

RESEARCH PAPER

OBSERVED AND EXPECTED MORTALITY EXPERIENCE FOR TRINIDAD AND TOBAGO ANNUITANTS & PENSIONERS BASED ON NATIONAL INSURANCE SCHEME ANNUITANT MORTALITY EXPERIENCE 2011-2013

CONSTRUCTION AND USE OF NISTT2012 ANNUITANT MORTALITY TABLE

PORT OF SPAIN
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Shaping Tomorrow's Solutions

Contents

1	SUMMARY	3
2	DISCLAIMERS.....	4
3	REVIEW OF OBSERVED T&T NIS PENSIONER MORTALITY.....	5
3.1	Exposure and Observed Deaths	5
3.2	Observed vs Expected Mortality.....	5
4	NISTT2012 MORTALITY TABLE	7
5	EXPECTED FUTURE MORTALITY IMPROVEMENTS	9
5.1	Example:.....	9
6	POTENTIAL FINANCIAL IMPACT	10
6.1	Expected Future Life Expectancy- Person Aged 65 in 2017.....	10
6.2	Value of Annuity of \$1 Per Year For Life - Person Aged 65 in 2017, 4% Interest	10
6.3	Observations.....	10
7	POSSIBLE ADJUSTMENTS.....	11
7.1	Risk Margins.....	11
7.2	Credibility.....	11
7.3	Lighter Mortality For Insurance Business	11
8	CONCLUSION.....	12

Appendices

1	NISTT2012 MORTALITY RATES
2	T&T NIS EXPOSURE AND OBSERVED DEATHS FOR PERIOD 2011 TO 2013
3	T&T NIS PENSIONER ACTUAL vs EXPECTED MORTALITY
4	NISTT2012 vs US GAM94 ANNUITANT MORTALITY TABLES
5	T&T VS CANADIAN MORTALITY RATES AND IMPROVEMENTS

1 SUMMARY

The source data for this paper was the Ninth Actuarial Review of the Trinidad and Tobago National Insurance System ("T&T NIS") as at 30 June 2013. This report contained detailed information on the observed mortality experience of T&T NIS pensioners for the three year period 1 July 2010 to 30 June 2013. This was the first time that such information was made available in the public domain.

The T&T NIS pensioner exposure and death information for this period was sufficiently large to support a credible analysis of mortality for the retired working population of Trinidad and Tobago ("T&T"). We compared the observed T&T NIS mortality experience to expected experience using standard annuitant valuation mortality tables to identify any significant differences. The results of this exercise were then used to produce an adjusted mortality table, NISTT2012, to fit the observed mortality experience of the T&T NIS pensioners over the period 2011 to 2013. Appendix 1 sets out the mortality probabilities of the NISTT2012 table.

There is limited information available locally or regionally for the setting of annuitant mortality assumptions in the valuation of life insurance and pension plan liabilities. Use of North American or UK standard mortality tables is typical. Locally, tax approved pension plans and individual deferred annuity policies are required to annuitize at least 75% of benefits payable at retirement. There is very little self-selected individual annuity business. The T&T NIS covers the local employed population and is expected to have significant overlap with pension plan and insurance company annuitants. As such, the NISTT2012 table is expected to be a better match for T&T annuitant experience than T&T population mortality or the standard foreign tables currently in use. On average, male annuitant mortality was 153% higher than the standard US GAM94AA table. Female annuitant mortality was 119% higher.

The NISTT2012 table provides a reasonable estimate of annuitant mortality in T&T for 2011-2013. For valuation and pricing purposes, adjustments should be made for future mortality improvements. The absence of earlier NIS mortality information did not permit the examination of past improvements in annuitant mortality. To assess possible future improvement factors, information on T&T population mortality was examined. Based on this review, improvements of 0.5%-0.75% per year after 2012 seemed reasonable.

NISTT2012 mortality with projected improvements is likely to produce actuarial reserves that are lower than the US / UK annuitant mortality tables currently in use. This is particularly the case for male annuitants. For pension plans, the reduction may be on the order of 0-5%. For life insurance companies, the reduction is likely to be higher, possibly in the range of 5-15%.

2 DISCLAIMERS

This research paper is a technical document outlining the construction and possible uses of the NISTT2012 annuitant mortality table. It has been prepared for circulation and use in the local insurance and pensions industry of Trinidad and Tobago. Expected users of this document and the NISTT2012 table would include actuaries and other persons responsible for the funding and management of life insurance companies and pension plans as well as relevant regulators, auditors and other professional advisors.

The paper represents the views and opinions of KR Services Limited and is the product of professional research. It intended to be read by persons familiar with life insurance, pensions and actuarial practice generally, and the T&T environment in particular. Where necessary, we have relied on our knowledge of regional and international actuarial and industry practice. Judgement was used in the methods used to produce the NISTT2012 table, particularly at higher ages. Other actuaries may reasonably hold different positions.

It is hoped that the NISTT2012 mortality table will be of use in assessing the expected mortality of annuitants in T&T. However, as with any actuarial table, due care should be taken in its use and professional judgement exercised. This would usually include consideration of an entity's own mortality experience and any other relevant data and information, including the purpose of the valuation and the required degree of accuracy.

It is hoped that this research will be supplemented by additional years of T&T NIS experience and possibly other Caribbean NIS or annuitant experience. In the meantime, we are unable to comment on the relevance or otherwise of the NISTT2012 for other Caribbean territories.

The Ninth Actuarial Review of the T&T NIS can be found on the T&T National Insurance Board ("NIB") website, www.nibtt.net. ENAP International prepared the report with the aid of the actuarial staff at the T&T NIB. ENAP is a well-regarded Canadian firm of actuaries with considerable experience in social security valuations. We have no reason to doubt the information provided in their report. We have not carried out any detailed or independent checks on the reported exposure and death information. The level and progression of reported mortality rates by age and gender appears reasonable and in line with expectations.

The course of future events will be different to any actuarial table or the expectation of any actuary. As a result, we accept no responsibility or liability to any person or party that makes use of our findings or uses the NISTT2012 table.

3 REVIEW OF OBSERVED T&T NIS PENSIONER MORTALITY

3.1 Exposure and Observed Deaths

Appendix 6 of the Ninth Actuarial Review included detailed information on the exposure and observed deaths for the T&T NIS retired population (ages 60 to 100) for the three year period to 30 June 2013. The detailed information is set out in Appendix 2 to this paper.

The information, summarized by age group is set out below.

Age Groups	Male Lives	Male Deaths	Female Lives	Female Deaths
61 - 65	49,910	910	26,826	223
66 - 70	38,706	984	19,422	250
71 - 75	25,031	1,047	11,941	254
76 - 80	16,268	979	7,885	255
81 - 85	9,540	936	4,712	257
86 - 90	5,026	723	2,520	241
91 - 100	2,216	476	1,205	201
	146,697	6,055	74,511	1,681

3.2 Observed vs Expected Mortality

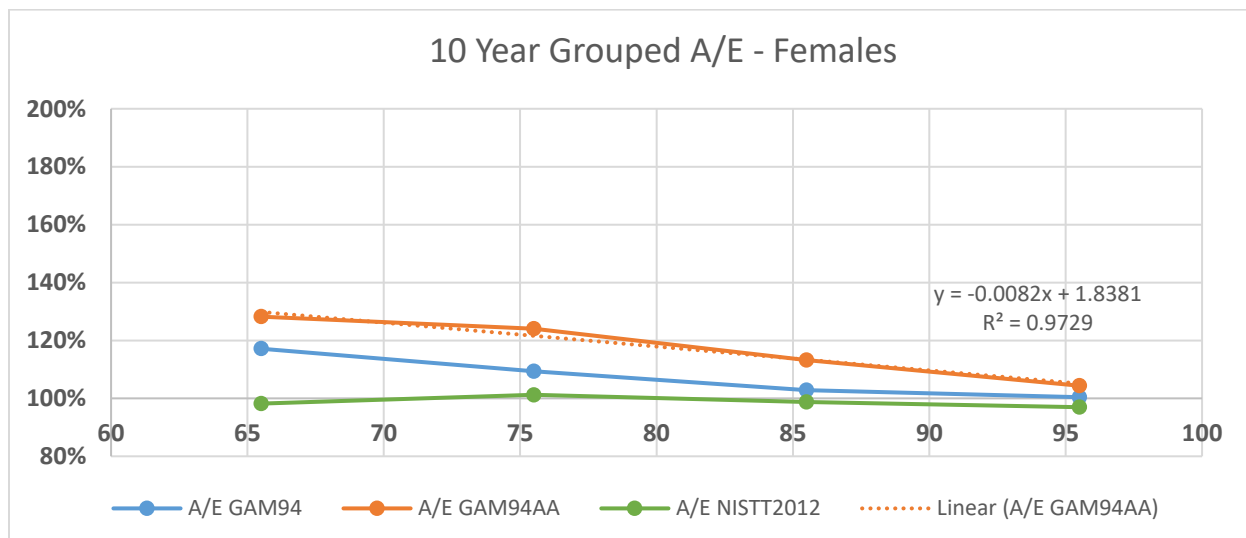
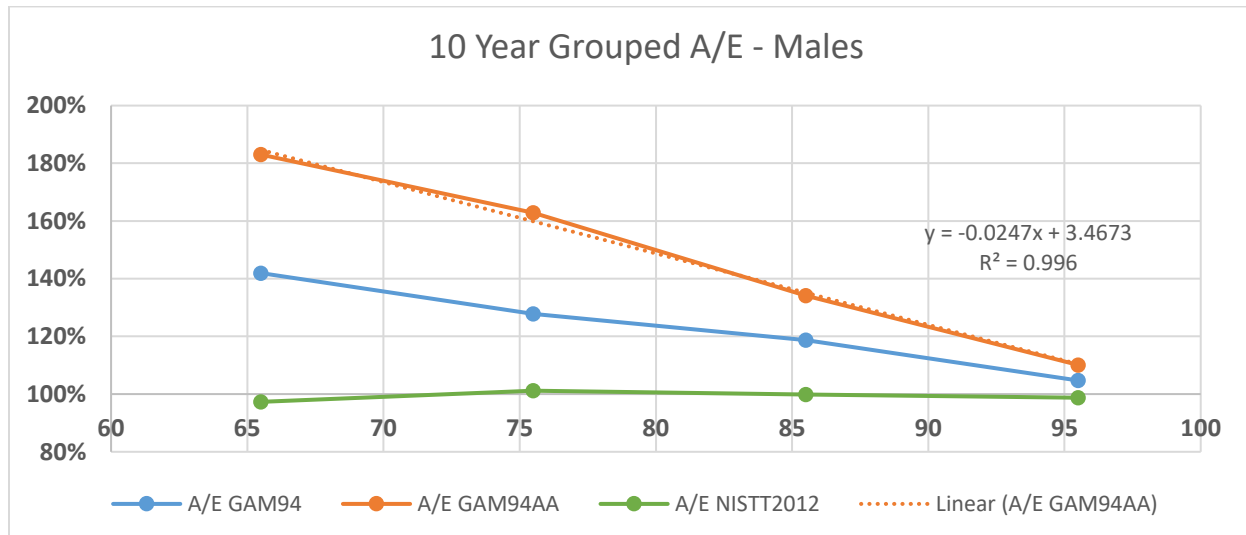
In T&T, expected future mortality assumptions are usually based on standard North American or UK mortality tables. The 2011-2013 NIS experience was compared to the commonly used US GAM94 and GAM94 AA annuitant mortality tables. Specifically, the GAM 94 Static table and the GAM94 table with AA projections to year of use 2012. Details are included in Appendix 3.

Actual / Expected ("A/E") Ratios – 5 Year Age Groups

Age Groups	Males			Females		
	A/E GAM94	A/E GAM94AA	A/E NISTT2012	A/E GAM94	A/E GAM94AA	A/E NISTT2012
61 - 65	157%	204%	104%	124%	136%	102%
66 - 70	130%	167%	92%	112%	122%	95%
71 - 75	135%	177%	105%	116%	132%	106%
76 - 80	121%	150%	97%	103%	117%	97%
81 - 85	121%	140%	99%	102%	115%	99%
86 - 90	116%	128%	101%	104%	111%	99%
91 - 100	105%	110%	99%	100%	104%	97%
Total	127%	153%	99%	108%	119%	99%

Our review of actual vs expected deaths for the T&T NIS pensioners over 2011 to 2013 showed:

- The observed NIS mortality was significantly higher than the GAM94 and GAM94AA comparative tables, particularly for males.
- At the younger ages, NIS male mortality was 200% of GAM94AA, falling to 110% at higher ages. In aggregate, observed male mortality was 153% of GAM94AA. This is a material difference.
- For females, NIS mortality was closer to the GAM94AA table, falling from 136% to 104% over the age range. In aggregate, observed female mortality was 119% of GAM94AA.
- The falls for both males and females was generally linear by age, especially when grouped in 5 and 10 year intervals. It is not possible to say whether this is due to generational effects or differences between local and US mortality.



4 NISTT2012 MORTALITY TABLE

The NISTT2012 mortality table was constructed based on the observed mortality experience of the T&T NIS retired population over the three year period 1 July 2010 to 30 June 2013. Smoothed rates were produced using the GAM94AA table.

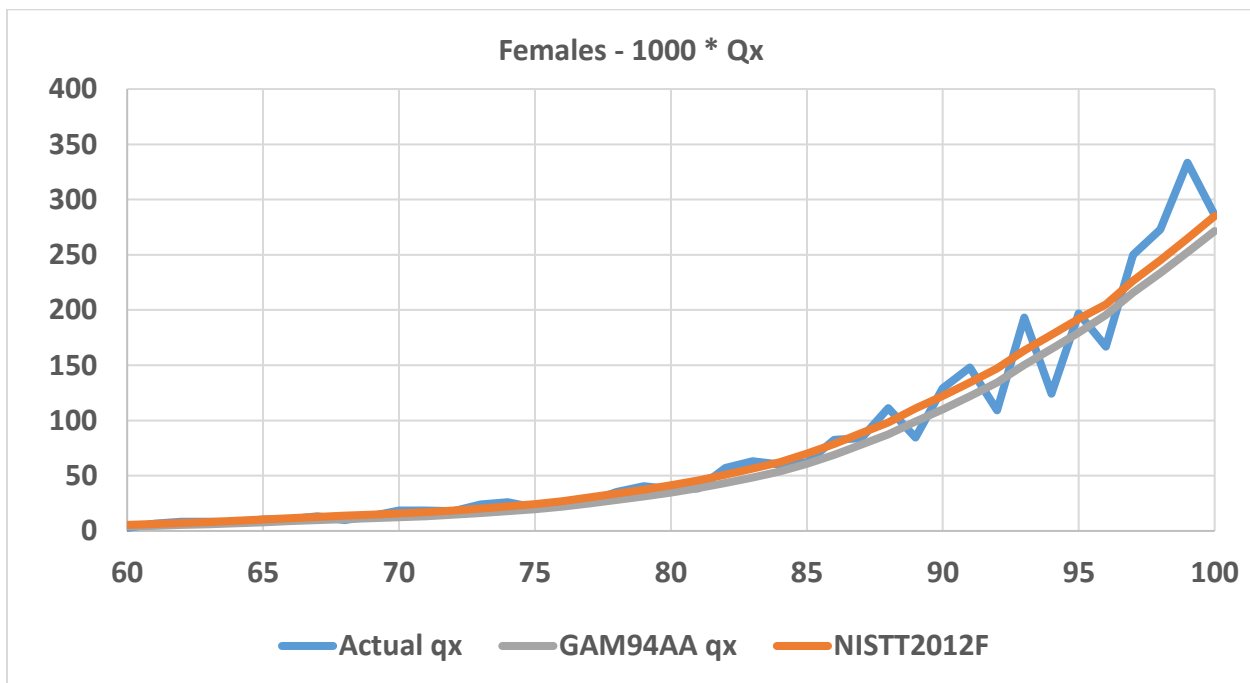
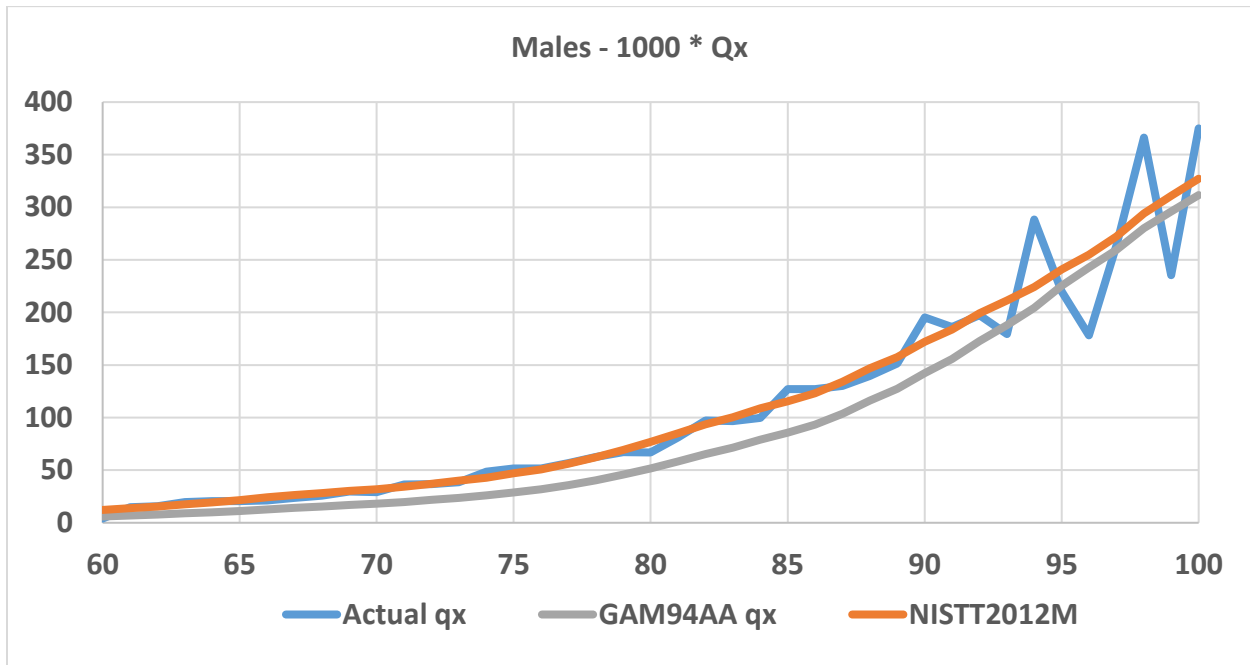
The ratios of actual to expected deaths using the GAM94AA table were calculated for individual ages and 5 and 10 year age groupings. The calculated actual to expected ratios are presented in Appendix 3. There was a clear pattern of falling A/E ratios with age for both males and females.

A simple linear regression model was used to produce smoothed A/E ratios that fit the observed ratios for ages 61 to 95. Age 60, the earliest age of retirement from the T&T NIS, was eliminated due to anomalously low deaths at that age. For ages over 95, the small volume of data reduced credibility.

These smoothed A/E ratios were then applied to the GAM94AA table to produce the NISTT2012 mortality rates. For ages below 60, the GAM94AA rates were adjusted by fixed multiples of 200% for males and 130% for females. For ages over 95, the GAM94AA table was adjusted by 105% for both males and females. These fixed multiples were selected to be slightly lower than the corresponding smoothed adjustment factors at ages 60 and 95. This approach is conservative given that the data suggests decreasing A/E ratios with age.

The resulting NISTT2012 mortality rates are set out in Appendix 1. Comparisons of the observed T&T NIS mortality rates with the GAM94AA and NISTT2012 tables are shown below.

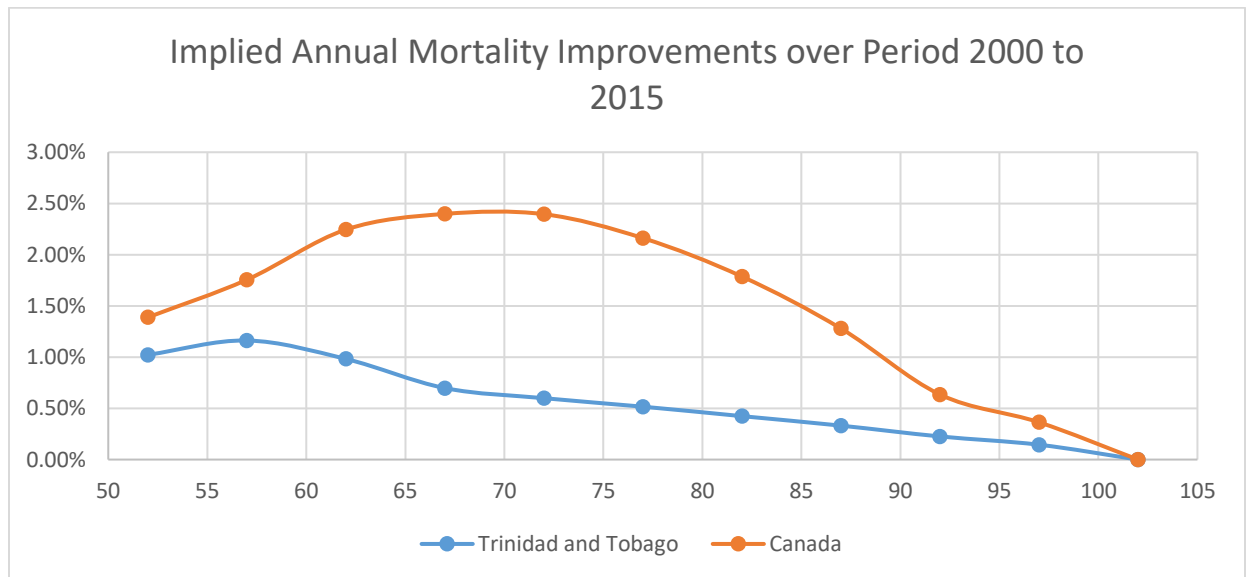
Actual T&T NIS vs GAM94AA and NISTT2012 Mortality Rates



5 EXPECTED FUTURE MORTALITY IMPROVEMENTS

The NISTT2012 tables provide a reasonable estimate of T&T annuitant mortality experienced in 2012. In order to estimate annuitant mortality in subsequent years, actuaries need to adjust for future mortality improvements. Unfortunately, we have no comparative data to easily assess how T&T NIS mortality in 2011-2013 compares to previous years.

The Global Health Observatory data repository of the World Health Organisation (WHO) includes life tables by country with statistics for the period 2000 to 2015. We have used the WHO mortality statistics to estimate and compare the implicit improvements in population mortality rates for Trinidad and Tobago and Canada over the observed period. Details of the mortality rates and implied mortality improvements are given in Appendix 5.



As shown above, the data suggests that T&T population mortality has improved at a slower rate than the equivalent Canadian population. We have also observed several articles indicating that developed country improvement rates have slowed in recent years. As such, for annuitant mortality, we would suggest that 0.5% - 0.75% is a reasonable best estimate for annual future improvements in mortality.

5.1 Example:

Under the NISTT2012 table, the probability of a male dying aged 70 during 2012 was 0.0320.

Assuming a future annual adjustment of 0.5%, the probability of a male dying aged 70 during 2020 would be 0.0307. $0.0307 = 0.0320 * (100\% - 0.5\%) ^ (2020 - 2012)$.

6 POTENTIAL FINANCIAL IMPACT

We have illustrated below the expected future life expectancy and annuity rates for a male and female aged 65 in 2017. The expected T&T results were determined using the NISTT2012 mortality with annual improvements of 0.5% from 2012. The results were compared to GAM94 with and without future mortality improvements.

6.1 Expected Future Life Expectancy- Person Aged 65 in 2017

Mortality	NISTT2012	GAM94	GAM94
Annual Mortality Improvements	0.5% from 2012	-	AA from 1994
Males	16.2	17.3	19.5
<i>Diff from NISTT2012 (years)</i>		1.1	3.3
Females	21.1	20.8	21.8
<i>Diff from NISTT2012 (years)</i>		(0.3)	0.7

6.2 Value of Annuity of \$1 Per Year For Life - Person Aged 65 in 2017, 4% Interest

Mortality	NISTT2012	GAM94	GAM94
Annual Mortality Improvements	0.5% from 2012	-	AA from 1994
Males	11.888	12.578	13.896
<i>Diff from NISTT2012 (%)</i>		6%	17%
Females	14.216	14.200	14.858
<i>Diff from NISTT2012 (%)</i>		0%	5%

6.3 Observations

The life expectancy and annuity rates are generally lower using NISTT2012 projected mortality, particularly for males. T&T female annuitants appear to be experiencing mortality closer to North American expectations.

Local pension plan valuations tend to use assumptions similar to the GAM94 table. Local life insurance company valuations are more likely to have assumptions closer to the GAM94AA figures. The sample NISTT2012 annuity values for a 65 year old, were only 0%-6% lower than GAM94 but 5%-17% lower than GAM94AA.

The differences did not change significantly when we used the NISTT2012 table with 0.75% per year future improvements.



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7 POSSIBLE ADJUSTMENTS

7.1 Risk Margins

The NISTT2012 table is a reasonably credible best estimate of T&T annuitant mortality experienced in 2011-2013. The suggested 0.5%-.75% subsequent annual adjustment would also represent a best estimate range. For valuations requiring assumptions with risk margins, the rates will have to be adjusted.

7.2 Credibility

For larger pension plans or insurance companies, we would suggest a credibility weighted approach. Rates based on the NISTT2012 table can be used as the complement of credibility to individual company experience.

7.3 Lighter Mortality For Insurance Business

It has been suggested that policyholders of individual deferred annuity blocks would be of a higher socio-economic group than the general working population covered by the T&T NIS. As such, they may experience lighter mortality than the NISTT2012 rates. Individual actuaries may wish to make suitable adjustments in this regard.



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8 CONCLUSION

The observed T&T NIS annuitant mortality experience over the period 2011 to 2013 was significantly heavier than the GAM94AA tables (153% males, 119% females). The NISTT2012 mortality table was developed to reflect the observed experience. The T&T NIS mortality is expected to be a closer fit to local pension plan and life insurance annuity mortality than either T&T population mortality or the North American / UK tables in common use.

Based on WHO information, annual improvements in T&T population mortality over age 60 have been around 0.5%-0.75% per year from 2000 to 2015. In the absence of other information, we suggest the use of these rates to project NISTT2012 rates to actual years of use.

The use of the NISTT2012 annuitant mortality table is likely to reduce life insurance annuity and pension reserves compared to current practice. This is likely to be more significant for males than females, and for life insurance companies than pension plans.

This research and the NISTT2012 tables can be developed further to reflect additional local and even regional experience. However, it is hoped that this analysis and the NISTT2012 annuitant mortality table provide valuable information that can be used when predicting expected future mortality for annuitants in T&T.

Copies of this paper and the NISTT2012 annuitant mortality table will be made available on the website of the Caribbean Actuarial Association ("CAA") for ease of access and reference.

If you have any comments or questions, please do not hesitate to send them to the CAA or to us at kr@kr-consulting.com.

**KR SERVICES LIMITED
PORT OF SPAIN
17 November 2017**

APPENDIX 1 – NISTT2012 MORTALITY RATES

Table of NISTT2012 mortality rates for males and females aged x in 2012.
These are qx rates and represent the probability of dying between ages x and x + 1.

Age (x)	Males qx (2012)	Females qx (2012)	Age (x)	Males qx (2012)	Females qx (2012)	Age (x)	Males qx (2012)	Females qx (2012)
20	0.00072	0.00028	53	0.00498	0.00200	86	0.12311	0.07864
21	0.00076	0.00027	54	0.00553	0.00226	87	0.13417	0.08866
22	0.00082	0.00028	55	0.00627	0.00258	88	0.14674	0.09829
23	0.00090	0.00028	56	0.00714	0.00299	89	0.15760	0.11077
24	0.00099	0.00029	57	0.00820	0.00347	90	0.17202	0.12224
25	0.00110	0.00029	58	0.00942	0.00399	91	0.18379	0.13438
26	0.00125	0.00031	59	0.01061	0.00459	92	0.19913	0.14709
27	0.00133	0.00032	60	0.01221	0.00549	93	0.21149	0.16328
28	0.00138	0.00033	61	0.01382	0.00626	94	0.22423	0.17738
29	0.00142	0.00035	62	0.01539	0.00712	95	0.24098	0.19207
30	0.00146	0.00038	63	0.01747	0.00811	96	0.25474	0.20514
31	0.00150	0.00042	64	0.01942	0.00919	97	0.27227	0.22652
32	0.00153	0.00045	65	0.02150	0.01036	98	0.29420	0.24514
33	0.00155	0.00047	66	0.02411	0.01155	99	0.31072	0.26474
34	0.00155	0.00049	67	0.02637	0.01275	100	0.32715	0.28507
35	0.00156	0.00051	68	0.02809	0.01384			
36	0.00158	0.00054	69	0.03026	0.01486			
37	0.00163	0.00057	70	0.03195	0.01596			
38	0.00169	0.00060	71	0.03438	0.01696			
39	0.00176	0.00065	72	0.03713	0.01860			
40	0.00186	0.00070	73	0.04001	0.02017			
41	0.00196	0.00076	74	0.04294	0.02226			
42	0.00209	0.00082	75	0.04699	0.02417			
43	0.00222	0.00087	76	0.05071	0.02681			
44	0.00235	0.00091	77	0.05610	0.03038			
45	0.00249	0.00095	78	0.06238	0.03375			
46	0.00267	0.00099	79	0.06939	0.03736			
47	0.00289	0.00104	80	0.07702	0.04134			
48	0.00314	0.00113	81	0.08514	0.04581			
49	0.00342	0.00123	82	0.09362	0.05088			
50	0.00372	0.00136	83	0.10027	0.05639			
51	0.00407	0.00152	84	0.10869	0.06225			
52	0.00447	0.00175	85	0.11555	0.06992			



**TRINIDAD & TOBAGO NIS MORTALITY 2011-2013
NISTT2012 ANNUITANT MORTALITY TABLE**

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APPENDIX 2 – T&T NIS EXPOSURE AND OBSERVED DEATHS FOR PERIOD 2011 TO 2013

The following sets out the exposure, observed deaths and observed mortality rates (qx 's) by age and gender for the period 1 July 2010 to 30 June 2013.

This information was extracted from Appendix 6 (pages 141 to 143) of the Ninth Actuarial Review of the Trinidad and Tobago National Insurance System as of 30 June 2013, prepared by ENAP International, June 2015.

Copies can be found at: http://www.nibtt.net/Actuarial_Review/9th_actuarial_review.html

APPENDIX 2 (cont'd) – T&T NIS EXPOSURE AND OBSERVED DEATHS FOR PERIOD 2011 TO 2013

Age	Exposure - Males				Deaths - Males				Observed Qx Males
	2011	2012	2013	2011-2013	2011	2012	2013	2011-2013	2011-2013
60	4,403	3,088	3,218	10,709	15	14	14	43	0.00402
61	3,339	3,349	3,477	10,165	57	52	41	150	0.01476
62	3,421	3,349	3,462	10,232	53	63	46	162	0.01583
63	3,196	3,410	3,419	10,025	69	70	59	198	0.01975
64	2,981	3,231	3,505	9,717	55	81	63	199	0.02048
65	3,265	3,155	3,351	9,771	67	61	73	201	0.02057
66	2,961	3,118	3,136	9,214	45	82	68	195	0.02116
67	2,675	2,915	3,060	8,649	62	71	72	205	0.02370
68	2,296	2,618	2,856	7,770	67	62	72	201	0.02587
69	2,073	2,229	2,558	6,860	64	62	77	203	0.02959
70	2,019	2,020	2,174	6,213	56	63	61	180	0.02897
71	1,783	1,960	1,951	5,694	69	76	62	207	0.03635
72	1,765	1,716	1,892	5,373	55	62	81	198	0.03685
73	1,612	1,712	1,645	4,969	51	67	74	192	0.03864
74	1,516	1,553	1,634	4,704	72	85	72	229	0.04868
75	1,383	1,435	1,473	4,291	77	70	74	221	0.05150
76	1,261	1,316	1,368	3,945	62	65	77	204	0.05171
77	1,166	1,182	1,250	3,599	82	65	57	204	0.05668
78	1,020	1,089	1,115	3,224	72	57	73	202	0.06266
79	902	952	1,029	2,883	61	59	74	194	0.06729
80	886	837	894	2,617	63	53	59	175	0.06687
81	802	823	781	2,406	61	59	75	195	0.08105
82	658	737	745	2,139	64	71	73	208	0.09724
83	604	590	677	1,872	57	52	72	181	0.09669
84	570	540	535	1,645	58	54	52	164	0.09970
85	490	509	479	1,478	63	66	59	188	0.12720
86	433	426	453	1,313	55	51	61	167	0.12719
87	403	379	369	1,152	51	49	50	150	0.13021
88	334	356	328	1,017	49	44	49	142	0.13963
89	269	276	314	858	47	33	50	130	0.15152
90	227	221	237	686	46	45	43	134	0.19534
91	179	191	182	553	35	33	35	103	0.18626
92	152	144	160	456	34	31	25	90	0.19737
93	119	121	117	357	21	17	26	64	0.17927
94	88	92	94	274	29	28	22	79	0.28832
95	57	62	73	191	16	13	13	42	0.21990
96	49	47	50	146	5	9	12	26	0.17808
97	27	42	41	110	9	6	14	29	0.26364
98	15	21	35	71	6	11	9	26	0.36620
99	10	10	13	34	5	-	3	8	0.23529
100	9	7	8	24	1	3	5	9	0.37500
TOTAL	51,418	51,828	54,158	157,406	1,986	2,015	2,097	6,098	0.03874



**TRINIDAD & TOBAGO NIS MORTALITY 2011-2013
NISTT2012 ANNUITANT MORTALITY TABLE**

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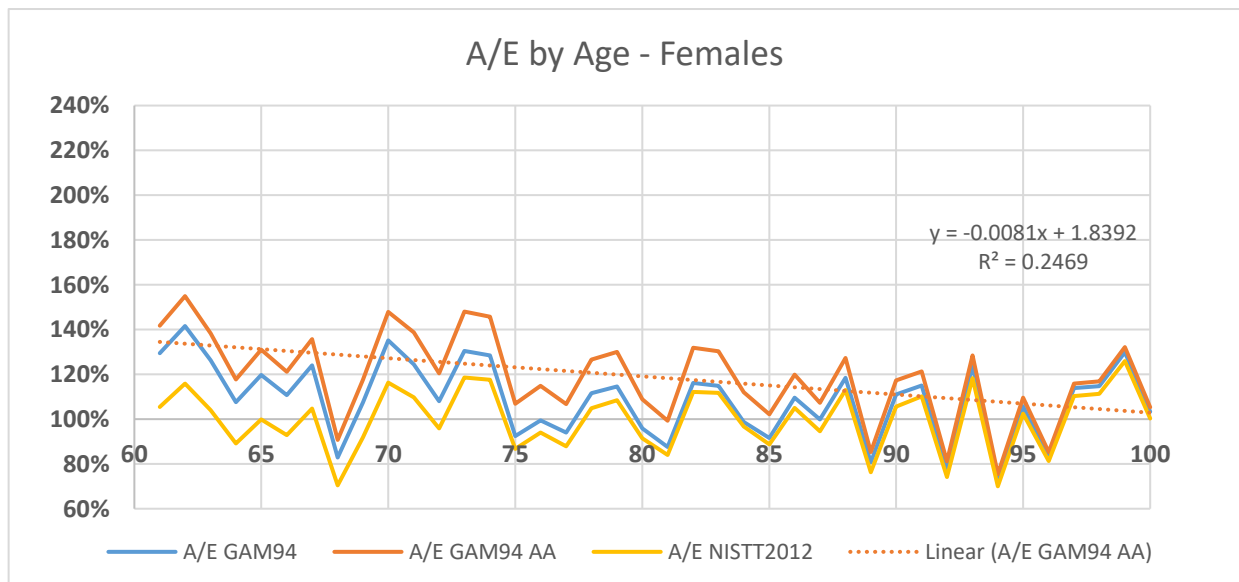
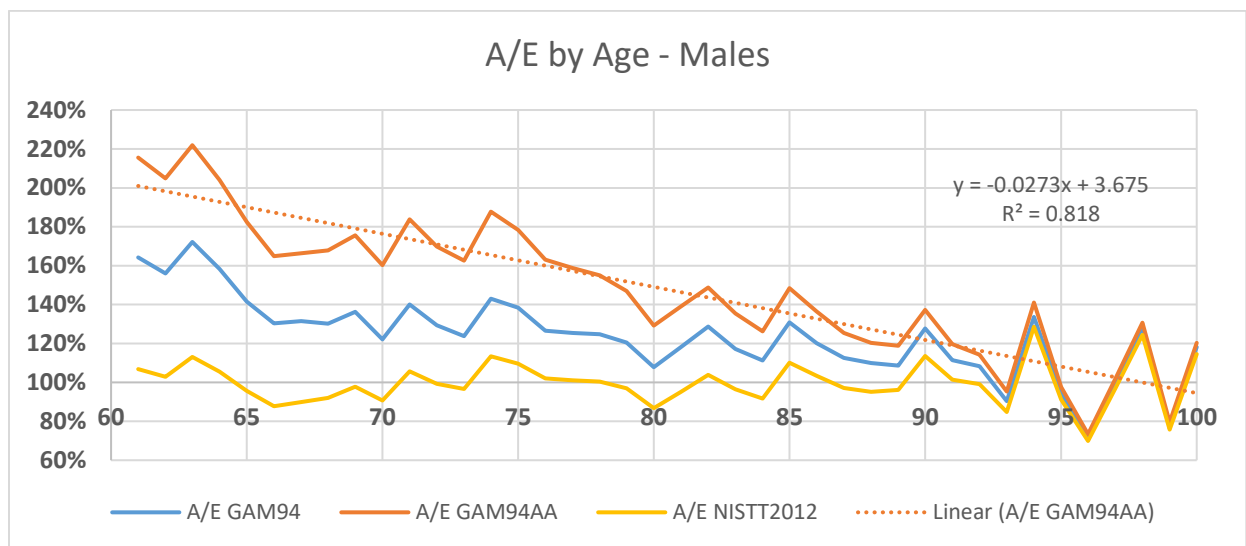
APPENDIX 2 (cont'd) – T&T NIS EXPOSURE AND OBSERVED DEATHS FOR PERIOD 2011 TO 2013

Age	Exposure - Females				Deaths - Females				Observed Qx Females
	2011	2012	2013	2011-2013	2011	2012	2013	2011-2013	2011-2013
60	2,545	1,831	1,998	6,373	7	6	4	17	0.00267
61	1,767	1,908	2,088	5,763	15	12	11	38	0.00659
62	1,780	1,789	2,004	5,572	11	15	20	46	0.00826
63	1,673	1,799	1,865	5,336	19	8	18	45	0.00843
64	1,540	1,703	1,882	5,124	15	11	16	42	0.00820
65	1,613	1,621	1,797	5,031	17	16	19	52	0.01034
66	1,463	1,561	1,637	4,661	12	21	17	50	0.01073
67	1,344	1,454	1,547	4,346	13	22	23	58	0.01335
68	1,133	1,331	1,437	3,900	17	14	7	38	0.00974
69	1,007	1,116	1,321	3,443	15	14	18	47	0.01365
70	970	997	1,104	3,072	8	26	23	57	0.01855
71	862	956	975	2,793	15	18	19	52	0.01862
72	793	850	936	2,579	15	15	16	46	0.01784
73	728	776	837	2,341	15	15	26	56	0.02392
74	714	707	757	2,178	19	20	18	57	0.02617
75	658	699	693	2,050	13	15	15	43	0.02098
76	583	642	681	1,906	22	11	15	48	0.02518
77	535	563	626	1,724	16	12	18	46	0.02668
78	465	515	545	1,525	18	16	20	54	0.03541
79	459	449	499	1,407	17	19	21	57	0.04051
80	451	439	433	1,323	19	14	17	50	0.03779
81	392	436	419	1,248	17	17	14	48	0.03846
82	303	370	413	1,086	26	18	18	62	0.05709
83	280	279	347	905	20	18	19	57	0.06298
84	244	262	259	764	17	18	11	46	0.06021
85	241	222	246	709	19	10	15	44	0.06206
86	200	222	209	630	18	13	21	52	0.08254
87	198	183	202	584	18	18	13	49	0.08390
88	167	175	162	504	17	16	23	56	0.11111
89	132	148	158	438	15	12	10	37	0.08447
90	111	117	137	364	16	11	20	47	0.12912
91	78	94	105	277	12	12	17	41	0.14801
92	66	71	82	220	7	8	9	24	0.10909
93	57	59	60	176	9	10	15	34	0.19318
94	53	49	51	153	6	5	8	19	0.12418
95	44	43	40	127	10	11	4	25	0.19685
96	29	37	37	102	7	5	5	17	0.16667
97	20	22	26	68	4	8	5	17	0.25000
98	11	15	17	44	5	5	2	12	0.27273
99	4	8	12	24	1	3	4	8	0.33333
100	5	4	5	14	-	1	3	4	0.28571
TOTAL	25,718	26,522	28,649	80,884	562	539	597	1,698	0.02099

APPENDIX 3 – T&T NIS PENSIONER ACTUAL vs EXPECTED MORTALITY

This appendix compares the observed mortality experience of T&T NIS pensioners over the period 2011 to 2013 with the expected experience using the US GAM94 Static Table with AA Projections to year of use 2012 ("GAM94AA") and the NISTT2012 table.

The comparisons are shown separately for males and females and for individual ages as well as 5 and 10 year age groupings.



APPENDIX 3 (cont'd) – T&T NIS PENSIONER ACTUAL vs EXPECTED MORTALITY

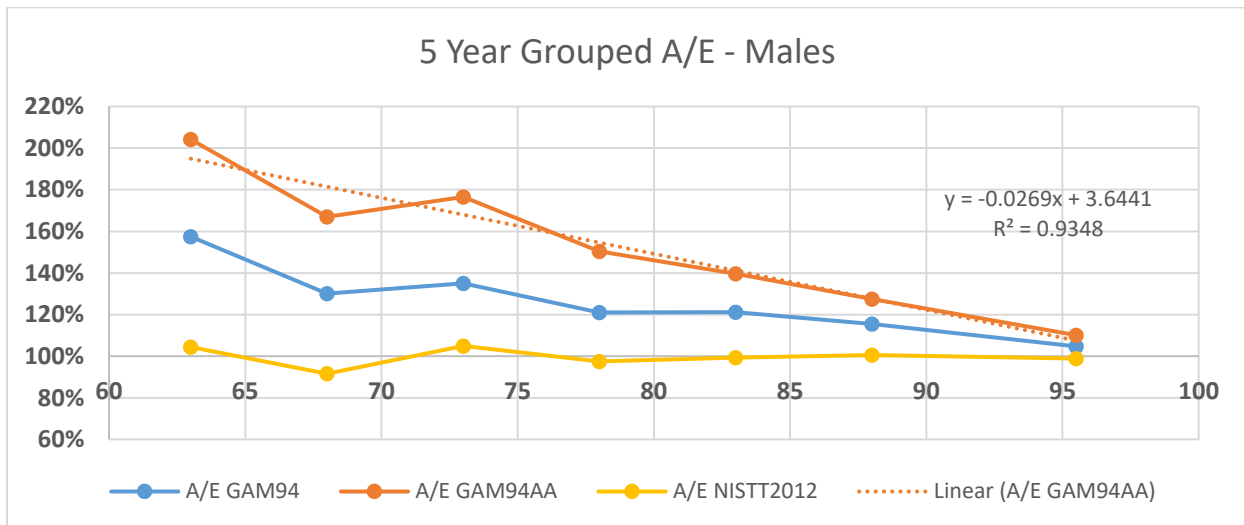
MALES (BY INDIVIDUAL AGES)					
Age (x)	T&T NIS Observed Deaths	GAM94AA Expected Deaths	Actual / Expected (GAM94AA)	NISTT2012 Expected Deaths	Actual / Expected (NISTT2012)
61	150	70	216%	140	107%
62	162	79	205%	157	103%
63	198	89	222%	175	113%
64	199	98	204%	189	105%
65	201	110	182%	210	96%
66	195	118	165%	222	88%
67	205	123	166%	228	90%
68	201	120	168%	218	92%
69	203	116	176%	208	98%
70	180	112	160%	198	91%
71	207	113	184%	196	106%
72	198	117	170%	200	99%
73	192	118	163%	199	97%
74	229	122	188%	202	113%
75	221	124	178%	202	110%
76	204	125	163%	200	102%
77	204	128	159%	202	101%
78	202	130	155%	201	100%
79	194	132	147%	200	97%
80	175	135	129%	202	87%
81	195	140	139%	205	95%
82	208	140	149%	200	104%
83	181	134	135%	188	96%
84	164	130	126%	179	92%
85	188	127	148%	171	110%
86	167	122	136%	162	103%
87	150	120	125%	155	97%
88	142	118	120%	149	95%
89	130	109	119%	135	96%
90	134	98	137%	118	114%
91	103	86	120%	102	101%
92	90	79	114%	91	99%
93	64	67	95%	76	85%
94	79	56	141%	61	129%
95	42	43	98%	46	91%
96	26	35	73%	37	70%
97	29	29	102%	30	97%
98	26	20	131%	21	124%
99	8	10	80%	11	76%
100	9	7	120%	8	115%
TOTAL	6,055	3,949	153%	6,092	99%

APPENDIX 3 (cont'd) – T&T NIS PENSIONER ACTUAL vs EXPECTED MORTALITY

FEMALES (BY INDIVIDUAL AGES)					
Age (x)	T&T NIS Observed Deaths	GAM94AA2012 Expected Deaths	Actual / Expected (GAM94AA2012)	NISTT2012 Expected Deaths	Actual / Expected (NISTT2012)
61	38	27	142%	36	105%
62	46	30	155%	40	116%
63	45	33	138%	43	104%
64	42	36	118%	47	89%
65	52	40	131%	52	100%
66	50	41	121%	54	93%
67	58	43	136%	55	105%
68	38	42	91%	54	70%
69	47	40	118%	51	92%
70	57	39	148%	49	116%
71	52	37	139%	47	110%
72	46	38	120%	48	96%
73	56	38	148%	47	119%
74	57	39	146%	48	118%
75	43	40	107%	50	87%
76	48	42	115%	51	94%
77	46	43	107%	52	88%
78	54	43	127%	51	105%
79	57	44	130%	53	108%
80	50	46	109%	55	91%
81	48	48	99%	57	84%
82	62	47	132%	55	112%
83	57	44	130%	51	112%
84	46	41	112%	48	97%
85	44	43	102%	50	89%
86	52	43	120%	50	105%
87	49	46	107%	52	95%
88	56	44	127%	50	113%
89	37	43	85%	49	76%
90	47	40	117%	44	106%
91	41	34	121%	37	110%
92	24	30	81%	32	74%
93	34	26	128%	29	118%
94	19	25	75%	27	70%
95	25	23	110%	24	102%
96	17	20	85%	21	81%
97	17	15	116%	15	110%
98	12	10	117%	11	111%
99	8	6	132%	6	126%
100	4	4	105%	4	100%
TOTAL	1,681	1,411	119%	1,696	99%

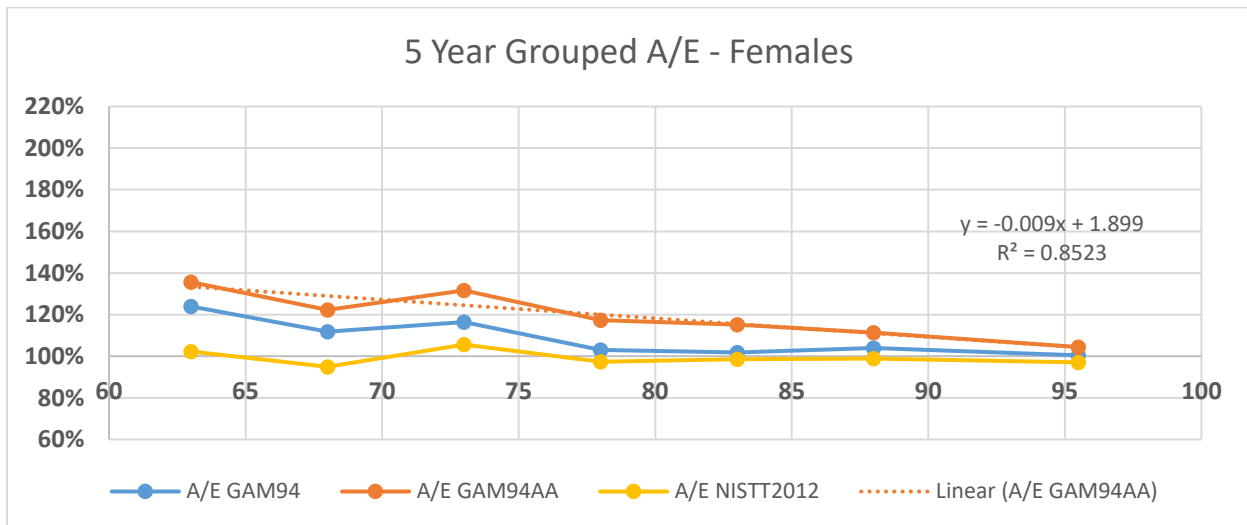
APPENDIX 3 (cont'd) – T&T NIS PENSIONER ACTUAL vs EXPECTED MORTALITY

MALES (5 YEAR AGE GROUPS)					
Age Group	T&T NIS Observed Deaths	GAM94AA Expected Deaths	Actual / Expected (GAM94AA)	NISTT2012 Expected Deaths	Actual / Expected (NISTT2012)
61 - 65	910	446	204%	872	104%
66 - 70	984	589	167%	1,075	92%
71 - 75	1,047	593	177%	998	105%
76 - 80	979	651	150%	1,005	97%
81 - 85	936	670	140%	942	99%
86 - 90	723	567	128%	719	101%
91 - 100	476	432	110%	482	99%
TOTAL	6,055	3,949	153%	6,092	99%



APPENDIX 3 (cont'd) – T&T NIS PENSIONER ACTUAL vs EXPECTED MORTALITY

FEMALES (5 YEAR AGE GROUPS)					
Age Group	T&T NIS Observed Deaths	GAM94AA Expected Deaths	Actual / Expected (GAM94AA)	NISTT2012 Expected Deaths	Actual / Expected (NISTT2012)
61 - 65	223	164	136%	218	102%
66 - 70	250	204	122%	263	95%
71 - 75	254	193	132%	241	106%
76 - 80	255	217	117%	262	97%
81 - 85	257	223	115%	261	99%
86 - 90	241	217	111%	244	99%
91 - 100	201	193	104%	207	97%
TOTAL	1,681	1,411	119%	1,696	99%



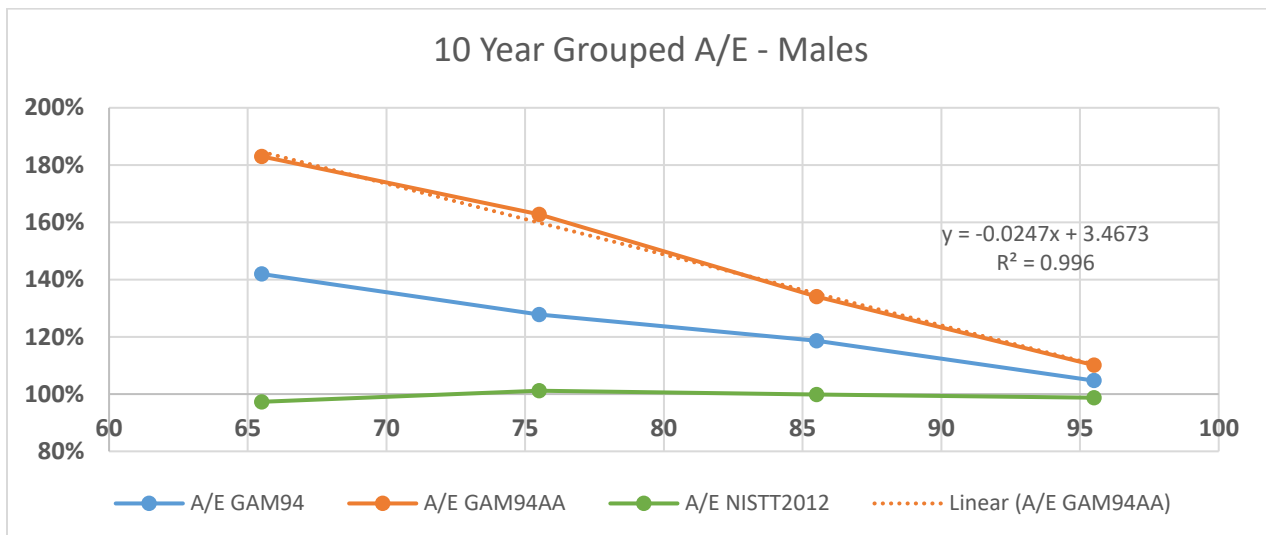


TRINIDAD & TOBAGO NIS MORTALITY 2011-2013
NISTT2012 ANNUITANT MORTALITY TABLE

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APPENDIX 3 (cont'd) – T&T NIS PENSIONER ACTUAL vs EXPECTED MORTALITY

MALES (10 YEAR AGE GROUPS)					
Age Group	T&T NIS Observed Deaths	GAM94AA Expected Deaths	Actual / Expected (GAM94AA)	NISTT2012 Expected Deaths	Actual / Expected (NISTT2012)
61-70	1,894	1,035	183%	1,946	97%
71-80	2,026	1,244	163%	2,002	101%
81-90	1,659	1,237	134%	1,661	100%
91-100	476	432	110%	482	99%
TOTAL	6,055	3,949	153%	6,092	99%



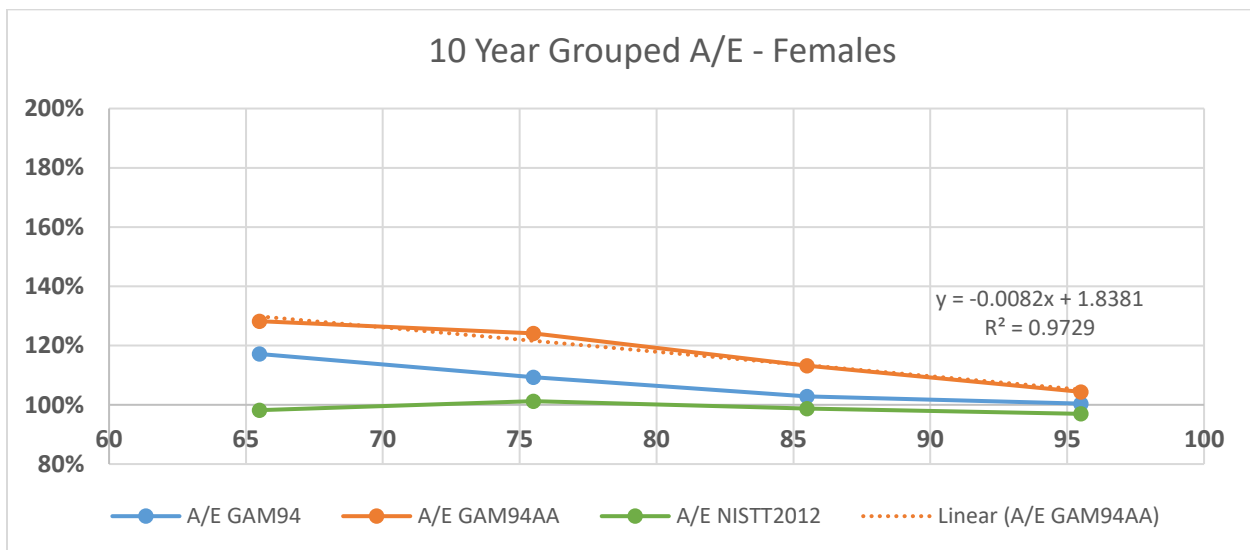


TRINIDAD & TOBAGO NIS MORTALITY 2011-2013
NISTT2012 ANNUITANT MORTALITY TABLE

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APPENDIX 3 (cont'd) – T&T NIS PENSIONER ACTUAL vs EXPECTED MORTALITY

FEMALES (10 YEAR AGE GROUPS)					
Age Group	T&T NIS Observed Deaths	GAM94AA Expected Deaths	Actual / Expected (GAM94AA)	NISTT2012 Expected Deaths	Actual / Expected (NISTT2012)
61-70	473	369	128%	482	98%
71-80	509	410	124%	503	101%
81-90	498	440	113%	504	99%
91-100	201	193	104%	207	97%
TOTAL	1,681	1,411	119%	1,696	99%



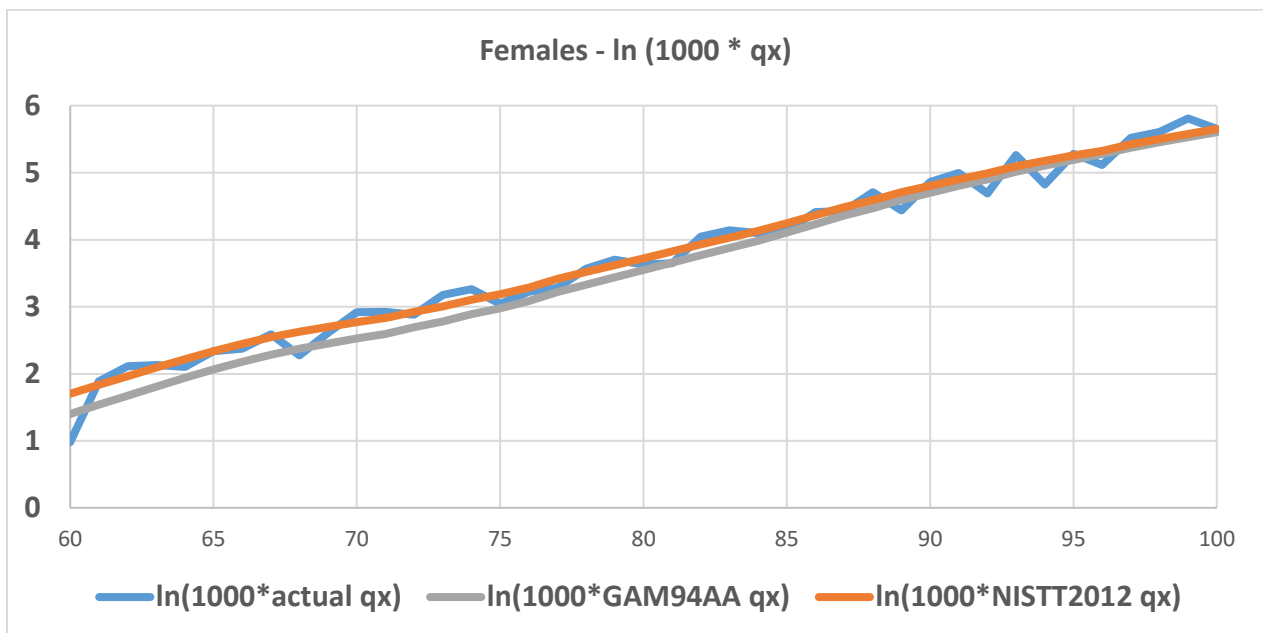
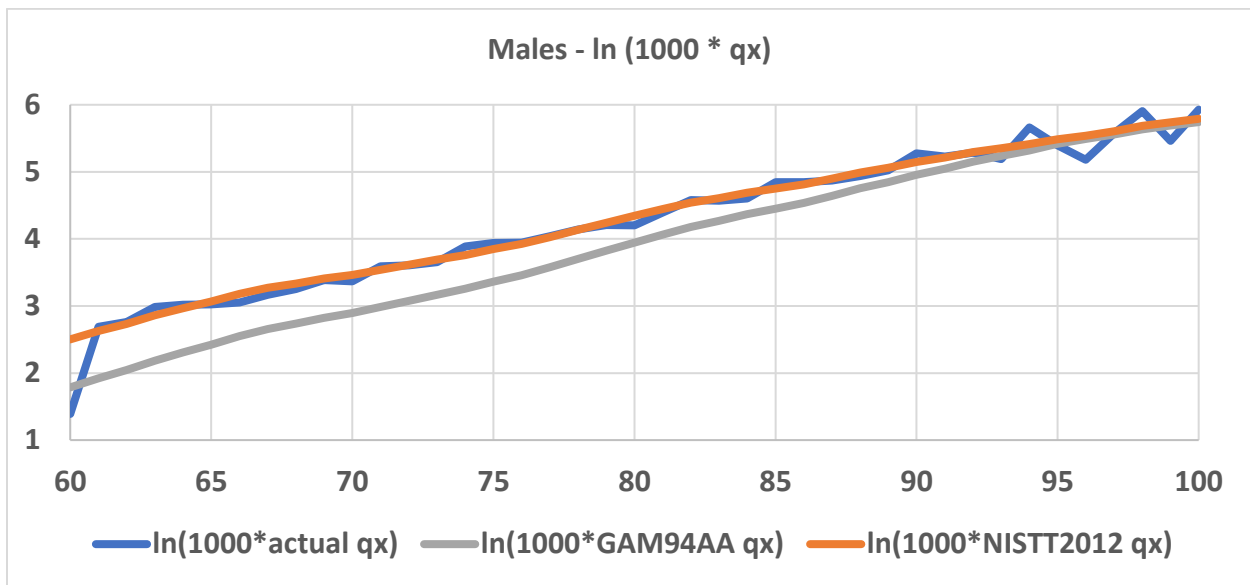


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APPENDIX 4 – NISTT2012 vs US GAM94 ANNUITANT MORTALITY TABLES

The following compares NISTT2012 mortality rates for males and females aged x in 2012 with the equivalent rates from the US GAM94 Static Table ("GAM94") and the US GAM94 Static Table with AA Projections to year of use 2012 ("GAM94AA").

Charts of Actual T&T NIS vs GAM94AA and NISTT2012 Mortality Rates



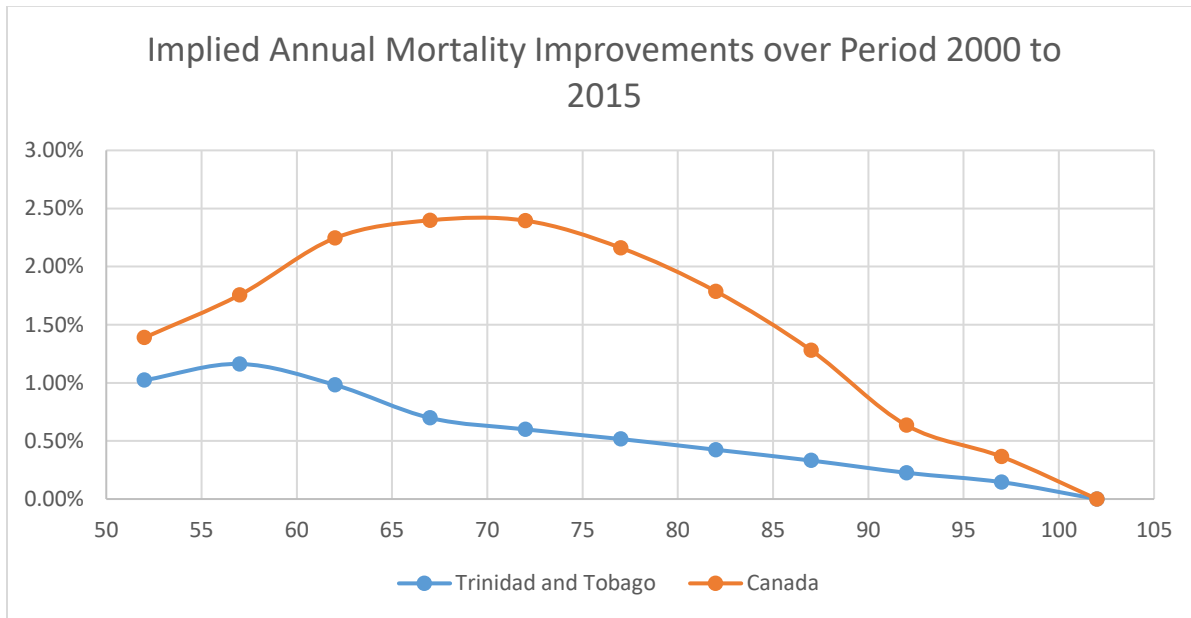
APPENDIX 4 (cont'd) – NISTT2012 vs US GAM94 ANNUITANT MORTALITY TABLES

MALES					
Age (x)	NISTT2012 qx	GAM94 qx	GAM94AA qx	Ratio of NISTT2012 to GAM94 qx	Ratio of NISTT2012 to GAM94AA qx
60	0.01221	0.00798	0.00597	153%	205%
61	0.01382	0.00899	0.00685	154%	202%
62	0.01539	0.01015	0.00773	152%	199%
63	0.01747	0.01147	0.00890	152%	196%
64	0.01942	0.01294	0.01004	150%	193%
65	0.02150	0.01454	0.01128	148%	191%
66	0.02411	0.01624	0.01283	148%	188%
67	0.02637	0.01803	0.01425	146%	185%
68	0.02809	0.01986	0.01541	141%	182%
69	0.03026	0.02173	0.01686	139%	180%
70	0.03195	0.02373	0.01808	135%	177%
71	0.03438	0.02595	0.01977	132%	174%
72	0.03713	0.02848	0.02170	130%	171%
73	0.04001	0.03120	0.02377	128%	168%
74	0.04294	0.03405	0.02594	126%	166%
75	0.04699	0.03721	0.02887	126%	163%
76	0.05071	0.04086	0.03170	124%	160%
77	0.05610	0.04517	0.03569	124%	157%
78	0.06238	0.05021	0.04040	124%	154%
79	0.06939	0.05586	0.04578	124%	152%
80	0.07702	0.06203	0.05176	124%	149%
81	0.08514	0.06862	0.05831	124%	146%
82	0.09362	0.07553	0.06536	124%	143%
83	0.10027	0.08251	0.07140	122%	140%
84	0.10869	0.08961	0.07897	121%	138%
85	0.11555	0.09724	0.08569	119%	135%
86	0.12311	0.10579	0.09323	116%	132%
87	0.13417	0.11567	0.10380	116%	129%
88	0.14674	0.12698	0.11602	116%	126%
89	0.15760	0.13945	0.12742	113%	124%
90	0.17202	0.15293	0.14229	112%	121%
91	0.18379	0.16726	0.15562	110%	118%
92	0.19913	0.18228	0.17268	109%	115%
93	0.21149	0.19839	0.18795	107%	113%
94	0.22423	0.21570	0.20434	104%	110%
95	0.24098	0.23361	0.22534	103%	107%
96	0.25474	0.25151	0.24261	101%	105%
97	0.27227	0.26882	0.25930	101%	105%
98	0.29420	0.28528	0.28019	103%	105%
99	0.31072	0.30130	0.29592	103%	105%
100	0.32715	0.31724	0.31158	103%	105%

APPENDIX 4 (cont'd) – NISTT2012 vs US GAM94 ANNUITANT MORTALITY TABLES

FEMALES					
Age (x)	NISTT2012 qx	GAM94 qx	GAM94AA qx	Ratio of NISTT2012 to GAM94 qx	Ratio of NISTT2012 to GAM94AA qx
60	0.00549	0.00444	0.00406	124%	135%
61	0.00626	0.00509	0.00465	123%	134%
62	0.00712	0.00583	0.00533	122%	134%
63	0.00811	0.00668	0.00610	121%	133%
64	0.00919	0.00762	0.00696	121%	132%
65	0.01036	0.00864	0.00789	120%	131%
66	0.01155	0.00969	0.00886	119%	130%
67	0.01275	0.01076	0.00984	118%	130%
68	0.01384	0.01176	0.01075	118%	129%
69	0.01486	0.01271	0.01161	117%	128%
70	0.01596	0.01373	0.01255	116%	127%
71	0.01696	0.01495	0.01342	113%	126%
72	0.01860	0.01651	0.01481	113%	126%
73	0.02017	0.01834	0.01616	110%	125%
74	0.02226	0.02038	0.01796	109%	124%
75	0.02417	0.02269	0.01963	107%	123%
76	0.02681	0.02533	0.02192	106%	122%
77	0.03038	0.02837	0.02500	107%	122%
78	0.03375	0.03173	0.02796	106%	121%
79	0.03736	0.03536	0.03116	106%	120%
80	0.04134	0.03940	0.03472	105%	119%
81	0.04581	0.04395	0.03873	104%	118%
82	0.05088	0.04915	0.04332	104%	117%
83	0.05639	0.05486	0.04834	103%	117%
84	0.06225	0.06098	0.05374	102%	116%
85	0.06992	0.06774	0.06078	103%	115%
86	0.07864	0.07535	0.06885	104%	114%
87	0.08866	0.08402	0.07818	106%	113%
88	0.09829	0.09382	0.08729	105%	113%
89	0.11077	0.10459	0.09909	106%	112%
90	0.12224	0.11627	0.11014	105%	111%
91	0.13438	0.12875	0.12197	104%	110%
92	0.14709	0.14197	0.13450	104%	109%
93	0.16328	0.15593	0.15041	105%	109%
94	0.17738	0.17068	0.16464	104%	108%
95	0.19207	0.18621	0.17962	103%	107%
96	0.20514	0.20254	0.19537	101%	105%
97	0.22652	0.21966	0.21573	103%	105%
98	0.24514	0.23771	0.23347	103%	105%
99	0.26474	0.25671	0.25213	103%	105%
100	0.28507	0.27643	0.27149	103%	105%

APPENDIX 5 – T&T VS CANADIAN MORTALITY RATES AND IMPROVEMENTS



The Global Health Observatory data repository of the World Health Organisation (WHO) includes population mortality tables. The table on the next page shows the mortality rates, $q_{x,n}$, for Trinidad and Tobago and Canada by gender for the years 2000 and 2015. The probabilities shown $q_{x,n}$ are the probabilities of dying between ages x and $x + n$. These can be accessed at:

- <http://apps.who.int/gho/data/view.main.60290?lang=en>
- <http://apps.who.int/gho/data/view.main.61690?lang=en>

We estimated the average improvement in mortality over the period 2000 to 2015. Average mortality rates were estimated below assuming 50% males and 50% females. The implied mortality improvements were then calculated as the improvement in these average mortality rates over the period 2000 to 2015.

Segregation by sex did not suggest significantly different conclusions. For the age groups above 60, the average of annual Canadian improvements over the period was 1.8% M, 1.4% F. For T&T, it was 0.5% for both males and females.

We note in passing that T&T population mortality is significantly higher than Canadian population mortality. This is illustrated in the graph after the table.

APPENDIX 5 (cont'd) – T&T VS CANADIAN MORTALITY RATES AND IMPROVEMENTS

TRINIDAD AND TOBAGO							
Age	2000			2015			Implied Mortality Improvement
	Males	Females	Average	Males	Females	Average	
50-54 years	0.059	0.032	0.046	0.050	0.028	0.039	1.02%
55-59 years	0.091	0.052	0.072	0.076	0.044	0.060	1.16%
60-64 years	0.138	0.080	0.109	0.118	0.070	0.094	0.98%
65-69 years	0.204	0.117	0.161	0.183	0.106	0.145	0.70%
70-74 years	0.287	0.177	0.232	0.262	0.162	0.212	0.60%
75-79 years	0.392	0.264	0.328	0.362	0.245	0.304	0.52%
80-84 years	0.513	0.378	0.446	0.480	0.356	0.418	0.42%
85-89 years	0.639	0.515	0.577	0.607	0.491	0.549	0.33%
90-94 years	0.753	0.657	0.705	0.727	0.636	0.682	0.23%
95-99 years	0.844	0.782	0.813	0.824	0.767	0.796	0.14%
100+ years	1.000	1.000	1.000	1.000	1.000	1.000	0.00%
CANADA							
Age	2000			2015			Implied Mortality Improvement
	Males	Females	Average	Males	Females	Average	
50-54 years	0.022	0.015	0.019	0.018	0.012	0.015	1.39%
55-59 years	0.037	0.023	0.030	0.028	0.018	0.023	1.76%
60-64 years	0.061	0.036	0.049	0.042	0.027	0.035	2.25%
65-69 years	0.098	0.056	0.077	0.064	0.043	0.054	2.40%
70-74 years	0.155	0.091	0.123	0.102	0.069	0.086	2.40%
75-79 years	0.241	0.149	0.195	0.167	0.114	0.141	2.16%
80-84 years	0.366	0.246	0.306	0.272	0.195	0.234	1.79%
85-89 years	0.552	0.416	0.484	0.451	0.347	0.399	1.28%
90-94 years	0.726	0.613	0.670	0.660	0.557	0.609	0.63%
95-99 years	0.861	0.792	0.827	0.817	0.748	0.783	0.36%
100+ years	1.000	1.000	1.000	1.000	1.000	1.000	0.00%

APPENDIX 5 (cont'd) – T&T VS CANADIAN MORTALITY RATES AND IMPROVEMENTS

