,317	531	52	148,256	19,239	381	46



Mortality Results No TPD Adjustment – Adults (15 – 64)

Age Last	Male			Female		
	Crude Rates-WL&EnD	Crude Rates-IL	qx-S9702	Crude Rates-WL&EnD	Crude Rates-IL	qx-S9702
15-19	0.4880	0.0678	0.286	0.3496	0.2343	0.171
20-24	0.5247	0.5526	0.508	0.3825	0.2242	0.190
25-29	0.3321	0.4055	0.433	0.1617	0.1592	0.227
30-34	0.3081	0.3698	0.424	0.1815	0.2044	0.322
35-39	0.4625	0.5505	0.644	0.2693	0.2596	0.456
40-44	0.6617	0.9281	1.017	0.5373	0.6706	0.690
45-49	1.0228	1.4980	1.542	0.7259	0.9069	1.105
50-54	2.0175	2.4901	2.591	1.2166	1.2312	1.783
55-59	2.6835	3.3040	4.582	1.8497	2.0140	2.806
60-64	4.4152	3.3950	8.084	2.5699	2.3910	4.264



Mortality Results with TPD Adjustment – Adults (15 – 64)

Age Last	Male			Female		
	Crude Rates-WL&EnD	Crude Rates-IL	qx-S9702	Crude Rates-WL&EnD	Crude Rates-IL	qx-S9702
15-19	0.4948	0.0678	0.286	0.3542	0.2343	0.171
20-24	0.5294	0.5526	0.508	0.3870	0.2271	0.190
25-29	0.3369	0.4058	0.433	0.1656	0.1596	0.227
30-34	0.3117	0.3711	0.424	0.1839	0.2051	0.322
35-39	0.4691	0.5527	0.644	0.2771	0.2623	0.456
40-44	0.6747	0.9311	1.017	0.5506	0.6748	0.690
45-49	1.0623	1.5155	1.542	0.7585	0.9229	1.105
50-54	2.1302	2.5491	2.591	1.2952	1.2656	1.783
55-59	2.9282	3.3900	4.582	2.0098	2.0735	2.806
60-64	4.7562	3.4793	8.084	2.8185	2.3976	4.264

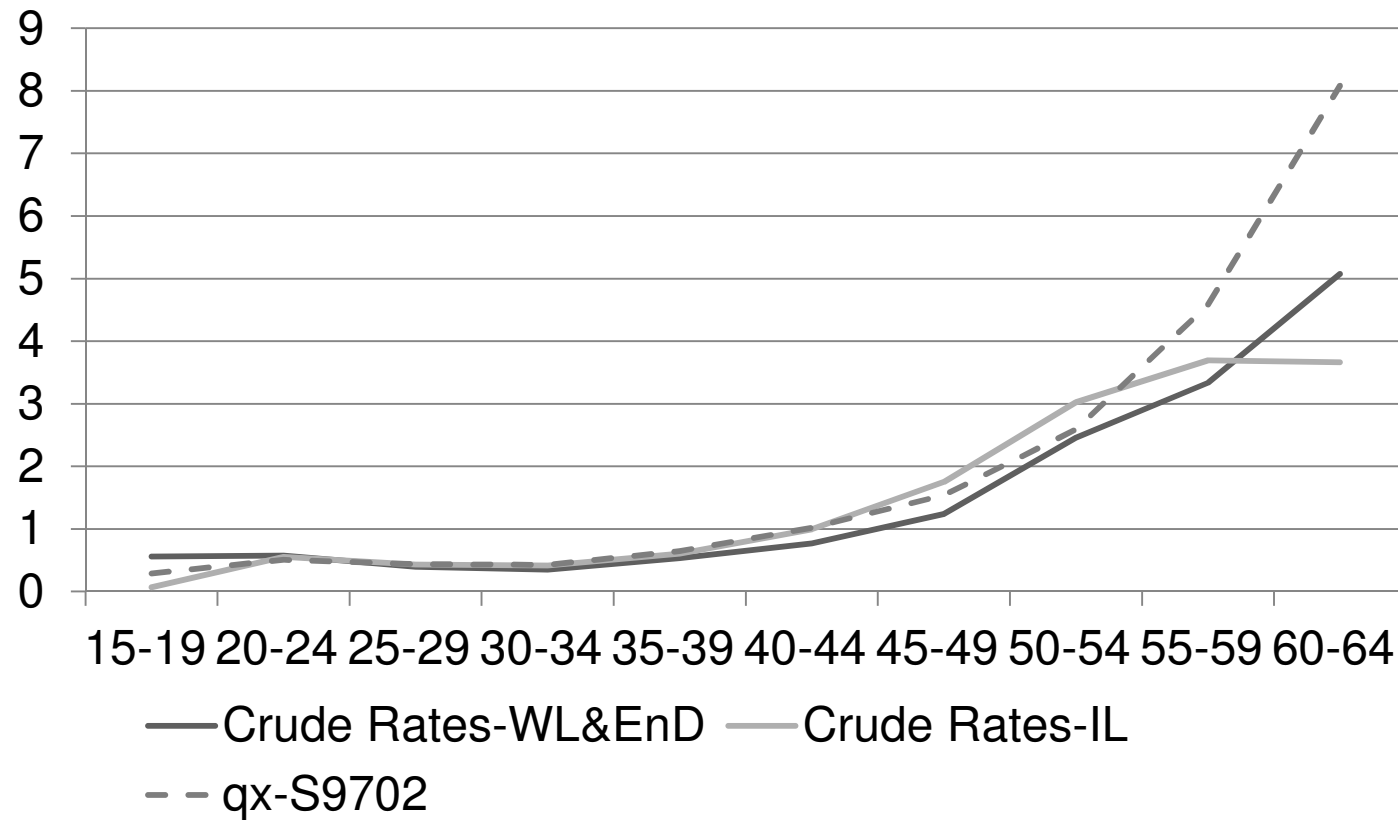


Mortality Results Death and TPD– Adults (15 – 64)

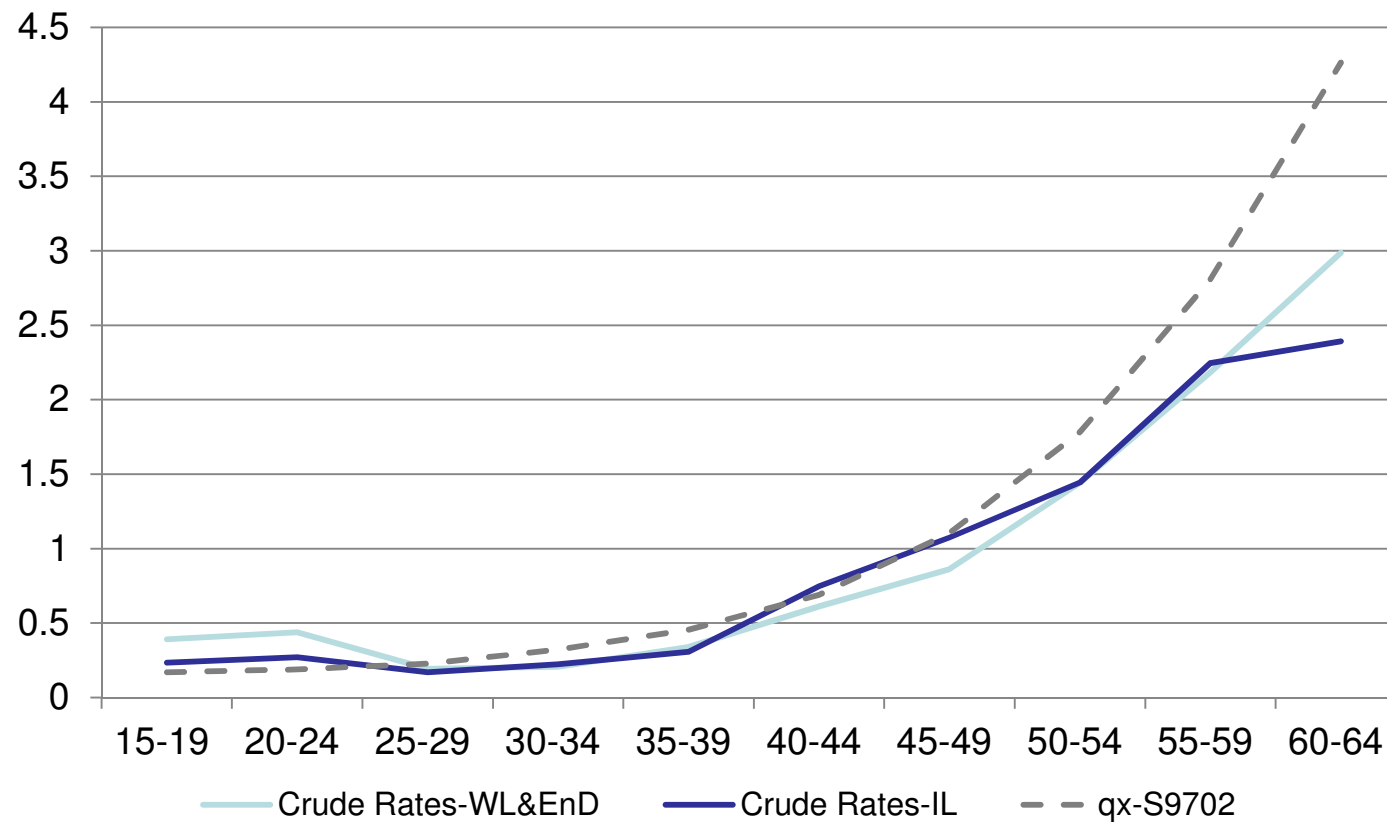
Age Last	Male			Female		
	Crude Rates-WL&EnD	Crude Rates-IL	qx-S9702	Crude Rates-WL&EnD	Crude Rates-IL	qx-S9702
15-19	0.5558	0.0678	0.286	0.3905	0.2343	0.171
20-24	0.5736	0.5526	0.508	0.4376	0.2711	0.190
25-29	0.3930	0.4303	0.433	0.1928	0.1694	0.227
30-34	0.3491	0.4135	0.424	0.2062	0.2231	0.322
35-39	0.5307	0.6038	0.644	0.3396	0.3084	0.456
40-44	0.7675	0.9902	1.017	0.6117	0.7485	0.690
45-49	1.2387	1.7509	1.542	0.8610	1.0756	1.105
50-54	2.4530	3.0241	2.591	1.4427	1.4443	1.783
55-59	3.3335	3.6946	4.582	2.1834	2.2464	2.806
60-64	5.0746	3.6637	8.084	2.9873	2.3910	4.264



Mortality Results Death and TPD– Adults (15 – 64) Males Rate‰



Mortality Results Death and TPD– Adults (15 – 64) Females Rate %

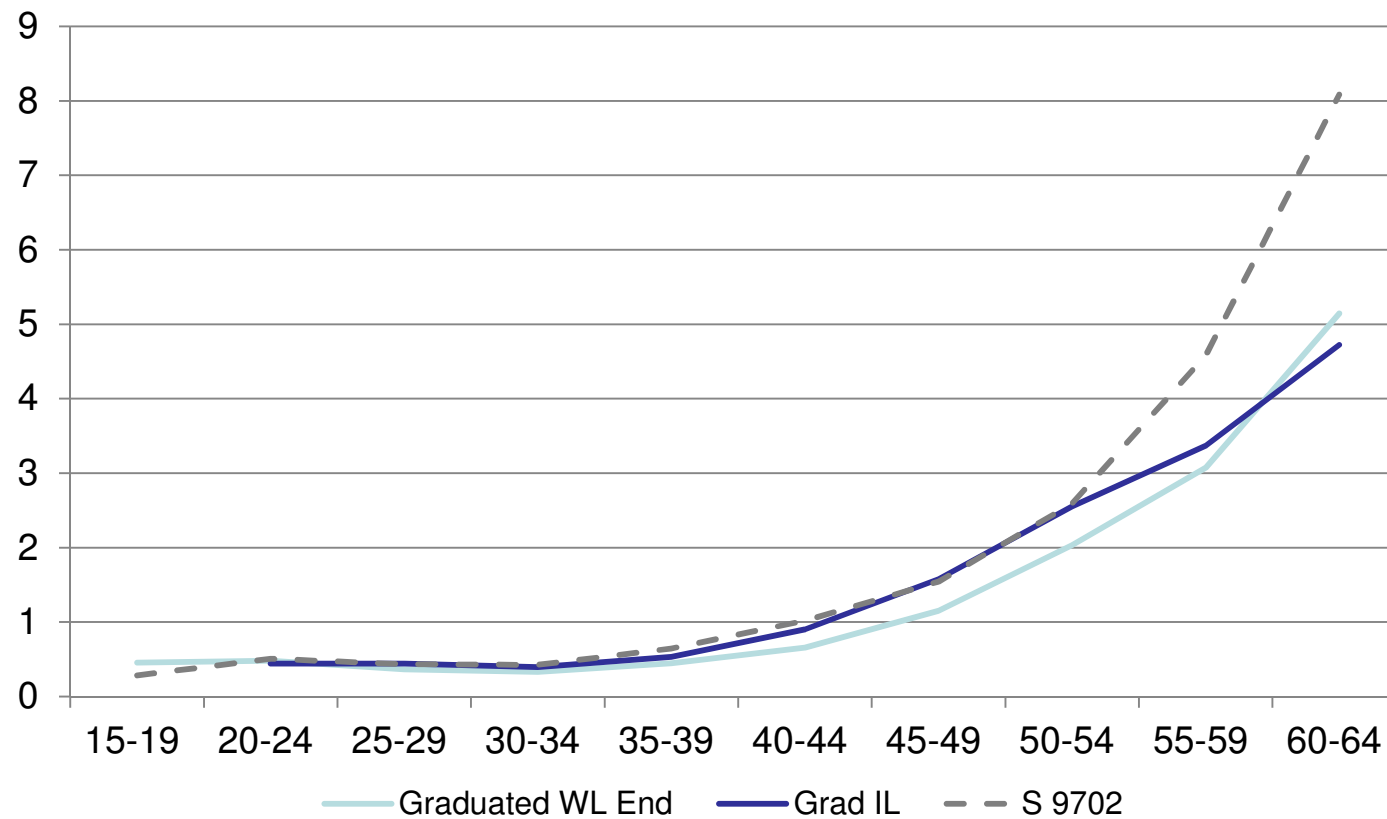


Mortality Results Graduated Death Only Table(15 – 64)

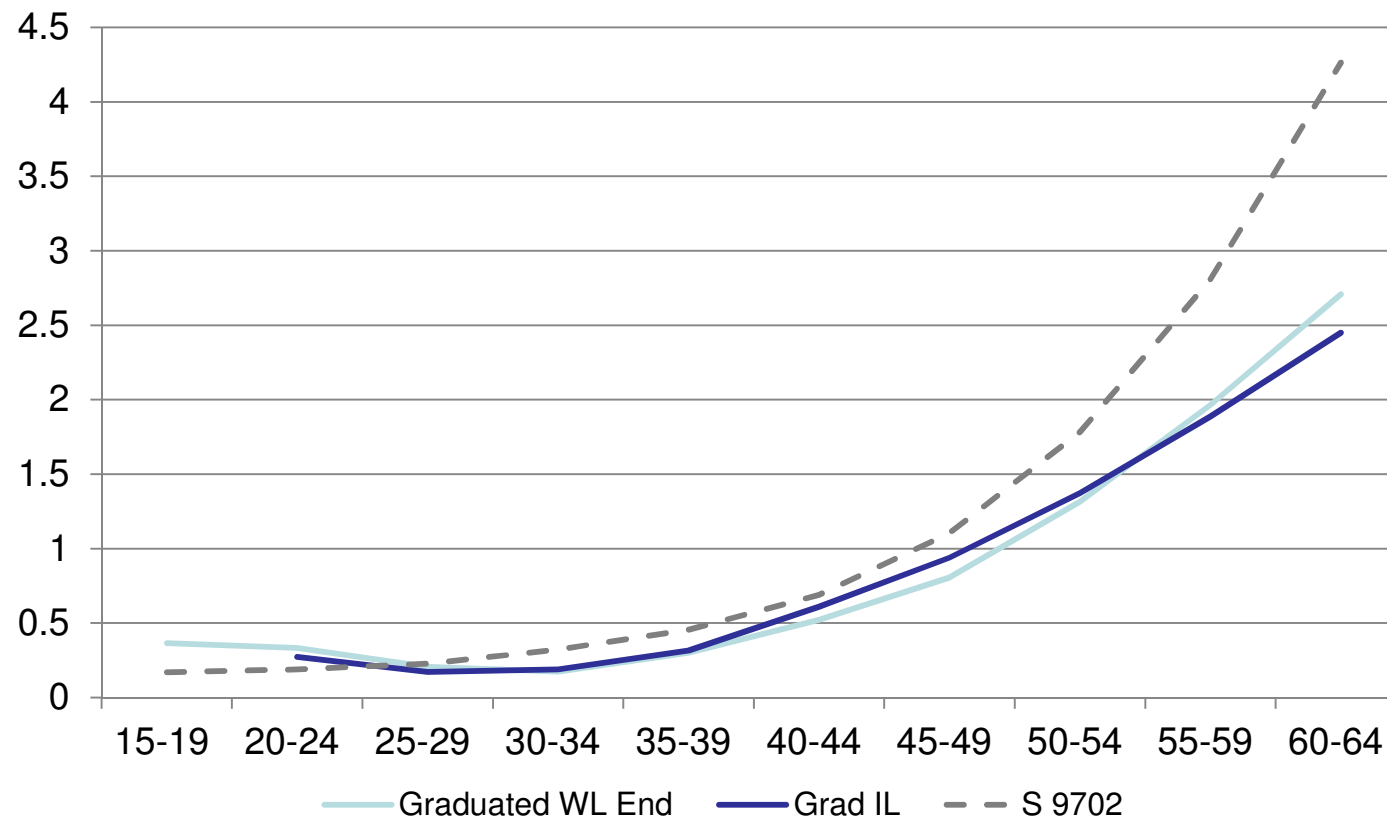
Age Last	Male			Female		
	Graduated WL End	Grad IL	S 9702	Graduated WL End	Grad IL	S 9702
15-19	0.455		0.286	0.365		0.171
20-24	0.483	0.441	0.508	0.334	0.274	0.19
25-29	0.366	0.445	0.433	0.206	0.172	0.227
30-34	0.331	0.395	0.424	0.175	0.190	0.322
35-39	0.447	0.533	0.644	0.301	0.317	0.456
40-44	0.657	0.902	1.017	0.522	0.610	0.69
45-49	1.153	1.577	1.542	0.805	0.940	1.105
50-54	2.033	2.555	2.591	1.316	1.373	1.783
55 - 59	3.075	3.368	4.582	1.964	1.887	2.806
60-64	5.145	4.725	8.084	2.707	2.449	4.264



Mortality Results Graduated Death Only Table(15 – 64) Males



Mortality Results Graduated Death Only Table(15 – 64) Females

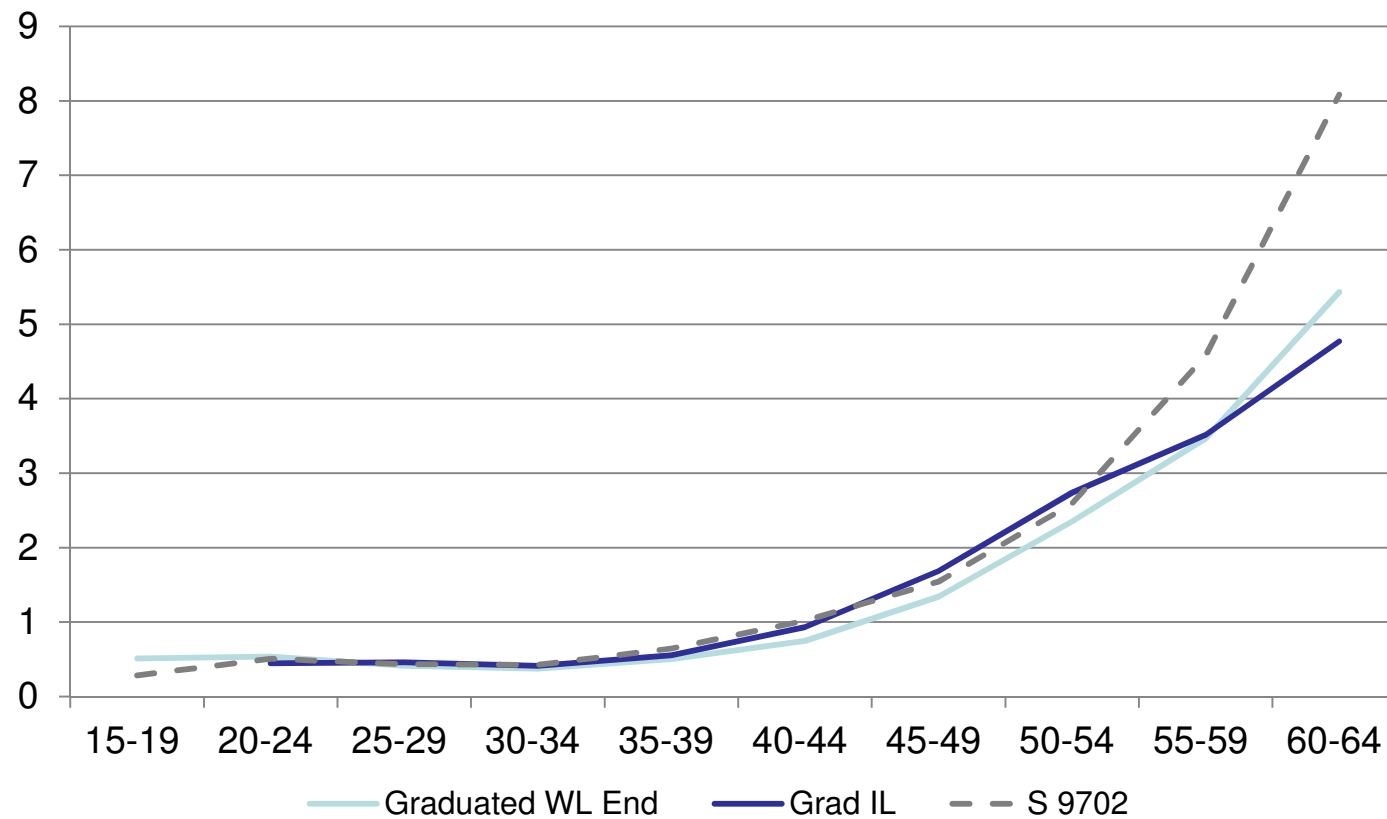


Mortality Results Graduated Death + TPD Table(15 – 64)

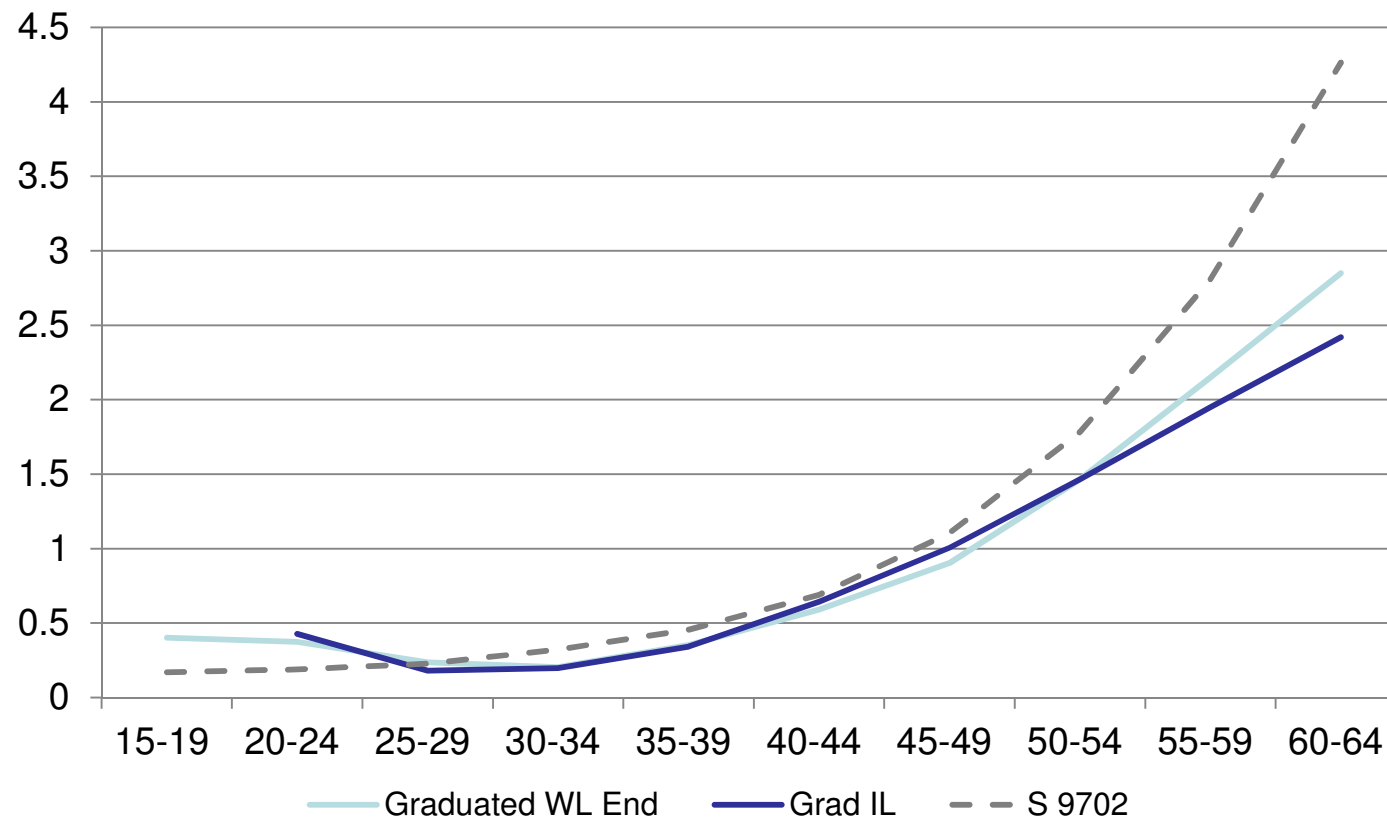
Age Last	Male			Female		
	Graduated WL End	Grad IL	S 9702	Graduated WL End	Grad IL	S 9702
15-19	0.511		0.286	0.402		0.171
20-24	0.536	0.447	0.508	0.375	0.428	0.190
25-29	0.411	0.459	0.433	0.236	0.181	0.227
30-34	0.376	0.414	0.424	0.205	0.198	0.322
35-39	0.504	0.556	0.644	0.353	0.342	0.456
40-44	0.750	0.933	1.017	0.591	0.642	0.690
45-49	1.341	1.685	1.542	0.903	1.005	1.105
50-54	2.352	2.740	2.591	1.466	1.466	1.783
55 - 59	3.467	3.516	4.582	2.149	1.949	2.806
60-64	5.433	4.772	8.084	2.850	2.419	4.264



Mortality Results Graduated Death + TPD Table(15 – 64) Males



Mortality Results Graduated Death + TPD Table(15 – 64) Females



Mortality Exposure – Juveniles (0 - 14)

Age Last	Male				Female			
	Life years exposed		Claims		Life years exposed		Claims	
	WL and End	IL	WL and End	IL	WL and End	IL	WL and End	IL
0-4	78,893	18,139	19	3	71,320	16,394	17	2
5-9	275,521	33,803	65	4	250,127	29,878	55	0
10-15	374,713	20,737	91	5	339,116	18,315	98	2



Mortality Results No TPD Adjustment – Juveniles (0 – 14)

Age Last	Male			Female		
	Crude Rates-WL&EnD	Crude Rates-IL	qx-Population 2008*	Crude Rates-WL&EnD	Crude Rates-IL	qx-Population 2008
0-4	0.2408	0.1654	0.1500	0.2384	0.1220	0.1700
5-9	0.2359	0.1183	0.1200	0.2199	0.0000	0.0600
10-14	0.2429	0.2411	0.1300	0.2890	0.1092	0.0900



Mortality Results with TPD Adjustment – Juveniles (0 -14)

Age Last	Male			Female		
	Crude Rates-WL&EnD	Crude Rates-IL	qx- Population 2008	Crude Rates-WL&EnD	Crude Rates-IL	qx- Population 2008
0-4	0.2421	0.1654	0.1500	0.2405	0.1220	0.1700
5-9	0.2392	0.1183	0.1200	0.2242	0.0000	0.0600
10-14	0.2477	0.2450	0.1300	0.2922	0.1092	0.0900



Mortality Results Death and TPD– Juveniles (0 – 14)

Age Last	Male			Female		
	Crude Rates-WL&EnD	Crude Rates-IL	qx- Population 2008	Crude Rates-WL&EnD	Crude Rates-IL	qx- Population 2008
0-4	0.2582	0.1654	0.1500	0.2574	0.1220	0.1700
5-9	0.2733	0.1183	0.1200	0.2579	0.0000	0.0600
10-14	0.2910	0.2884	0.1300	0.3236	0.1092	0.0900

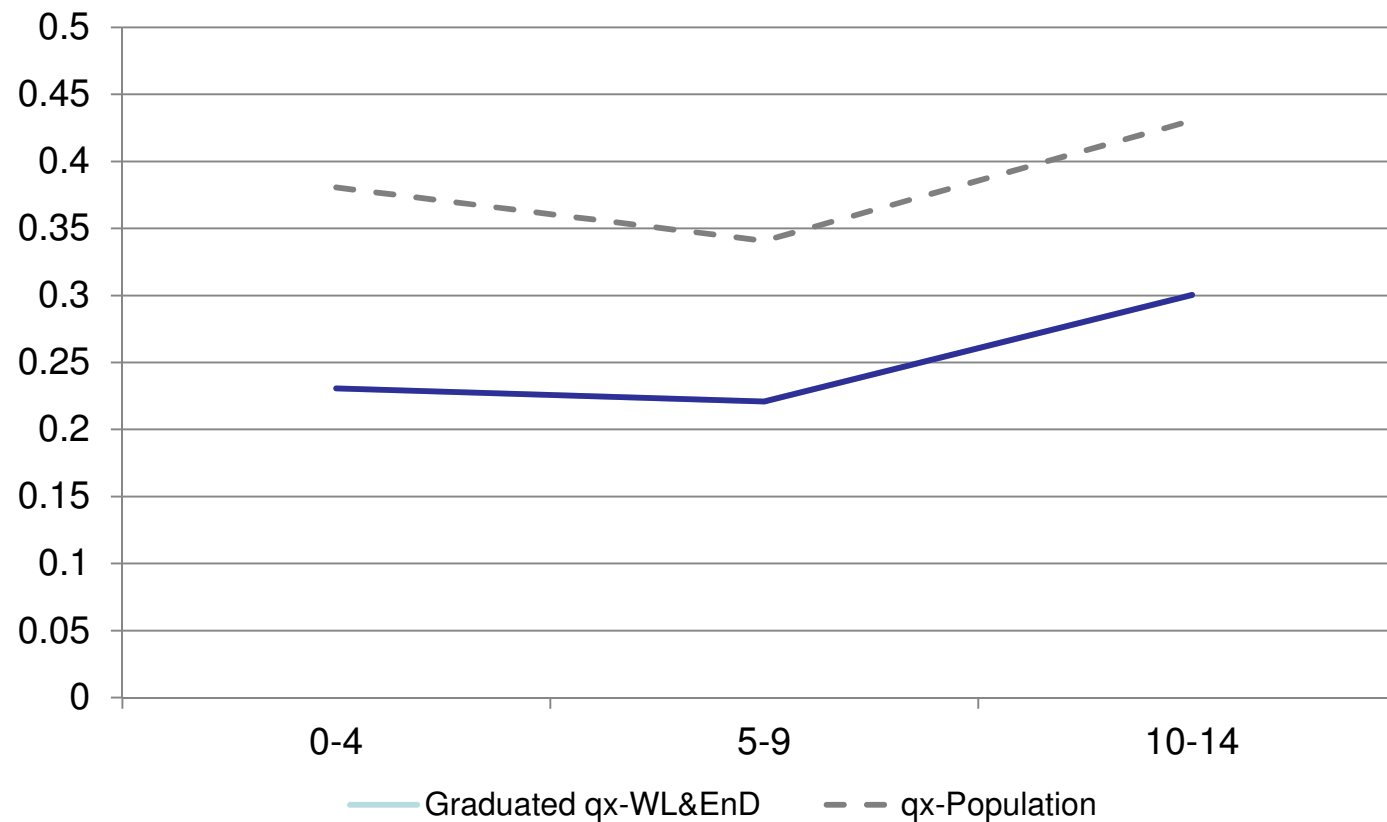


Mortality Results Graduated Death Table– Juveniles (0 – 14)

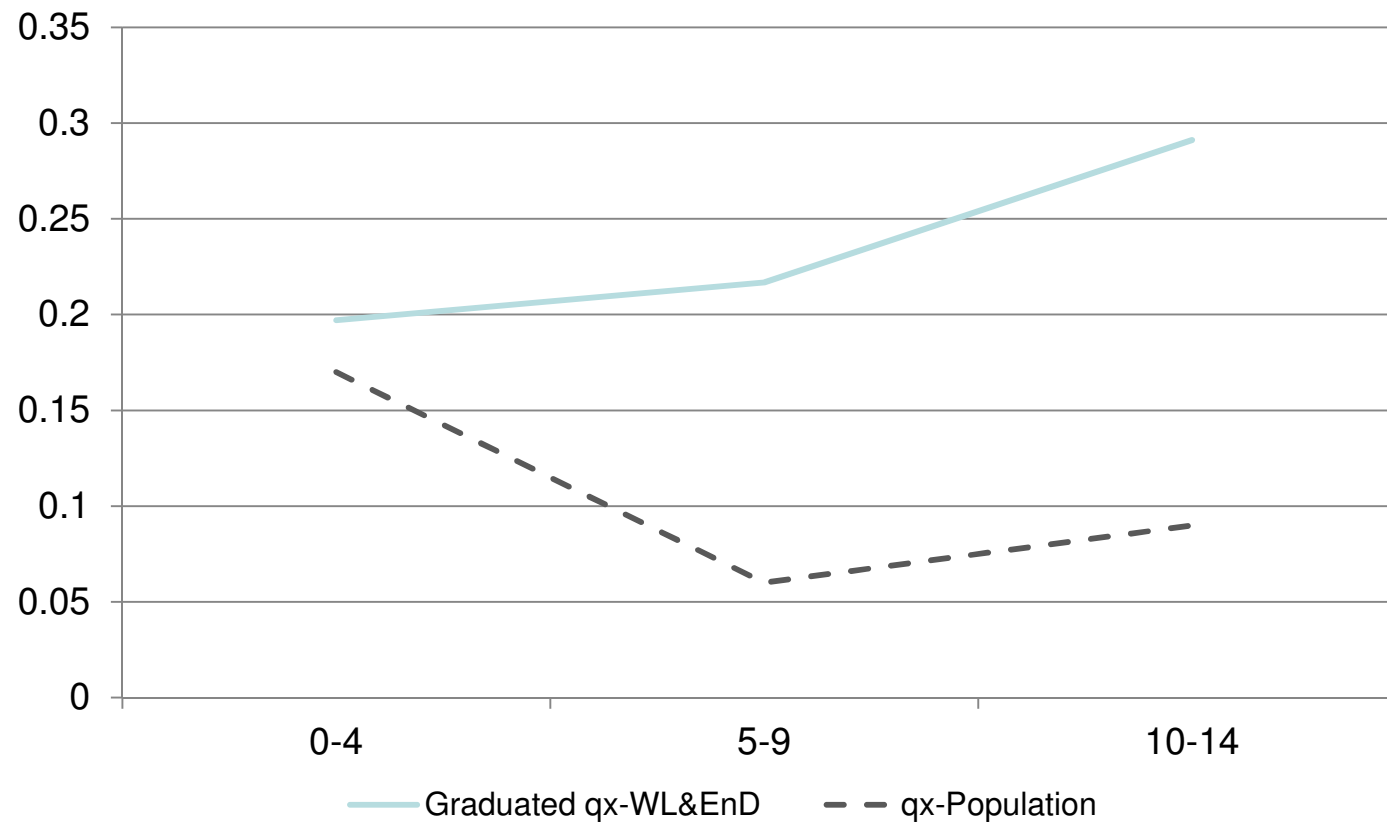
Age Last	Male			Female		
	Graduated qx-WL&EnD	Graduatede qx-IL	qx- Population 2008	Graduated qx-WL&EnD	Graduatede qx-IL	qx- Population 2008
0-4	0.2307		0.1500	0.1970		0.1700
5-9	0.2208		0.1200	0.2168		0.0600
10-15	0.3004		0.1300	0.2912		0.0900



Mortality Results Graduated Death Table– Juveniles (0 – 14) Males



Mortality Results Graduated Death Table– Juveniles (0 – 14) Females



Mortality Results Graduated Death and TPD– Juveniles (0 – 14)

Age Last	Male			Female		
	Graduated qx- WL&EnD	Graduated e qx-IL	qx- Population	Graduated qx- WL&EnD	Graduated e qx-IL	qx- Population
0-4	0.2373		0.1500	0.2327		0.1700
5-9	0.2529		0.1200	0.2462		0.0600
10-15	0.3488		0.1300	0.3195		0.0900



Mortality Exposure – over 65 (65 - 99)

Age Last	Male				Female			
	Life years exposed		Claims		Life years exposed		Claims	
	WL and End	IL	WL and End	IL	WL and End	IL	WL and End	IL
65-69	49,633	5,762	451	58	66,156	8,058	263	23
70-74	14,458	1,375	259	10	15,569	1,925	138	16
75-79	4,625	266	119	11	4,566	357	98	3
80-84	1,274	51	48	0	964	35	41	3
85-89	324	8	23	0	211	5	14	1
90-94	89	4	4	1	56	0	2	0
95-99	73	0	0	0	34	0	1	0

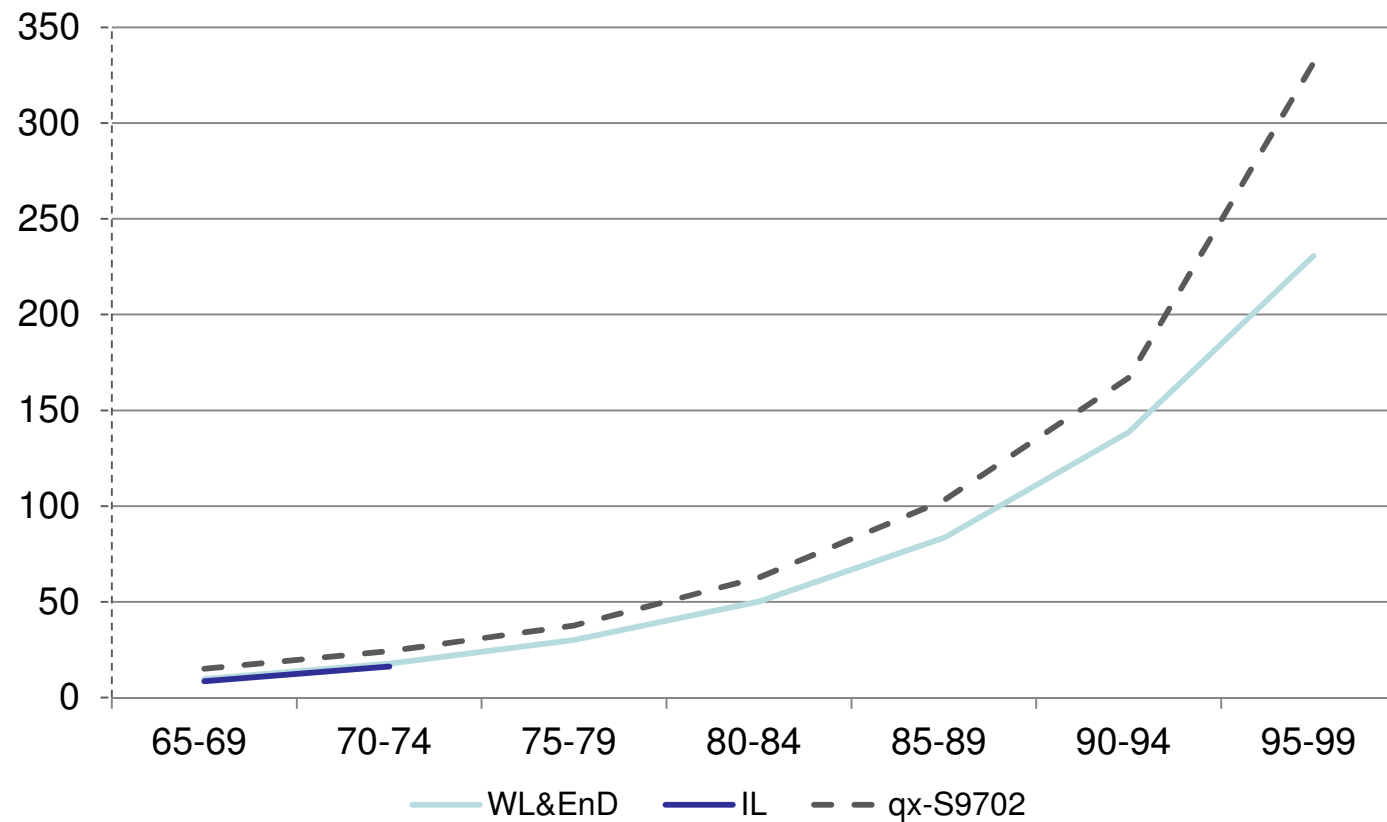


Mortality Results No TPD Adjustment – over 65 (65 - 99)

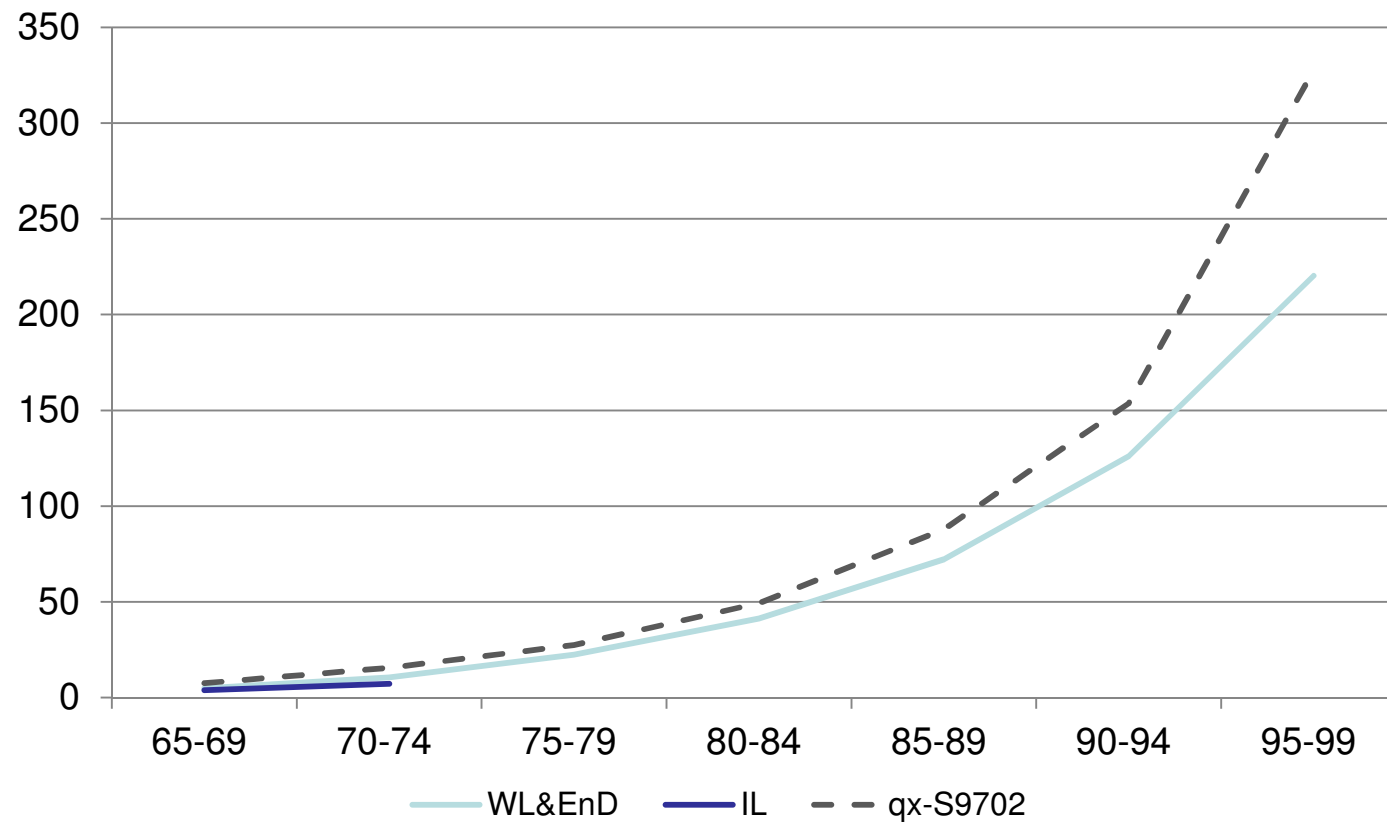
Age Last	Male			Female		
	Crude qx-WL&EnD	Crude qx-IL	qx-S9702	Crude qx-WL&EnD	Crude qx-IL	qx-S9702
65-69	9.087	10.066	15.066	3.975	2.854	7.461
70-74	17.914	7.273	24.276	8.864	8.312	15.524
75-79	25.730	41.353	37.693	21.463	8.403	27.479
80-84	37.677	0.000	62.625	42.531	85.714	49.386
85-89	70.988	0.000	103.015	66.351	200.000	87.845
90-94	44.944	250.000	166.974	35.714	-	153.656
95-99	0.000	-	331.607	29.412	-	327.788



Mortality Results Death only Graduated Table—over 65 (65 - 99) Males



Mortality Results Death only Graduated Table—over 65 (65 - 99) Females



Mortality Results Death and TPD Graduated Table –over 65 (65 - 99)

Age Last	Male			Female		
	WL&EnD	IL	qx-S9702	WL&EnD	IL	qx-S9702
65-69	9.842	8.554	15.066	4.864	3.933	7.461
70-74	18.290	16.269	24.276	10.786	7.774	15.524
75-79	32.211		37.693	23.054		27.479
80-84	53.001		62.625	43.186		49.386
85-89	86.545		103.015	74.750		87.845
90-94	141.673		166.974	128.651		153.656
95-99	231.917	-	331.607	221.418		327.788



Comparison Mortality Graduated Table and S 9702

Age Last	Males			Females			
	S9702	2004 - 08	Ratio	S9702	2004 - 08	Ratio	
15	0.1662	0.3975	239.2%	0.1535	0.3442	224.2%	
25	0.4642	0.4167	89.8%	0.1993	0.2571	129.0%	
35	0.5108	0.3858	75.5%	0.3921	0.2308	58.9%	
45	1.2776	0.8792	68.8%	0.9025	0.6718	74.4%	
55	3.599	2.6004	72.3%	2.3343	1.7116	73.3%	
65	11.4962	7.3706	64.1%	5.5154	3.5441	64.3%	
75	30.4798	24.3188	79.8%	21.4652	16.5601	77.1%	
85	83.744	67.302	80.4%	68.9931	57.0486	82.7%	
95	219.1431	186.194	85.0%	210.0997	174.0441	82.8%	



Age 52 issue for Males

Age 52 issue for Males - Deaths

Age Last	Exposure		Claims		Crude qx %	
	Males	Females	Males	Females	Males	Females
50	149,884	151,738	228	169	1.521	1.114
51	141,869	142,712	240	160	1.692	1.121
52	132,852	132,632	334	170	2.514	1.282
53	122,866	121,195	283	160	2.303	1.320
54	109,791	108,447	241	140	2.195	1.291



TPD Exposure

TPD					
Females					
	Non IL		Non Medical	Medical	Total
		WOL	1,672,878	141,205	1,814,083
		Term	69,403	16,411	85,814
			1,742,281	157,616	1,899,897
	Investment Linked				
		WOL	251,095	7,781	258,876
		Term	-	-	-
			251,095	7,781	258,876
Males					
	Non IL		Non Medical	Medical	Total
		WOL	1,460,340	158,735	1,619,075
		Term	89,403	31,002	120,405
			1,549,743	189,737	1,739,480
	Investment Linked				
		WOL	271,965	10,099	282,064
		Term	-	-	-
			271,965	10,099	282,064
TOTAL			3,815,084	365,233	4,180,317

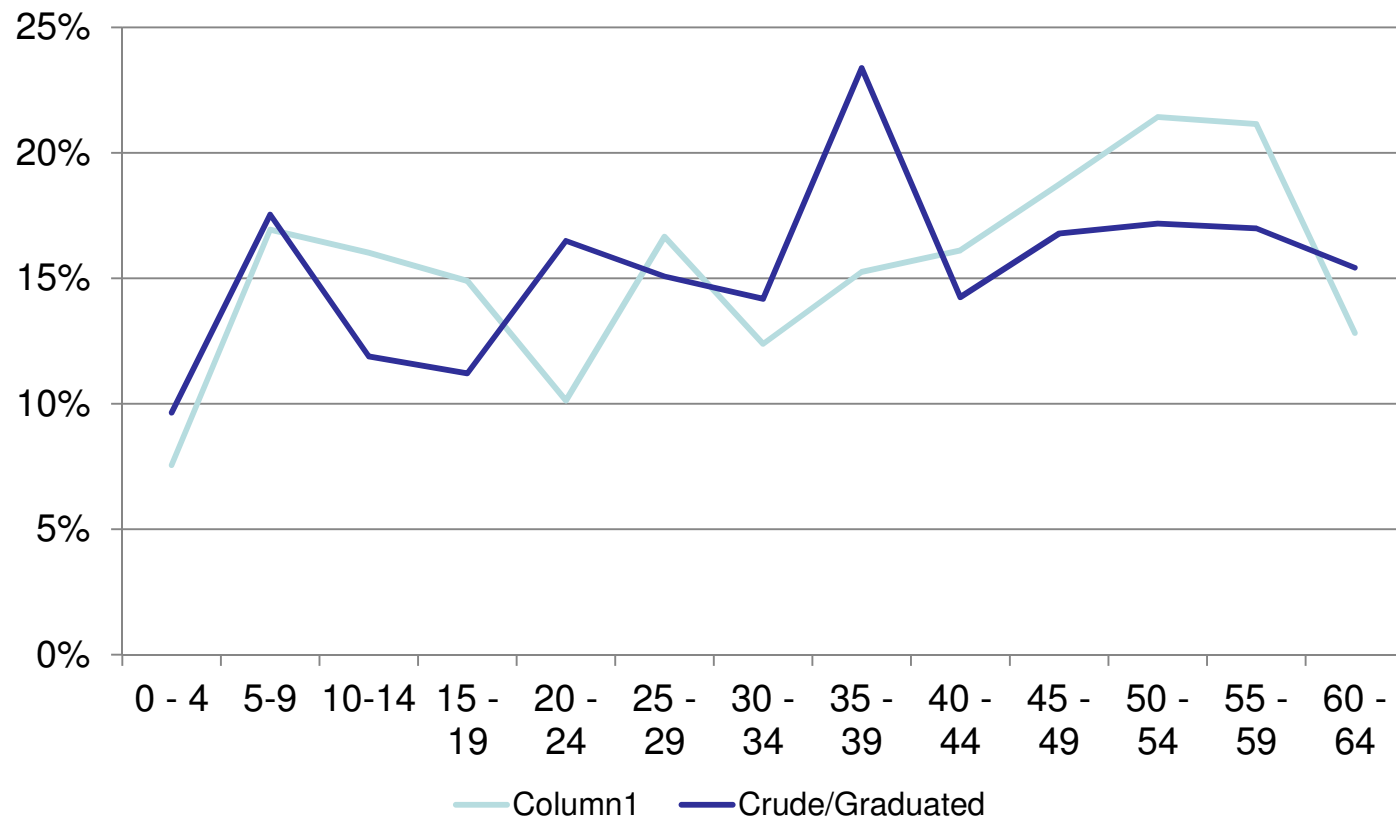


TPD Results

Age Last Group	Males WL and End			Females WL and End		
	Exposure	TPD	Crude rate	Exposure	TPD	Crude rate
0 - 4	114,962	2	0.0174	105,281	2	0.0190
5 - 9	374,262	14	0.0374	341,887	13	0.0380
10 - 14	477,971	23	0.0481	433,780	15	0.0346
15 - 19	427,643	29	0.0678	366,948	15	0.0409
20 - 24	368,009	18	0.0489	308,396	17	0.0551
25 - 29	525,350	32	0.0609	578,868	18	0.0311
30 - 34	731,032	30	0.0410	928,599	23	0.0248
35 - 39	894,343	61	0.0682	1,110,178	78	0.0703
40 - 44	1,039,738	110	0.1058	1,169,441	87	0.0744
45 - 49	986,505	213	0.2159	1,080,724	146	0.1351
50 - 54	769,191	335	0.4355	836,131	189	0.2260
55 - 59	418,424	272	0.6501	485,464	162	0.3337
60 - 64	130,434	86	0.6593	174,892	73	0.4174
65 - 69	50,947	19	0.3729	73,959	21	0.2839
70 - 99	19,202	34	1.7707	20,557	9	0.4378



TPD Results Males



TPD Results

Age Last Group	Males ILP			Females ILP		
	Exposure	TPD Claim	Crude rate‰	Exposure	TPD Claim	Crude rate‰
0 - 4	18,139	3	0.1654	16,394	2	0.1220
5 - 9	33,803	4	0.1183	29,878	0	0.0000
10 - 14	20,737	5	0.2411	18,315	2	0.1092
15 - 19	14,753	1	0.0678	12,807	3	0.2343
20 - 24	25,335	14	0.5526	26,761	6	0.2242
25 - 29	150,450	61	0.4055	169,610	27	0.1592
30 - 34	302,903	112	0.3698	293,478	60	0.2044
35 - 39	361,494	199	0.5505	300,405	78	0.2596
40 - 44	355,552	330	0.9281	265,434	178	0.6706
45 - 49	291,724	437	1.4980	215,026	195	0.9069
50 - 54	196,777	490	2.4901	146,197	180	1.2312
55 - 59	65,073	215	3.3040	62,562	126	2.0140
60 - 64	15,317	52	3.3950	19,239	46	2.3910
65 - 69	5,762	58	10.0668	8,058	23	2.8545
70 - 99	1,703	22	12.9184	2,321	23	9.9117



Critical Illness Exposure

CRITICAL ILLNESS WITH 100% acceleration					
Females					
	Non IL		Non Medical	Medical	Total
		WOL	484,643	47,643	532,286
		Term	11,373	1,087	12,460
			496,016	48,730	544,746
	Investment Linked				
		WOL	83,396	3,019	86,415
		Term	-	-	-
			83,396	3,019	86,415
Males					
	Non IL		Non Medical	Medical	Total
		WOL	380,340	41,059	421,399
		Term	15,083	3,595	18,678
			395,423	44,654	440,077
	Investment Linked				
		WOL	73,320	3,689	77,009
		Term	-	-	-
			73,320	3,689	77,009
TOTAL			1,048,155	100,092	1,148,247



Critical Illness Exposure

CRITICAL ILLNESS WITHOUT 100% acceleration					
Females					
	Non IL		Non Medical	Medical	Total
		WOL	112,089	12,726	124,815
		Term	455	278	733
			112,544	13,004	125,548
	Investment Linked				
		WOL	20,526	3,371	23,897
		Term	-	-	-
			20,526	3,371	23,897
Males					
	Non IL		Non Medical	Medical	Total
		WOL	98,013	13,092	111,105
		Term	534	496	1,030
			98,547	13,588	112,135
	Investment Linked				
		WOL	21,118	3,911	25,029
		Term	-	-	-
			21,118	3,911	25,029
TOTAL			252,735	33,874	286,609



Critical Illness Exposure

TOTAL CRITICAL ILLNESS					
Females					
	Non IL		Non Medical	Medical	Total
		WOL	596,732	60,369	657,101
		Term	11,828	1,365	13,193
			608,560	61,734	670,294
	Investment Linked				
		WOL	103,922	6,390	110,312
		Term	-	-	-
			103,922	6,390	110,312
Males					
	Non IL		Non Medical	Medical	Total
		WOL	478,353	54,151	532,504
		Term	15,617	4,091	19,708
			493,970	58,242	552,212
	Investment Linked				
		WOL	94,438	7,600	102,038
		Term	-	-	-
			94,438	7,600	102,038
TOTAL			1,300,890	133,966	1,434,856



Critical Illness Results (Acc plus Add)

Sample Graduated Critical Illness Rates per 1000					
Age					
Last		Males	% S9702	Females	% S9702
5		0.295	NA	0.265	NA
15		0.451	244%	0.335	216%
25		0.269	58%	0.301	151%
35		0.389	76%	0.662	169%
45		1.674	131%	2.341	259%
55		4.871	135%	4.371	187%
65		11.995	104%	8.097	147%
75		33.201	109%	16.492	77%

