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Canadian Individual Life Experience for Policy Year 2020-2021

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1 Executive summary

This is the 72nd annual report of the intercompany mortality experience for Canadian individual life insurance policies. The study covers the one-year period beginning with the policy anniversary in 2020 on an age-nearest-birthday basis for data submitted by seven companies. This report focuses on individual life insurance policies and riders issued in Canada that require full underwriting; however, other individual life insurance segments are also analyzed. More information about the data can be found in Section 3.

Key enhancements:

- The standard segment now excludes experience of renewable term policies after the first renewal, both for the current policy year and any prior policy years referenced. Renewal experience is reported separately and is still available in the databases.
- The databases for the previous eleven years have been revised due to the discovery of some misclassifications between base policy and riders. As a result, some policy counts have changed, but amounts are unchanged.
- More information on COVID-19 deaths is included in this report.

Key findings:

- There is an increase in overall A/E ratios for this policy year compared to the previous years. This is a notable exception to the overall downward trend in A/E ratios over the last several years.
 - The overall A/E by amount is 95.4% for the current policy year compared to 88.2% for last year, with expected on CIA2014.
 - There is an increase in A/E by amount for all risk classes except male smoking unknown. The increases are larger in the select period than in ultimate.
 - COVID-19 may be responsible for much of the increase, but the increase is larger than COVID-19, especially when measured by amount. More detail on COVID-19 is given in Appendix 3.
- The variation in mortality by policy size remains a very significant factor.
- The study of preferred, residual and non-preferred experience has been clarified by removing some heterogeneity in the comparisons. The A/E ratio by amount for preferred over the last five policy years is shown to be 84% of the A/E ratio for residual for males and 87% for females.

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3 Data and method

3.1 Overview

This is the 72nd annual report of the intercompany mortality experience for Canadian individual life insurance policies. The study covers the one-year period beginning with the policy anniversary in 2020 and ending a day before the next anniversary. Age is presented on an age-nearest-birthday basis. When age-last-birthday was used and a date of birth was provided, age-nearest-birthday is calculated. Other data submitted on an age-last-birthday basis is split with half going to the specified age and half to the next age for both exposures and deaths.

Most tables of this study show experience for standard individual life insurance policies and riders issued in Canada that required full underwriting and prior to the first renewal of renewable term policies. This group of records is referred to as “the standard segment” and sometimes simply as “standard”. Unless stated otherwise, experience in this report is for the standard segment only. For clarity, the standard segment excludes policies or riders that are:

- Joint
- Arising from a conversion
- Substandard
- Simplified Issue
- Guaranteed Issue
- Renewable term after the first renewal
- For attained ages over 100¹

This report includes an analysis of experience for all excluded segments except joint and Guaranteed Issue.

Records were submitted by seven companies, the same as last year. There was a total of 11.1 million records submitted for the 2020-2021 policy year, with a total face amount of \$2.3 trillion. For more details regarding the data, see Appendix 1. Included in the total was \$0.2 trillion of insurance on new issues of 2020. By way of comparison, the CLHIA factbook reported \$3.2 trillion in force in their survey, which includes most of the individual insurance industry, and the LIMRA reported \$0.28 trillion of new business in 2020.

Table 1 shows the quantity of data, both exposure and deaths, included in the standard segment of this study and in the previous four policy years. There were eight contributing companies for the two policy years 2017-2019, and seven for the other years.

Policy year of study	Exposure		Deaths	
	Policies	Amount k\$	Policies	Amount k\$
2016-2017	8,219,029	1,433,797,064	66,849	2,769,583
2017-2018	8,772,594	1,665,759,984	70,837	3,311,577
2018-2019	8,966,388	1,758,496,591	70,473	3,306,913
2019-2020	8,502,604	1,643,703,651	71,596	3,268,585
2020-2021	8,449,396	1,710,567,586	74,761	3,791,424
Total	42,910,011	8,212,324,876	354,515	16,448,083

The numbers for the previous studies have changed because of small corrections in the data for prior years and because of excluding renewable term after the first renewal. More detail on the method can be found in Appendix 1.

¹ See the 2019 report, [rp221113](#), Section 4.9 for more detail on experience at older ages. The analysis is not repeated in this report, but the conclusions are the same: raw mortality rates over age 100 appear to be severely understated. The observed experience from the current year is shown in Appendix 2.

3.2 Contributing companies

Table 2 lists the companies contributing to the current and previous studies. The percentages shown are the proportion of the total exposure that was submitted by each company, calculated by amount.

Company	Exposure %, by amount	
	2019-2020	2020-2021
Canada Life	25.0%	23.7%
Desjardins	5.6%	5.8%
Equitable Life	6.4%	6.8%
Industrial-Alliance	14.1%	14.7%
Manulife	23.2%	23.1%
RBC Life	7.2%	7.4%
Sun Life	18.6%	18.5%
Total	100.0%	100.0%

On behalf of the CIA, we thank these companies for their willingness to contribute, the effort expended and their care to maintain the quality of the study.

Of course, not all companies have the same experience. This year, the actual-to-expected (A/E) ratios on CIA2014 by company were between 95% and 105% of the aggregate A/E for four of seven companies. Last year, three of seven companies were within 5%.

4 Experience for policy year 2020-2021

4.1 Overall results

Table 3 shows the overall results for the standard segment. This table is comprised of three sections: select experience by policy year, select experience by issue age and ultimate experience by attained age. Note that, throughout this report, the select period is taken as the first 20 policy years² from issue. Thus, the first two sections cover the same experience but group the data differently. A/E ratios are shown for both CIA2014 and CIA9704. Standard deviations are calculated on CIA2014 only; if calculated on CIA9704, they would be proportionately smaller because of the A/E ratios being smaller on CIA9704. Tables 4 and 5 present the same data as Table 3, but split between females in Table 4 and males in Table 5.

Overall A/E ratios are higher this year than last. The overall ratios this year are 100.7% for policies and 95.4% for face amount, compared to 98.8% and 88.2% for last year.³ The differences are higher for males than for females and much higher for select than for ultimate.

In Table 3, all A/E ratios in the select section are higher this year than last except for issue ages 10-29 by policies and 10-19 by amount. In the ultimate section, the A/E ratios are consistently higher this year for attained ages 50 and up; for younger ages, some ratios are lower.

² The select period was set at 20 years because CIA2014 is a 20-year select table. For expected on CIA9704, the mortality rates for policy years 16-20 were taken from the ultimate of that table.

³ The A/E ratios shown in the previous report were 99.2% by policies and 90.3% by face amount, but the report last year included the experience of renewable term policies after the first renewal and is not directly comparable with this report.

Table 3. Experience for all data in the standard segment for policy year 2020-2021

	CIA2014				CIA9704		Exposure		Deaths	
	A/E		Std dev		A/E		Pols k	Amt M\$	Pols	Amt k\$
	Pols	Amt	Pols	Amt	Pols	Amt				
Select by policy year										
1st	114.0%	77.1%	9.8%	26.0%	82.8%	54.9%	308.2	145,712	114	31,578
2nd	121.4%	78.2%	8.5%	23.1%	70.1%	47.3%	287.1	133,876	161	42,189
3rd	132.6%	90.3%	8.0%	25.6%	78.2%	55.6%	271.4	122,899	199	52,119
4th	127.5%	83.1%	7.0%	19.5%	78.3%	52.6%	281.5	122,033	248	54,887
5th	118.2%	98.0%	6.2%	17.8%	73.1%	62.4%	310.9	134,633	294	86,663
6-10th	110.6%	96.7%	2.4%	6.7%	69.3%	61.9%	1,266.0	473,260	1,823	476,203
11-15th	113.3%	89.0%	2.2%	7.3%	74.3%	58.2%	890.2	221,043	2,202	328,659
16-20th	112.0%	92.0%	1.7%	6.0%	76.8%	60.7%	760.4	124,710	3,556	391,696
Subtotal	113.3%	91.8%	1.1%	3.6%	74.3%	59.5%	4,375.7	1,478,166	8,597	1,463,995
Select by issue age										
0-9	125.7%	91.0%	11.4%	40.1%	90.8%	63.2%	514.5	57,369	92	6,485
10-19	105.4%	91.6%	10.6%	39.8%	89.3%	76.4%	244.4	39,561	90	11,328
20-29	111.3%	95.4%	5.9%	13.6%	78.8%	64.3%	720.5	207,444	306	62,578
30-39	102.0%	90.6%	3.5%	6.5%	72.0%	63.1%	1,216.6	558,098	799	257,095
40-49	109.4%	91.3%	2.6%	6.6%	70.7%	60.4%	930.0	409,907	1,526	396,067
50-59	111.0%	86.1%	2.2%	7.9%	65.3%	50.7%	524.0	165,448	2,126	332,557
60-69	117.9%	92.3%	2.2%	10.2%	78.3%	56.7%	194.2	35,521	2,323	221,853
70-79	116.6%	100.6%	3.0%	16.1%	85.4%	72.2%	29.8	4,591	1,127	147,636
80-100	161.1%	152.6%	8.0%	24.9%	125.3%	116.7%	1.8	226	211	28,396
Subtotal	113.3%	91.8%	1.1%	3.6%	74.3%	59.5%	4,375.7	1,478,166	8,597	1,463,995
Ultimate by attained age										
20-29	99.0%	90.2%	9.5%	19.0%	88.3%	76.9%	228.5	12,304	106	4,884
30-39	137.2%	116.5%	6.2%	18.6%	130.7%	109.6%	353.3	16,933	335	12,950
40-49	118.4%	115.2%	4.2%	11.5%	113.5%	105.6%	439.8	23,454	643	30,950
50-59	106.9%	95.6%	2.1%	5.2%	84.6%	75.5%	772.3	58,277	2,229	137,779
60-69	101.5%	96.0%	1.1%	3.2%	67.9%	62.8%	1,029.2	70,432	7,261	412,940
70-79	100.8%	94.9%	0.8%	2.7%	76.8%	67.1%	766.0	35,987	15,166	583,536
80-89	101.3%	100.3%	0.6%	3.0%	92.7%	86.8%	380.9	12,396	24,326	722,771
90-100	92.4%	99.2%	0.7%	3.2%	77.9%	81.5%	103.7	2,618	16,100	421,620
Subtotal	99.3%	97.9%	0.4%	1.5%	81.7%	74.9%	4,073.7	232,401	66,164	2,327,430
Total	100.7%	95.4%	0.3%	1.7%	80.8%	68.1%	8,449.4	1,710,568	74,761	3,791,424

Table 4. Experience for all females in the standard segment for policy year 2020-2021

	CIA2014				CIA9704		Exposure		Deaths	
	A/E		Std dev		A/E		Pols k	Amt M\$	Pols	Amt k\$
	Pols	Amt	Pols	Amt	Pols	Amt				
Select by policy year										
1st	128.1%	84.9%	17.4%	46.6%	89.9%	57.3%	145.7	60,830	39	7,873
2nd	126.8%	80.9%	14.2%	32.8%	64.8%	43.0%	136.0	54,201	58	10,998
3rd	138.9%	79.4%	12.8%	37.2%	75.9%	45.8%	130.6	51,492	78	13,254
4th	131.9%	75.7%	11.2%	32.6%	77.4%	46.7%	136.3	52,162	98	15,364
5th	100.6%	160.6%	9.6%	27.2%	60.9%	101.4%	151.3	58,151	100	46,714
6-10th	106.3%	90.4%	3.7%	10.4%	66.9%	58.5%	621.0	201,095	733	148,396
11-15th	107.0%	95.0%	3.2%	10.3%	72.0%	63.9%	460.2	100,064	972	138,490
16-20th	109.0%	90.5%	2.4%	8.5%	79.2%	63.6%	390.8	54,020	1,721	157,012
Subtotal	109.1%	94.0%	1.6%	5.3%	73.8%	62.3%	2,171.8	632,014	3,799	538,102
Select by issue age										
0-9	147.7%	127.0%	19.8%	74.2%	99.1%	80.8%	253.5	28,808	35	3,075
10-19	109.4%	111.0%	19.0%	74.2%	101.6%	102.9%	118.1	19,462	28	4,203
20-29	116.1%	106.7%	9.1%	18.3%	89.0%	79.1%	385.4	106,258	132	26,314
30-39	100.2%	93.5%	5.4%	9.1%	72.4%	67.6%	604.8	246,061	325	92,597
40-49	107.0%	96.1%	4.0%	10.5%	69.3%	63.1%	439.7	156,960	627	133,778
50-59	110.8%	93.0%	3.3%	12.3%	66.2%	53.2%	249.3	57,832	911	106,860
60-69	110.1%	92.1%	3.1%	13.2%	76.9%	59.0%	102.0	13,828	1,035	84,363
70-79	107.7%	79.0%	3.9%	18.4%	80.9%	58.2%	17.9	2,627	612	64,608
80-100	118.5%	148.9%	10.2%	27.4%	92.6%	114.3%	1.1	178	96	22,303
Subtotal	109.1%	94.0%	1.6%	5.3%	73.8%	62.3%	2,171.8	632,014	3,799	538,102
Ultimate by attained age										
20-29	83.1%	64.4%	17.1%	36.6%	75.6%	56.8%	113.7	6,310	26	1,085
30-39	119.3%	100.1%	10.3%	25.8%	125.0%	103.4%	173.4	8,359	104	3,994
40-49	92.4%	93.6%	6.3%	17.4%	90.6%	88.2%	219.3	11,538	213	10,580
50-59	96.1%	87.8%	3.2%	7.4%	75.1%	68.7%	384.6	25,869	883	48,729
60-69	98.5%	93.0%	1.8%	4.4%	66.9%	61.8%	481.0	26,319	2,835	122,530
70-79	99.9%	90.9%	1.3%	3.8%	85.0%	71.7%	336.8	11,783	5,458	143,135
80-89	100.0%	88.8%	1.0%	5.2%	101.0%	84.3%	167.3	4,348	9,056	185,434
90-100	92.8%	100.6%	1.0%	4.6%	82.9%	87.9%	52.2	1,148	7,304	166,832
Subtotal	97.5%	92.7%	0.6%	2.2%	86.4%	76.1%	1,928.3	95,673	25,877	682,319
Total	98.9%	93.3%	0.5%	2.6%	84.5%	69.3%	4,100.1	727,687	29,676	1,220,421

Table 5. Experience for all males in the standard segment for policy year 2020-2021

	CIA2014				CIA9704		Exposure		Deaths	
	A/E		Std dev		A/E		Pols k	Amt M\$	Pols	Amt k\$
	Pols	Amt	Pols	Amt	Pols	Amt				
Select by policy year										
1st	107.9%	74.9%	11.8%	30.7%	79.5%	54.2%	162.6	84,883	75	23,705
2nd	118.6%	77.3%	10.6%	28.8%	73.4%	49.1%	151.1	79,675	103	31,191
3rd	128.9%	94.7%	10.1%	32.7%	79.7%	60.0%	140.7	71,407	121	38,865
4th	124.8%	86.3%	8.9%	24.2%	78.9%	55.2%	145.2	69,870	150	39,522
5th	129.9%	67.3%	8.0%	23.0%	81.6%	43.1%	159.6	76,482	194	39,949
6-10th	113.7%	99.8%	3.2%	8.6%	70.9%	63.6%	645.0	272,165	1,090	327,807
11-15th	118.9%	85.1%	3.0%	10.1%	76.1%	54.7%	430.1	120,979	1,230	190,169
16-20th	115.1%	93.1%	2.4%	8.4%	74.7%	59.0%	369.6	70,691	1,835	234,684
Subtotal	116.8%	90.6%	1.5%	4.9%	74.7%	58.0%	2,203.9	846,153	4,798	925,893
Select by issue age										
0-9	115.2%	72.5%	13.9%	47.2%	86.4%	52.8%	261.0	28,562	57	3,410
10-19	103.8%	83.1%	12.8%	47.1%	84.6%	66.3%	126.3	20,100	62	7,125
20-29	108.0%	88.6%	7.8%	18.8%	72.5%	56.6%	335.0	101,186	174	36,264
30-39	103.2%	89.0%	4.6%	8.7%	71.7%	60.8%	611.7	312,038	474	164,498
40-49	111.2%	89.0%	3.5%	8.3%	71.7%	59.1%	490.3	252,947	899	262,289
50-59	111.2%	83.2%	3.0%	10.0%	64.6%	49.6%	274.7	107,616	1,215	225,697
60-69	125.0%	92.4%	3.0%	14.3%	79.4%	55.4%	92.2	21,693	1,289	137,489
70-79	129.5%	127.8%	4.8%	28.2%	91.5%	88.9%	11.9	1,964	515	83,028
80-100	229.6%	168.0%	13.1%	59.3%	177.3%	126.5%	0.7	48	115	6,094
Subtotal	116.8%	90.6%	1.5%	4.9%	74.7%	58.0%	2,203.9	846,153	4,798	925,893
Ultimate by attained age										
20-29	105.6%	101.8%	11.3%	22.0%	93.5%	85.5%	114.9	5,995	80	3,799
30-39	147.1%	125.7%	7.8%	25.1%	133.5%	112.6%	179.9	8,573	232	8,955
40-49	137.7%	130.9%	5.5%	15.4%	129.7%	117.6%	220.5	11,916	430	20,370
50-59	115.3%	100.5%	2.9%	7.0%	92.2%	79.9%	387.7	32,409	1,346	89,050
60-69	103.5%	97.2%	1.5%	4.1%	68.5%	63.2%	548.1	44,113	4,426	290,410
70-79	101.3%	96.3%	1.0%	3.4%	72.8%	65.7%	429.2	24,204	9,709	440,401
80-89	102.1%	105.0%	0.8%	3.7%	88.3%	87.7%	213.6	8,048	15,270	537,337
90-100	92.0%	98.2%	0.9%	4.4%	74.1%	77.8%	51.5	1,470	8,796	254,789
Subtotal	100.5%	100.2%	0.5%	1.9%	79.0%	74.4%	2,145.4	136,728	40,287	1,645,111
Total	102.0%	96.5%	0.4%	2.2%	78.5%	67.5%	4,349.3	982,881	45,085	2,571,003

Tables following this section in this report show A/E ratios on CIA2014 only, and not on CIA9704. However, all tables in the [Excel workbook supplementary](#) to this study calculate A/E on both mortality tables.

4.2 Distinguishing by smoking status

Table 6 shows the experience by sex and smoking status.

For attained ages under 16, all experience is included under smoking unknown. For all issue ages, smoking is shown as submitted when attained age exceeds 15.

In the select period, non-smokers and smokers generally show higher A/E ratios than last year, and smoking unknown generally lower. In the ultimate, females generally show lower A/E ratios than last year, and males generally higher.

Risk class	A/E		Std dev		Exposure		Deaths	
	Pols	Amt	Pols	Amt	Pols k	Amt M\$	Pols	Amt k\$
Select experience								
Female non-smoker	108.1%	94.8%	1.8%	5.7%	1,716.5	568,425	2,932	477,975
Female smoker	102.2%	87.5%	3.5%	15.2%	206.9	32,789	718	57,330
Female unknown	215.5%	110.2%	11.6%	79.1%	248.4	30,800	149	2,797
Male non-smoker	115.2%	91.4%	1.8%	5.3%	1,675.4	750,837	3,544	812,844
Male smoker	106.9%	84.9%	3.3%	11.9%	270.3	64,595	956	108,697
Male unknown	215.9%	90.0%	8.1%	53.1%	258.1	30,721	298	4,352
All	113.3%	91.8%	1.1%	3.6%	4,375.7	1,478,166	8,597	1,463,995
Ultimate experience								
Female non-smoker	107.8%	93.4%	1.0%	3.3%	902.4	64,991	9,615	438,163
Female smoker	89.2%	87.8%	1.4%	3.3%	362.0	14,797	3,850	110,725
Female unknown	93.4%	94.8%	0.8%	2.3%	663.8	15,885	12,413	133,431
Male non-smoker	107.5%	101.7%	0.9%	3.0%	897.1	93,741	11,366	971,186
Male smoker	95.8%	107.1%	1.4%	3.8%	358.1	17,352	4,652	221,843
Male unknown	98.4%	94.2%	0.6%	1.7%	890.3	25,635	24,270	452,082
All	99.3%	97.9%	0.4%	1.5%	4,073.7	232,401	66,164	2,327,430
All experience								
Female non-smoker	107.9%	94.1%	0.9%	3.3%	2,618.9	633,416	12,547	916,138
Female smoker	91.0%	87.7%	1.3%	5.7%	569.0	47,586	4,568	168,055
Female unknown	94.0%	95.1%	0.8%	2.6%	912.2	46,686	12,562	136,228
Male non-smoker	109.3%	96.7%	0.8%	3.0%	2,572.5	844,578	14,910	1,784,030
Male smoker	97.5%	98.6%	1.3%	5.1%	628.4	81,947	5,608	330,539
Male unknown	99.0%	94.2%	0.6%	1.8%	1,148.4	56,356	24,568	456,435
All	100.7%	95.4%	0.3%	1.7%	8,449.4	1,710,568	74,761	3,791,424

4.3 Distinguishing by preferred underwriting

Table 7 shows the experience for different classes of preferred, separately for males and females. The three classes presented are non-preferred (preferred rates were not available for this plan), residual (preferred rates were available, but the life insured did not qualify) and preferred (the life insured qualified for preferred rates).

Because of the 20-year select period, there is very little exposure in the ultimate period other than for the non-preferred class, and therefore the ultimate is not shown. Because preferred rates are generally available only for face amounts of at least \$100k, and because preferred class non-smoker experience is more credible, Table 7 shows experience only for non-smokers and for amounts of \$100 thousand to \$2 million.

One would expect preferred to have the lowest A/E ratios of the three classes, and residual the highest. The A/E ratios are directionally as one would expect except for male non-preferred compared to male residual by policies. The differences between classes appear to be statistically significant.⁴

Risk class	A/E		Std dev		Exposure		Deaths	
	Pols	Amt	Pols	Amt	Pols k	Amt M\$	Pols	Amt k\$
Select experience								
Female non-preferred	98.0%	95.2%	4.0%	5.7%	411.1	95,088	559	128,871
Female residual	108.6%	103.3%	4.3%	5.5%	561.0	229,406	535	151,031
Female preferred	83.8%	80.7%	6.0%	7.1%	321.4	158,051	218	78,457
Male non-preferred	110.9%	94.8%	3.9%	5.6%	375.5	100,790	707	161,423
Male residual	107.1%	102.7%	3.5%	4.4%	652.2	308,843	853	305,221
Male preferred	78.6%	74.2%	5.2%	6.3%	288.8	152,219	277	109,890
All	101.3%	94.0%	1.7%	2.3%	2,610.0	1,044,396	3,149	934,894

4.4 Distinguishing by size

Table 8 shows the experience for eight size bands of face amount, separately for females and males. Note that each band is closed-open; that is, it begins with the specified amount and ends at less than the second specified amount. Size bands are determined by the total face amount for the coverages in a policy issued on the same date and to the same life. For example, if the base plan was for \$80k, and a rider was for \$200k, then both records would be assigned to the 250-500k band.

The findings in this table are particularly significant. There is a strong downward trend in A/E ratios with increasing size, except for the first band. The highest band for males is an exception, but note the large standard deviation.

⁴ "Statistically significant" generally connotes a confidence of at least 95% that the difference is not due to random fluctuation.

Size band	A/E		Std dev		Exposure		Deaths	
	Pols	Amt	Pols	Amt	Pols k	Amt M\$	Pols	Amt k\$
Female								
0-10k	91.1%	98.8%	0.9%	1.1%	343.1	1,295	9,496	34,817
10k-50k	106.7%	105.7%	0.8%	0.9%	1,183.0	27,333	14,260	268,576
50k-100k	97.0%	96.1%	1.8%	1.8%	734.2	42,234	2,829	159,421
100k-250k	93.2%	92.7%	2.0%	2.0%	949.7	132,439	2,199	278,144
250k-500k	98.9%	98.4%	4.0%	4.0%	456.4	146,665	557	168,355
500k-1M	86.8%	86.7%	5.9%	5.9%	311.7	185,972	228	132,695
1M-2M	88.8%	86.3%	9.8%	9.9%	100.1	112,928	83	91,942
2M+	77.0%	70.4%	16.6%	24.3%	21.9	78,820	25	86,471
All	98.9%	93.3%	0.5%	2.6%	4,100.1	727,687	29,676	1,220,421
Male								
0-10k	95.1%	103.3%	0.8%	0.9%	369.8	1,553	13,411	58,469
10k-50k	108.8%	108.3%	0.7%	0.8%	1,165.0	27,018	19,951	411,758
50k-100k	104.1%	102.7%	1.3%	1.4%	720.8	42,455	5,567	327,268
100k-250k	99.1%	98.4%	1.5%	1.5%	989.8	136,062	4,306	545,508
250k-500k	90.7%	90.7%	2.9%	2.9%	488.5	154,784	997	302,550
500k-1M	89.4%	91.1%	4.0%	4.0%	381.5	224,582	529	311,878
1M-2M	86.8%	86.0%	5.9%	6.0%	177.9	199,831	235	264,895
2M+	91.8%	94.2%	9.7%	14.0%	56.2	196,595	91	348,676
All	102.0%	96.5%	0.4%	2.2%	4,349.3	982,881	45,085	2,571,003

4.5 Distinguishing by policy type

Table 9 shows the experience for various policy types⁵ (also known as plans of insurance or products), separately by sex.

For females, the experience for T10 is significantly lower than for the overall experience, and UL-YRT higher for policies. For males, mortality is significantly higher for T100, UL-YRT and Other for policies.

⁵ The table uses abbreviations for each policy type to save space. "Whole life" means a permanent plan that does not expire but may include endowments. "T100" is term to 100 and similar products. "UL-YRT" means Universal Life with cost of insurance generally varying each year. "UL-LCOI" means Universal Life with level cost of insurance. "UL-LP" means Universal Life with cost of insurance level for a limited period of years and zero thereafter. "T10" means 10-year renewable term; typically, the premium rates for successive terms are much higher than for a newly underwritten T10 at the same attained age; the renewal periods could be 10 years, one year, or some other length. "T20" is similar for 20-year terms. "Other term" means other lengths of renewable term and any other product design which is properly considered term insurance but not T10 or T20. "Other" means all other product designs that do not reasonably fit in any of the preceding types.

Table 9. Summary of experience by sex and policy type, policy year 2020-2021. Expected mortality on CIA2014								
Policy type	A/E		Std dev		Exposure		Deaths	
	Pols	Amt	Pols	Amt	Pols k	Amt M\$	Pols	Amt k\$
Female								
Whole life	98.0%	95.7%	0.6%	3.7%	2,091.5	166,967	22,032	498,897
T100	99.0%	89.1%	2.0%	7.3%	159.0	11,034	2,113	122,754
UL-YRT	112.2%	96.7%	3.8%	13.3%	215.5	31,350	707	61,293
UL-LCOI	101.1%	90.7%	2.0%	8.0%	393.4	52,275	2,153	237,939
UL-LP	92.2%	122.8%	7.8%	29.1%	168.1	21,436	140	20,786
T10	84.4%	74.2%	6.3%	10.4%	247.0	122,926	197	58,281
T20	105.5%	96.9%	4.5%	6.1%	546.9	263,603	482	145,410
Other term	96.4%	86.6%	4.4%	10.3%	140.3	44,540	438	27,681
Other	105.0%	102.8%	2.5%	7.5%	138.3	13,557	1,415	47,380
All	98.9%	93.3%	0.5%	2.6%	4,100.1	727,687	29,676	1,220,421
Male								
Whole life	100.8%	94.6%	0.5%	2.9%	2,259.1	203,654	35,879	1,153,485
T100	108.3%	119.8%	2.0%	6.7%	137.2	14,158	2,458	284,520
UL-YRT	116.5%	100.3%	3.2%	12.0%	224.1	39,758	1,046	129,372
UL-LCOI	105.1%	89.7%	2.1%	7.2%	370.1	73,755	2,293	343,083
UL-LP	101.8%	78.7%	7.6%	21.8%	139.4	19,166	171	17,181
T10	98.5%	100.7%	4.4%	8.9%	334.4	220,062	497	240,508
T20	103.3%	90.0%	3.6%	5.9%	600.4	336,237	750	272,778
Other term	95.4%	84.8%	3.5%	9.9%	160.6	61,404	719	60,116
Other	115.7%	113.9%	2.9%	10.4%	124.0	14,687	1,272	69,961
All	102.0%	96.5%	0.4%	2.2%	4,349.3	982,881	45,085	2,571,003

4.6 Distinguishing by province/region

Contributing companies are asked to provide information on province of residence, but not all companies are able to do so. Table 10 shows experience by province (or region) of residence for those companies that do distinguish by province. "Other" includes the territories⁶ and business that was issued as Canadian but for which the residence is now outside of Canada. The four Atlantic provinces are combined into one region.

One should interpret this table with caution. The distribution by size and by plan could be quite different between provinces; the differences in A/E ratio may reflect that distribution more than a real difference in mortality.

The exposure and deaths are shown as a percentage of the total reported for those companies that distinguished province. The absolute amounts are not shown to protect the privacy of company-specific information.

⁶ There were only 12 deaths for the territories, and as such it is not reasonable to distinguish them in the table.

Table 10. Summary of experience by sex and province/region, policy year 2020-2021. Excluding companies that could not distinguish province. Expected mortality on CIA2014

Province/Region	A/E		Std dev		Exposure dist		Death dist	
	Pols	Amt	Pols	Amt	Pols	Amt	Pols	Amt
Female								
Atlantic	106.6%	96.5%	3.0%	11.5%	4.7%	3.9%	6.2%	4.9%
Quebec	99.5%	91.5%	1.0%	4.5%	38.3%	19.7%	46.2%	27.7%
Ontario	99.8%	87.3%	1.3%	5.5%	30.2%	35.6%	31.9%	36.2%
Manitoba	103.9%	92.5%	5.6%	28.2%	2.1%	2.8%	1.7%	2.8%
Saskatchewan	102.3%	112.2%	5.7%	17.3%	1.7%	2.3%	1.6%	3.1%
Alberta	99.3%	92.2%	3.3%	12.1%	7.5%	12.1%	4.6%	9.2%
British Columbia	91.6%	84.9%	2.9%	11.5%	9.7%	16.1%	5.7%	12.5%
Other	84.2%	96.4%	4.5%	25.2%	5.8%	7.4%	2.1%	3.7%
All	99.2%	90.1%	0.7%	3.3%	100.0%	100.0%	100.0%	100.0%
Male								
Atlantic	112.9%	121.1%	2.3%	8.7%	5.2%	4.1%	7.3%	6.3%
Quebec	104.1%	91.0%	1.0%	4.9%	35.6%	19.7%	37.7%	24.7%
Ontario	103.0%	101.8%	1.0%	4.9%	30.0%	34.4%	33.4%	37.6%
Manitoba	106.3%	121.4%	3.9%	12.2%	2.5%	3.1%	2.5%	3.5%
Saskatchewan	103.2%	86.3%	4.0%	14.1%	2.0%	2.5%	2.3%	1.9%
Alberta	96.2%	91.1%	2.4%	9.7%	8.3%	12.7%	6.0%	8.8%
British Columbia	95.4%	99.5%	2.1%	7.7%	10.0%	14.7%	7.9%	12.7%
Other	89.9%	84.5%	3.2%	20.4%	6.5%	8.9%	3.0%	4.4%
All	102.6%	98.0%	0.6%	2.8%	100.0%	100.0%	100.0%	100.0%

4.7 Distinguishing by cause of death

Table 11 shows the causes of death identified in this study. This table includes the data from only the five companies that were able to submit cause of death consistently. The number and amount (in thousands) of death claims are shown in the second and third columns, respectively. The fourth and fifth columns show the proportion of the number of deaths and amount of death claims of the total for which the cause of death is identified as one of our listed causes except “other” and “unknown”. “Unknown” means that no cause of death was provided to the company or that the cause was stated as “unknown”. “Other” means that the company specified a cause of death not among the 14 codes distinguished by the CIA.

Unfortunately for our study, “unknown” represents a large proportion of the total. However, the proportion does not seem unreasonable when compared to the data published by Statistics Canada; particularly at the older ages, the cause of death is often listed as unknown by Statistics Canada.

The “proportion of policies identified” is generally greater than the “proportion of amount identified”. The exceptions are malignant neoplasms, accidents, intentional self-harm, liver disease and cirrhosis, and assault.

A discussion of COVID-19 deaths compared to inferred “excess” deaths can be found in Appendix 3.

Compared to the report last year, the ranking of causes by number shows little change except that COVID-19 has increased from ninth to third. However, over half of the experience of last years’ study was prior to the pandemic. There are two notable decreases in ranking. Influenza and pneumonia dropped from fourth to fifth. Intentional self-harm dropped from seventh to ninth.

Cause of death	Number of deaths	Death claims k\$	Proportion of policies identified	Proportion of amount identified	A/E by policies	A/E by amount
Malignant neoplasms	14,399	864,775	47.7%	49.3%	29.7%	31.7%
Diseases of heart	6,263	344,070	20.8%	19.6%	12.9%	12.6%
COVID-19	2,079	92,598	6.9%	5.3%	4.3%	3.4%
Cerebrovascular	1,704	91,902	5.6%	5.2%	3.5%	3.4%
Influenza and pneumonia	1,595	65,558	5.3%	3.7%	3.3%	2.4%
Chronic lower respiratory	1,131	51,693	3.7%	2.9%	2.3%	1.9%
Alzheimer's	1,010	52,908	3.3%	3.0%	2.1%	1.9%
Accidents	884	89,363	2.9%	5.1%	1.8%	3.3%
Intentional self-harm	386	51,173	1.3%	2.9%	0.8%	1.9%
Nephritis, etc.	270	14,673	0.9%	0.8%	0.6%	0.5%
Liver disease and cirrhosis	239	22,458	0.8%	1.3%	0.5%	0.8%
Diabetes mellitus	164	4,494	0.5%	0.3%	0.3%	0.2%
Assault	34	6,278	0.1%	0.4%	0.1%	0.2%
Unintended drug overdose	18	1,796	0.1%	0.1%	0.0%	0.1%
Subtotal: identified causes	30,176	1,753,741	100.0%	100.0%	62.2%	64.3%
Other/unknown	18,160	844,599	60.2%	48.2%	37.5%	31.0%
Total	48,336	2,598,340	160.2%	148.2%	99.7%	95.3%

4.8 Distinguishing by rating

The data specifications allow the submission of substandard policies for which the mortality rating was a multiple of standard, but not those with flat extras. These policies are excluded from the study in all subsections except this one.

Table 12 compares the experience for the standard segment with the records indicated as substandard. The expected is on CIA2014 in both cases, with no adjustment for the rating. The data submitted indicates whether a policy is substandard. Some companies began this year providing also the rating assigned in the underwriting process; it is expected that the next study will be able to provide more information about rating.

There is much less substandard experience than standard, and accordingly, standard deviations are much higher for substandard. The summaries do not distinguish by smoking status because the standard deviations for substandard are so large, particularly for smokers and unknown, that no inferences can be drawn.

Table 12. Summary of experience by rating, policy year 2020-2021. Expected mortality on CIA2014								
	A/E		Std dev		Exposure		Deaths	
	Pols	Amt	Pols	Amt	Pols k	Amt M\$	Pols	Amt k\$
All								
Standard	100.7%	95.4%	0.3%	1.7%	8,449.4	1,710,568	74,761	3,791,424
Substandard	171.1%	155.7%	3.2%	17.6%	258.4	91,215	2,341	266,978
Female select								
Standard	109.1%	94.0%	1.6%	5.3%	2,171.8	632,014	3,799	538,102
Substandard	164.7%	125.3%	7.6%	29.4%	102.7	31,665	428	53,533
Male select								
Standard	116.8%	90.6%	1.5%	4.9%	2,203.9	846,153	4,798	925,893
Substandard	168.1%	163.9%	7.2%	25.3%	118.9	57,574	495	151,653
Female ultimate								
Standard	97.5%	92.7%	0.6%	2.2%	1,928.3	95,673	25,877	682,319
Substandard	164.5%	147.8%	5.5%	20.2%	19.8	798	727	17,007
Male ultimate								
Standard	100.5%	100.2%	0.5%	1.9%	2,145.4	136,728	40,287	1,645,111
Substandard	185.8%	181.0%	6.0%	57.1%	17.0	1,179	691	44,785

4.9 Term insurance

Term insurance represents over half of the exposure in the study by amount. There are two aspects of term insurance that can influence the experience.

The first is that most renewable term insurance is designed with the expectation that those who can qualify for a newly underwritten policy at the end of the first term will choose to do so, and those remaining will exhibit markedly higher A/E ratios than would be experienced for a comparable permanent policy. The second aspect is that term insurance can be used either as a base policy or as rider on another policy, and experience may differ between the two.

Table 13 shows the experience for renewable term plans with a term of 5, 10, 15 or 20 years,⁷ base plans compared to term riders and first term compared to renewal. "Renewal" could mean another term of the same length or some other term, as provided by the policy. Note that experience after the first renewal is not part of the standard segment and is shown in Table 13 only.

A/E ratios are markedly higher for renewal terms compared to the initial term for base policies. The same is true for riders overall, but the difference within a size band is not always statistically significant.

A/E ratios are generally lower for riders than for base plans for both the initial term and after the first renewal.

⁷ The data specifications do not permit identifying any other length of term. For term lengths that are not a multiple of five, the code used on the record is for the next shorter term that is a multiple of five. For example, if a coverage had a specified term of 13 years, it would be coded as T10, and the first 10 years would be shown under "first term" and the remaining years under "renewal". As a result, policy years 11-13 would be assigned to the wrong section of the table. This is a limitation in the data. It is not possible to estimate how much of the experience is incorrectly assigned, but it is likely to be small enough that no conclusions would be different.

Table 13. Experience for term plans, policy year 2020-2021. Expected mortality on CIA2014								
Size band	Act/Exp		Std dev		Exposure		Deaths	
	Pols	Amt	Pols	Amt	Pols k	Amt M\$	Pols	Amt k\$
First term, base policies								
0-100k	125.5%	123.2%	7.3%	7.8%	50.8	2,615	222	10,335
100k-250k	106.3%	105.3%	3.6%	3.8%	424.5	58,903	775	100,998
250k-500k	95.4%	94.4%	4.1%	4.2%	572.1	166,216	544	154,770
500k-1M	94.3%	96.4%	5.2%	5.3%	510.1	282,789	338	190,770
1M+	81.3%	83.6%	7.5%	10.6%	250.3	357,357	139	214,415
All	100.6%	92.9%	2.2%	4.2%	1,807.8	867,879	2,018	671,289
First term, riders								
0-100k	n/a	125.1%	n/a	16.5%	n/a	1,175	n/a	2,222
100k-250k	n/a	100.7%	n/a	8.4%	n/a	25,599	n/a	19,903
250k-500k	n/a	99.6%	n/a	11.8%	n/a	35,028	n/a	20,148
500k-1M	n/a	94.8%	n/a	17.0%	n/a	35,667	n/a	16,888
1M+	n/a	37.7%	n/a	34.3%	n/a	24,706	n/a	5,700
All	n/a	86.8%	n/a	8.9%	n/a	122,175	n/a	64,860
Renewal terms, base policies								
0-100k	149.4%	145.0%	9.5%	10.2%	39.5	1,902	272	12,039
100k-250k	148.5%	149.8%	6.6%	6.9%	113.7	14,295	572	70,713
250k-500k	182.2%	178.9%	13.6%	13.9%	43.7	12,307	166	45,945
500k-1M	206.4%	206.3%	22.9%	23.3%	17.2	9,278	67	36,226
1M+	189.7%	226.9%	41.3%	61.2%	4.8	6,553	19	29,950
All	156.4%	174.1%	4.9%	9.2%	219.0	44,335	1,096	194,873
Renewal terms, riders								
0-100k	n/a	139.0%	n/a	14.1%	n/a	824	n/a	5,194
100k-250k	n/a	169.8%	n/a	14.4%	n/a	3,573	n/a	15,753
250k-500k	n/a	141.4%	n/a	34.3%	n/a	1,841	n/a	5,000
500k-1M	n/a	29.2%	n/a	68.7%	n/a	1,065	n/a	500
1M+	n/a	205.4%	n/a	144.7%	n/a	600	n/a	2,000
All	n/a	147.9%	n/a	13.7%	n/a	7,903	n/a	28,447

5 Experience for last five (or ten) years

Although it is important to observe the experience of each year closely, one cannot get the full picture of mortality within the Canadian life insurance industry from one year alone. It is better to examine at least five years. Over that time the effect of statistical fluctuation is of less concern and the trend in mortality may emerge.

However, note that not all companies contributed data in all years. The totals shown reflect the data received.

5.1 Trend in A/E ratios

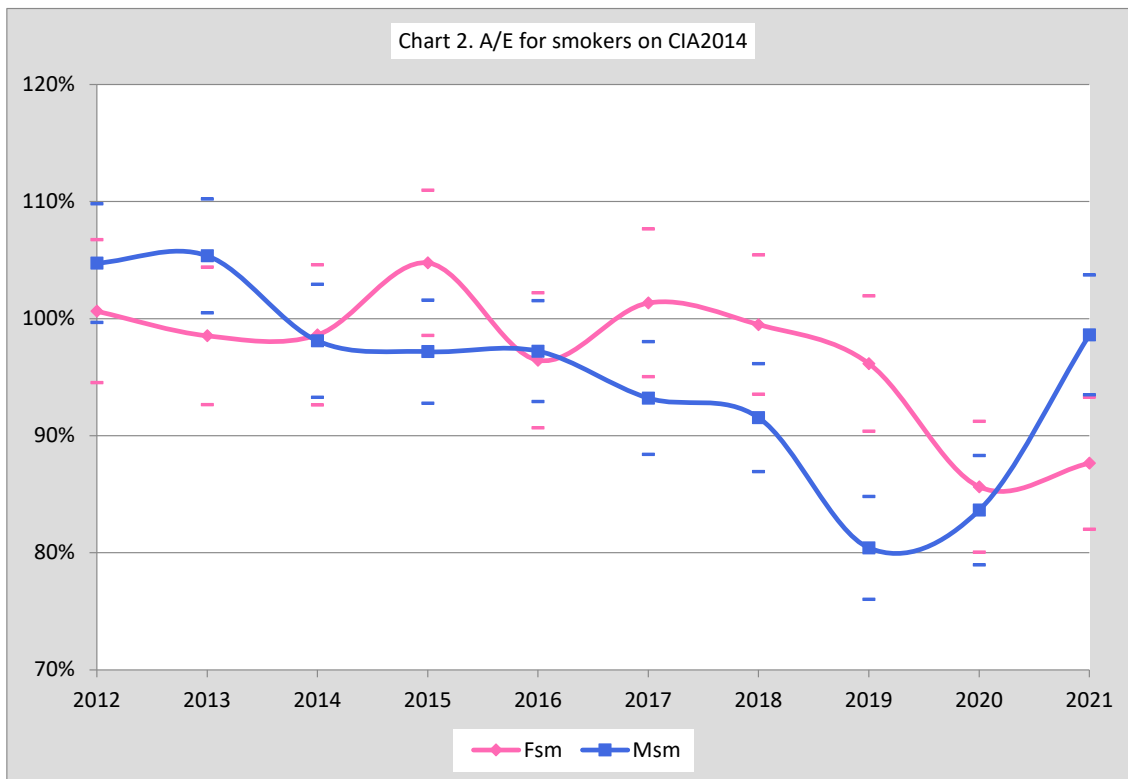
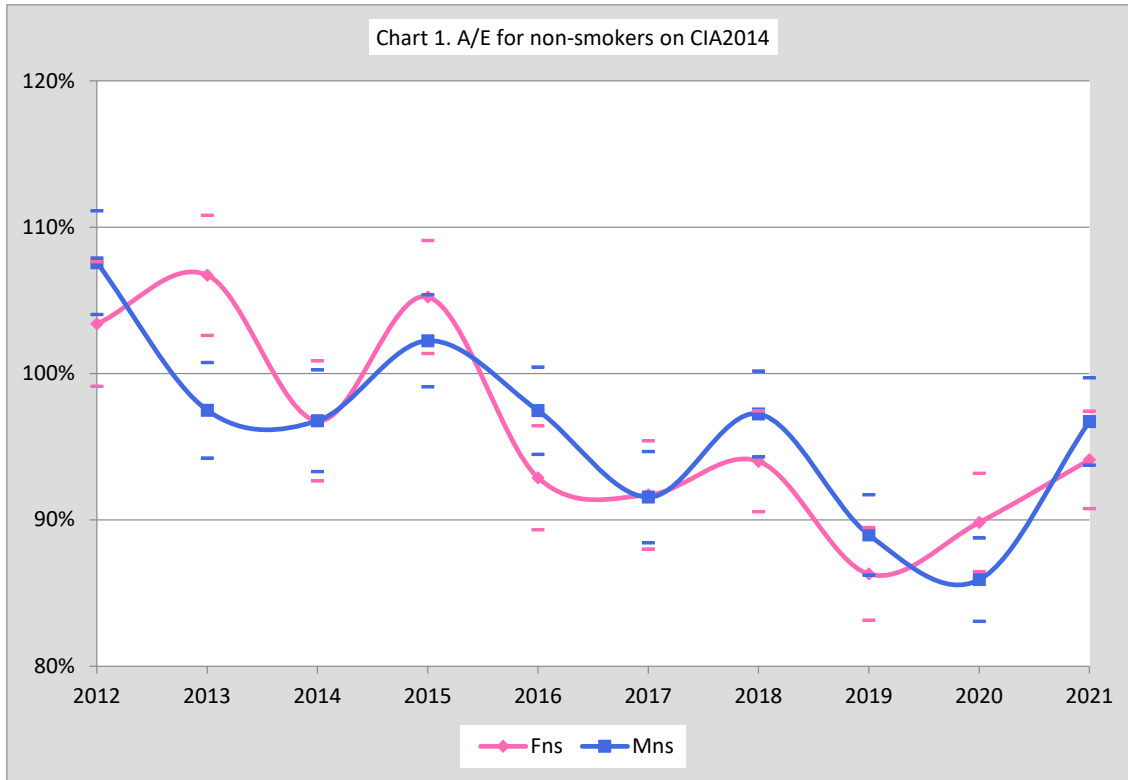
Table 14 shows the A/E ratios for each of the last five years and for the five years combined. Note that there is an increase in A/E ratio for the current year compared to the previous.

The increase in deaths since the previous policy year is partially due to increase in COVID-19 deaths (accounting for a substantial proportion by both policies and amount). However, there are increases and decreases for other causes. For example, cancer is up substantially in both policies and amount. Also, there is a large decrease in "unknown/other".

Policy year	A/E		Std dev		Exposure		Deaths	
	Pols	Amt	Pols	Amt	Pols k	Amt M\$	Pols	Amt k\$
Female								
2016-2017	101.3%	94.1%	0.6%	2.8%	3,941.3	598,588	26,260	888,727
2017-2018	102.1%	95.3%	0.6%	2.7%	4,226.0	702,236	28,009	1,049,841
2018-2019	98.4%	88.6%	0.5%	2.5%	4,334.7	746,415	28,062	1,061,199
2019-2020	98.7%	89.7%	0.5%	2.6%	4,121.3	696,329	28,762	1,086,598
2020-2021	98.9%	93.3%	0.5%	2.6%	4,100.1	727,687	29,676	1,220,421
Last 5 years	99.8%	92.1%	0.2%	1.2%	20,723.3	3,471,254	140,769	5,306,786
Male								
2016-2017	102.1%	93.2%	0.5%	2.2%	4,277.8	835,209	40,589	1,880,856
2017-2018	103.1%	96.6%	0.5%	2.1%	4,546.6	963,524	42,828	2,261,736
2018-2019	99.0%	88.2%	0.4%	2.0%	4,631.7	1,012,082	42,411	2,245,714
2019-2020	98.9%	87.5%	0.4%	2.1%	4,381.3	947,375	42,834	2,181,987
2020-2021	102.0%	96.5%	0.4%	2.2%	4,349.3	982,881	45,085	2,571,003
Last 5 years	101.0%	92.4%	0.2%	0.9%	22,186.7	4,741,070	213,746	11,141,296

Chart 1 shows the A/E ratio by amount for non-smokers for each of the last 10 years for females (in pink) and males (in blue). The pink and blue tick marks above and below the A/E lines represent one standard deviation above and below the mean. Chart 2 shows comparable ratios for smokers.

It is particularly significant to note that this year is the only one of the last nine to show an increase in A/E ratio over the previous year in all of female non-smoker, male non-smoker, female smoker and male smoker. The increase is larger for males than for females. The increase is smallest for female smokers.



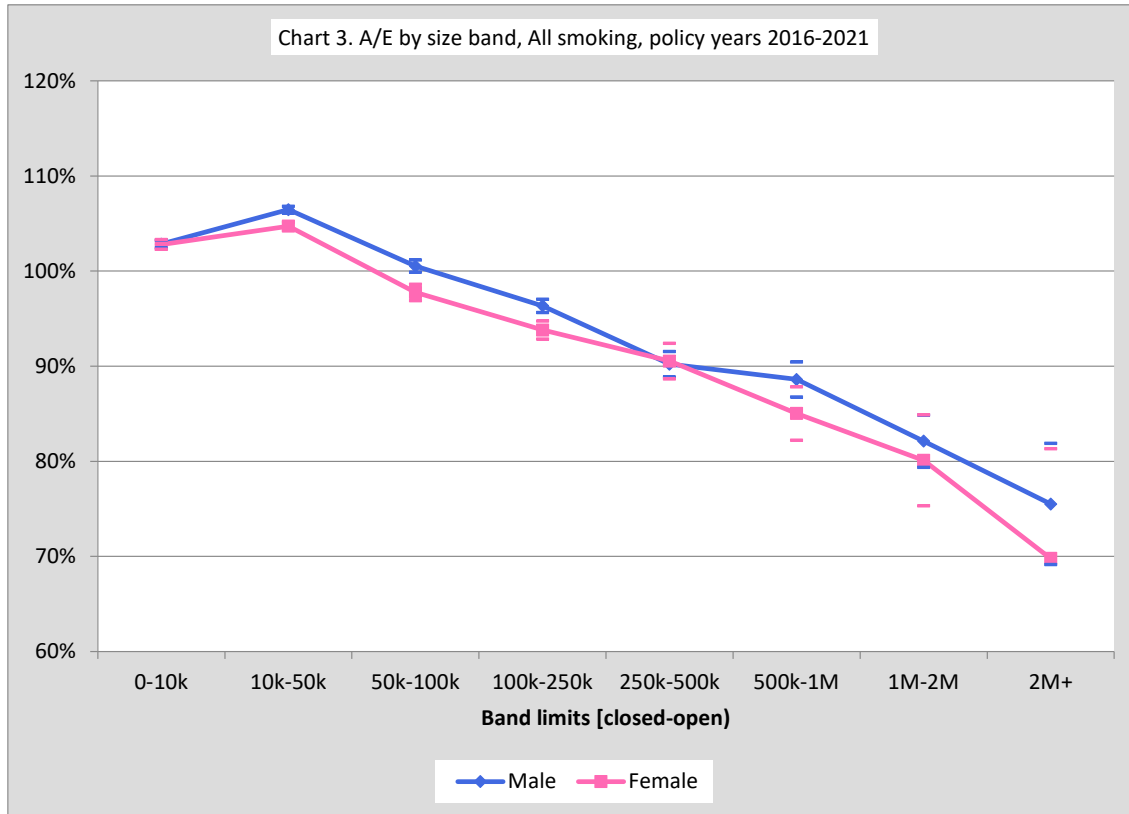
5.2 Size bands

Because the correlation between size and mortality is so significant, it is good to look at the A/E ratios over a five-year period to lessen the effect of fluctuation. Table 15 shows the ratios separately for females and males. (Recall that size bands are closed-open intervals.)

Except for the first band, the A/E ratios decrease monotonically both by policies and amount.

Table 15. Summary of experience, by sex and size, policy years 2016-2021. Expected mortality on CIA2014								
Size band	A/E		Std dev		Exposure		Deaths	
	Pols	Amt	Pols	Amt	Pols k	Amt M\$	Pols	Amt k\$
Female								
0-10k	95.1%	102.8%	0.4%	0.5%	1,787.0	6,692	50,718	186,016
10k-50k	106.1%	104.7%	0.4%	0.4%	5,950.9	137,142	63,951	1,183,031
50k-100k	98.3%	97.8%	0.8%	0.9%	3,609.7	208,216	12,409	703,752
100k-250k	94.2%	93.8%	0.9%	0.9%	4,917.3	667,150	9,975	1,258,496
250k-500k	90.7%	90.5%	1.9%	1.9%	2,406.3	745,759	2,313	695,132
500k-1M	85.4%	85.0%	2.8%	2.8%	1,515.9	880,958	979	562,803
1M-2M	81.8%	80.1%	4.7%	4.8%	444.1	497,349	324	360,545
2M+	74.0%	69.8%	8.1%	11.5%	92.3	327,988	100	357,012
All	99.8%	92.1%	0.2%	1.2%	20,723.3	3,471,254	140,769	5,306,786
Male								
0-10k	95.6%	102.8%	0.3%	0.4%	1,971.4	8,318	69,018	298,751
10k-50k	107.7%	106.5%	0.3%	0.4%	5,970.4	137,830	93,111	1,888,835
50k-100k	101.4%	100.5%	0.6%	0.6%	3,571.1	211,089	23,988	1,420,725
100k-250k	97.1%	96.3%	0.7%	0.7%	5,122.1	689,721	19,252	2,437,132
250k-500k	90.4%	90.2%	1.3%	1.3%	2,572.9	793,856	4,618	1,392,524
500k-1M	88.6%	88.6%	1.8%	1.8%	1,890.9	1,097,152	2,402	1,384,628
1M-2M	82.8%	82.1%	2.7%	2.8%	835.0	934,786	1,012	1,136,651
2M+	80.4%	75.5%	4.6%	6.4%	252.9	868,318	346	1,182,052
All	101.0%	92.4%	0.2%	0.9%	22,186.7	4,741,070	213,746	11,141,296

Chart 3 shows the A/E ratios by amount, the same information as in Table 15. The graphical display shows how strongly size and mortality are related. Note that the tick marks for one standard deviation above and below the observed mean are not evident for the first two bands because the numbers are so close together.



Although the downward trend by size seems strong for both males and females, we should also check the trend for non-smokers and smokers. Chart 4 shows that the downward trend is even more clearly established for non-smokers.

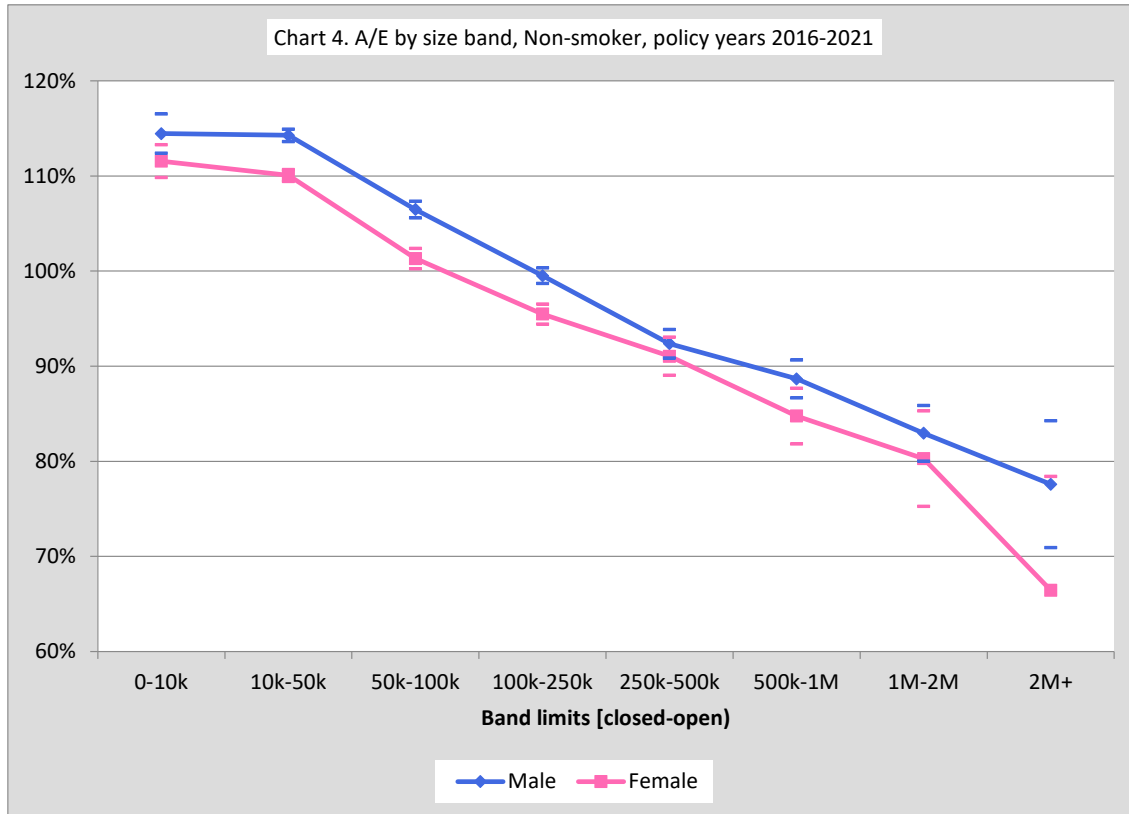
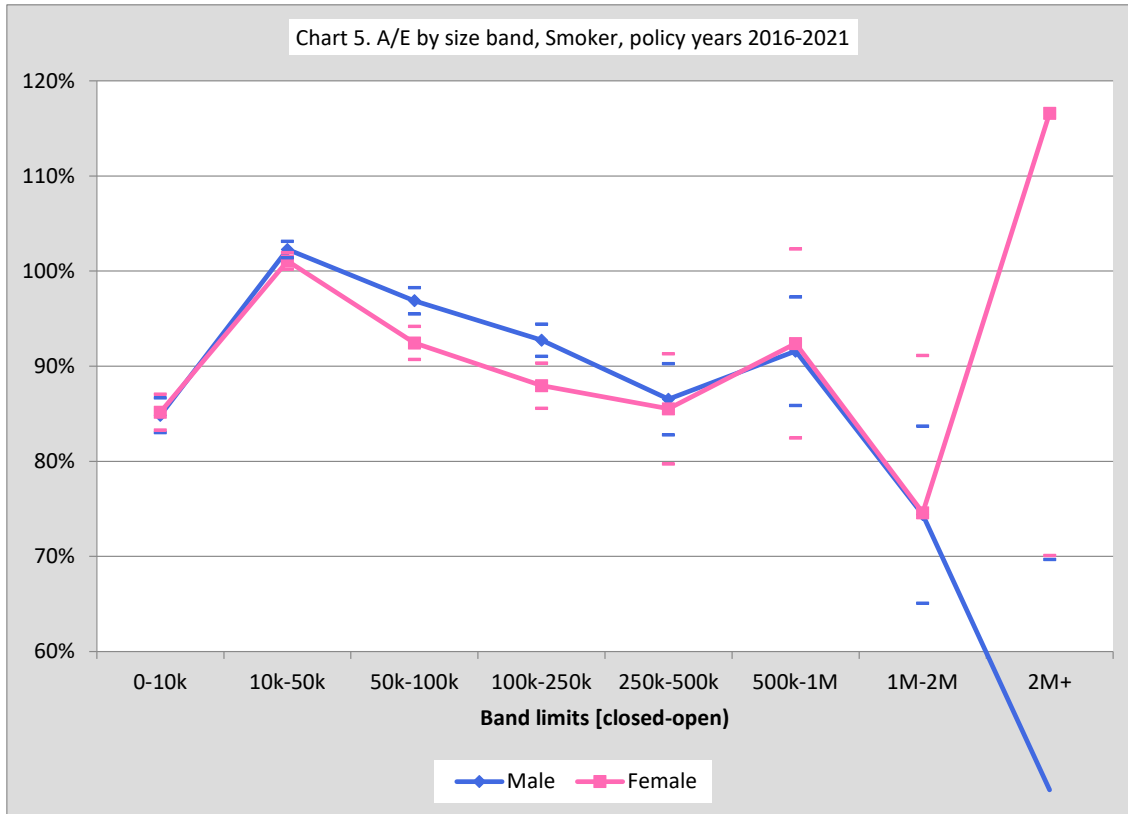


Chart 5 shows comparable information for smokers. The trend is less clear for smokers than for non-smokers. The A/E ratio for the first band is markedly lower than for the second, but thereafter the trend is generally downward. The slope is not as steep as for non-smokers. Incidentally, the average attained age of the first band is much older than for the other bands, mostly more than 20 years older.



5.3 Preferred underwriting

Table 16 shows information comparable to that of Table 7 but for the last five policy years rather than just the current year. Both tables show select non-smoker experience for face amounts of \$100 thousand to \$2 million.

With five years of data, there is more consistency between females and males. The difference between preferred and residual appears to be statistically significant. The male A/E ratio by amount is higher for non-preferred than for residual, but the difference is not significant.

Risk class	A/E		Std dev		Exposure		Deaths	
	Pols	Amt	Pols	Amt	Pols k	Amt M\$	Pols	Amt k\$
Select experience								
Female non-preferred	97.7%	90.5%	1.7%	2.4%	2,154.0	478,201	3,118	652,801
Female residual	96.8%	93.7%	2.0%	2.6%	2,879.4	1,035,692	2,165	589,995
Female preferred	87.0%	81.8%	2.8%	3.3%	1,759.0	828,624	1,033	358,343
Male non-preferred	103.1%	94.6%	1.6%	2.3%	2,019.3	528,008	3,749	890,624
Male residual	97.5%	94.0%	1.6%	2.0%	3,273.0	1,430,656	3,594	1,248,667
Male preferred	83.5%	79.1%	2.4%	2.8%	1,577.5	808,022	1,386	551,665
All	96.4%	90.2%	0.8%	1.0%	13,662.2	5,109,204	15,045	4,292,095

5.4 Distinguishing by par/non-par

In order to make a more consistent comparison, only whole life policies are included in this subsection.

Table 17 shows select and ultimate separately and size bands within each. The A/E ratio for par is lower than for non-par overall and for most size bands. For the higher size bands, the standard deviations are so large that no valid statistical inferences can be drawn, and therefore, the highest three size bands have been combined into 500k+.

Many of the differences appear to be statistically significant. It would likely be wise to study the differences between par and non-par in more depth before concluding that the mortality assumption should be different between par and non-par. Even within whole life, there can be significant differences in product design; there are differences between companies in what products are offered as par or non-par.

Table 17. Summary of experience, whole life policies only, by par and size, policy years 2016-2021. Expected mortality on CIA2014

Size band	A/E		Std dev		Exposure		Deaths	
	Pols	Amt	Pols	Amt	Pols k	Amt M\$	Pols	Amt k\$
Non-par select								
0-10k	226.6%	187.6%	3.4%	5.6%	99.1	222	1,769	2,417
10k-50k	133.7%	132.9%	2.0%	2.2%	730.5	15,716	2,910	54,790
50k-100k	129.9%	130.5%	4.6%	4.7%	484.5	25,027	558	29,378
100k-250k	123.2%	123.0%	5.1%	5.5%	519.0	53,443	433	44,813
250k-500k	95.7%	87.9%	11.5%	13.9%	121.0	19,358	66	11,882
500k+	88.3%	99.6%	12.3%	24.0%	89.9	62,829	53	56,238
All	149.7%	116.4%	1.5%	8.1%	2,044.0	176,596	5,789	199,518
Par select								
0-10k	143.8%	129.7%	4.1%	4.9%	56.3	264	751	3,038
10k-50k	118.4%	114.6%	1.7%	1.9%	1,222.4	36,057	3,576	88,032
50k-100k	110.0%	108.3%	3.0%	3.1%	789.2	50,947	1,086	66,107
100k-250k	102.8%	100.9%	3.1%	3.3%	932.7	122,881	963	121,979
250k-500k	89.5%	87.6%	5.5%	5.9%	358.3	93,894	272	76,747
500k+	79.1%	72.3%	5.1%	10.9%	378.4	518,351	274	392,603
All	113.2%	84.0%	1.2%	6.7%	3,737.3	822,394	6,922	748,505
Non-par ultimate								
0-10k	84.3%	96.4%	0.7%	0.9%	414.3	1,464	13,899	49,344
10k-50k	111.1%	110.1%	0.6%	0.7%	1,675.1	30,415	24,310	403,083
50k-100k	98.7%	98.9%	1.4%	1.4%	828.3	43,532	4,565	245,943
100k-250k	98.0%	98.4%	2.4%	2.5%	235.8	25,042	1,469	167,920
250k-500k	89.0%	89.0%	6.9%	7.1%	14.1	3,859	159	46,464
500k+	105.6%	95.5%	9.5%	12.4%	5.4	4,281	100	83,854
All	99.4%	102.0%	0.4%	1.3%	3,173.1	108,593	44,501	996,608
Par ultimate								
0-10k	96.2%	103.5%	0.3%	0.3%	2,948.8	12,079	97,343	402,627
10k-50k	104.2%	102.8%	0.3%	0.4%	5,686.2	134,715	92,249	1,884,044
50k-100k	96.7%	95.2%	0.7%	0.8%	2,041.8	129,235	15,441	960,048
100k-250k	90.4%	89.3%	1.0%	1.1%	1,340.4	163,883	7,735	981,381
250k-500k	87.4%	86.2%	2.6%	2.7%	166.0	49,475	1,122	350,110
500k+	87.3%	88.8%	3.8%	5.6%	58.8	55,686	542	542,849
All	99.2%	95.8%	0.2%	0.7%	12,242.2	545,073	214,432	5,121,059

5.5 Converted policies

Converted policies are excluded from the standard segment, but for this section only, converted policies are shown.⁸ The data specifications distinguish several types of conversions: term to permanent, term to term, from UL-YRT, from

⁸ That is, the filter used is the same as for the standard segment except that the selection applying to conversion is inverted. Thus, for example, substandard and renewable term after the first renewal are still excluded.

group, from other types of policies and unknown type of conversion. Table 18 keeps term to permanent and group conversions separate and combines all other types of conversions. Expected mortality uses the duration from conversion, not from original issue. The latter would be preferred (except for group conversion for which it is not applicable), but too few companies are able to provide the date of original issue.

A/E ratios for conversions from term to permanent are quite high in the initial five policy years, but there is a strong downward trend with increasing duration. The ultimate is closer to what is observed for the standard segment but is 13% higher.

A/E ratios for other individual conversions do not show a clear pattern.

A/E ratios for group conversions are very high initially, but they decrease rapidly. Group conversions have significantly higher mortality than term-to-permanent conversions at all durations. Ultimate group conversion mortality is higher than ultimate standard mortality for all attained ages. Ultimate group conversion mortality A/E decreases by attained age; however, it does not converge to the standard segment mortality A/E by attained ages 90-100.

Further investigation done for the previous report showed that the higher mortality is not related to differences in size.

Table 18. Summary of experience for converted policies, policy years 2016-2021. Expected mortality on CIA2014								
Policy years	A/E		Std dev		Exposure		Deaths	
	Pols	Amt	Pols	Amt	Pols k	Amt M\$	Pols	Amt k\$
Converting term to permanent								
1-5	236.6%	186.1%	4.1%	13.0%	575.0	135,127	1,837	214,714
6-10	169.0%	143.4%	2.9%	8.5%	493.9	87,194	2,602	276,978
11-15	145.3%	128.7%	2.6%	7.6%	344.3	51,379	2,686	268,904
16-20	132.5%	123.1%	2.6%	7.7%	234.9	29,263	2,462	223,834
21+	109.0%	108.3%	1.2%	3.1%	534.0	42,761	9,806	576,257
All	129.1%	126.7%	0.9%	2.8%	2,182.1	345,724	19,393	1,560,687
Other individual conversions								
1-5	145.9%	143.2%	6.1%	10.9%	426.3	187,951	511	180,077
6-10	121.5%	102.3%	5.0%	8.2%	335.6	131,729	617	181,118
11-15	118.2%	106.1%	6.2%	11.6%	132.7	27,734	397	59,875
16-20	123.9%	109.4%	5.2%	10.5%	85.8	10,265	576	56,912
21+	113.0%	120.9%	4.9%	9.0%	52.4	6,070	587	70,046
All	123.4%	116.8%	2.4%	4.8%	1,032.8	363,749	2,688	548,029
Group conversions								
1-5	682.8%	957.4%	9.5%	14.3%	44.7	3,482	965	68,698
6-10	264.2%	279.4%	6.8%	10.4%	41.3	3,078	723	37,590
11-15	217.7%	226.8%	6.0%	9.3%	34.0	2,437	762	36,596
16-20	164.4%	168.7%	5.4%	8.4%	23.4	1,439	702	28,351
21+	136.2%	136.4%	1.7%	2.8%	144.9	4,600	5,367	122,046
All	166.0%	205.0%	1.5%	2.6%	288.2	15,035	8,519	293,280

5.6 Simplified Issue

Data has been submitted for Simplified Issue policies for eight years. The experience on these policies appears in this subsection only.

As stated in the request for data to contributing companies, “Simplified Issue refers to products that ask a short list of health questions and require no physical evidence.”

For these products, there may be proportionately more claims for less than the face amount, particularly in the first two years. However, this report uses the face amount for all deaths even if the claim is settled for some lesser amount.

Table 19 shows experience for Simplified Issue for the last five years. As expected, A/E ratios are much higher than for the standard segment, and the difference remains large into the ultimate period.

	A/E		Std dev		Exposure		Deaths	
	Pols	Amt	Pols	Amt	Pols k	Amt M\$	Pols	Amt k\$
Female select	248.7%	180.6%	4.4%	10.5%	328.9	56,703	2,082	51,636
Male select	266.5%	172.3%	4.9%	10.5%	293.9	55,968	1,807	66,647
Female ultimate	138.5%	146.6%	6.2%	7.8%	12.9	173	510	4,036
Male ultimate	148.5%	145.5%	9.4%	13.9%	10.7	187	247	2,529
All	226.6%	174.0%	2.8%	7.1%	646.5	113,031	4,646	124,848

6 Significant observations

The more significant observations for the study are:

1. There is an increase in overall A/E ratios for this policy year compared to the previous. This is a notable exception to the overall downward trend in A/E ratios over the last several years. The overall A/E by amount is 95.4% for the current policy year compared to 88.2% for last year. There is an increase in A/E by amount for all risk classes except male smoking unknown. The increases are larger in the select period than in ultimate.
2. For calendar years 2020-2021, excess death claims are estimated to be 8.6% of trended death claims by amount and 4.8% by policies. COVID-19 death claims are 3.6% by amount and 4.3% by policy. COVID-19 appears to be responsible for much of the increase by policy but less so by amount. See Appendix 3 for details.
3. The A/E ratios decrease strongly with increasing face amount, especially for non-smokers. Size and mortality are strongly correlated. Size is probably the most significant factor not currently reflected in standard mortality tables.
4. The A/E ratios (considering whole life policies only) for par are significantly lower than for non-par, and the difference persists within most size bands.
5. The A/E ratio for preferred is 84% of the A/E ratio for residual for males and 87% for females by amount. The relationship between non-preferred and residual is less clear.
6. The mortality experience for group conversions and for term policies converted to permanent is significantly higher than for the standard segment and remains higher in the ultimate period.
7. Mortality experience for Simplified Issue policies is higher than the standard segment, and this persists into the ultimate policy years.

7 For further study

7.1 *Additional tables available*

More detailed tables for the current year and for the last five years are available in an [Excel workbook](#). The format of all tables is the same as shown above for Table 3. There is a worksheet called “index” that lists all tables available and provides a hyperlink to each table.

7.2 *Database for independent study*

The format for the database is the same as last year. There is a file, in comma-separated-value format, for the current year and each of the prior 11 years. The database contains expected fields on CIA2014. There is a supplied Excel workbook that may be used to change the table for expected mortality to any table desired by the member. CIA2014, CIA9704 and CIA8692 are supplied in the workbook. The member may use one of these tables as published, or apply a multiple to it or add a worksheet for a completely different table.

There is a zipped archive containing each of the 12 years available [here](#). The archive contains the databases, text files with a detailed description of the database and its codes and said workbook. The previous databases have been revised because a non-material error was found in what was published last year. Policy counts were off in some cases; amounts were correct.

8 Credits

This report was prepared by R.C.W. (Bob) Howard and approved by the CIA Research Council, the Experience Research Committee and the Life Insurance Mortality Subcommittee:

Alison Rose, FCIA (Chair, Research Council)

Martin Labelle, FCIA (Chair, Mortality Risk Research Committee)

Canadian Insured Life Annual Mortality Study Subcommittee:

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Appendix 1 Details of data and method

1.1 History of changes

1.1.1 2020-2021

The data specifications allowed for a numeric rating for substandard policies rated as a multiple of a standard table. The change was optional for this year of experience.

The experience of renewable term policies and riders after the first renewal was removed from the standard segment and studied only separately.

1.1.2 2019-2020

There were no changes in the data specifications for this year.

Some changes were made to data of prior years. The most significant change is in the preferred type indicator; two companies discovered errors affecting many prior years. An error was found and corrected in the categorizing of term plans between base and rider for one company. Other changes have only a small impact on the previously reported results of prior years. A few deaths in prior years were found to have been reported in error. Some policies that had been reported as lapses were subsequently reinstated; the correction causes a very small increase in exposure.

1.1.3 2018-2019

1. Cause of death is requested for all death records.
2. Substandard business may be included if separately identified and the rating is a multiple of the standard class. Business with flat extras is still excluded.
3. Province code is to refer to current residence.
4. Guaranteed Issue business may be included and separately identified.
5. Policies are counted after combining records with the same policy number and other identifying fields. Previously, one policy was counted for each unique combination of policy number, sex, date of birth and policy type. In both cases, riders were ignored for policy count.
6. The size band was determined by totalling the amounts for all records with the same policy number, date of issue and date of birth. Previously, the size band was determined for each record independently.

1.1.4 2017-2018

1. Province code was requested, based on province of residence at issue.
2. Codes were added to indicate whether blood, urine or saliva were used in the underwriting process.

1.1.5 2013-2014

1. Codes to indicate the type of conversion and the date of conversion were added. In 2013-2014 and 2014-2015 conversions with issue date equal to conversion date were excluded. Subsequently all conversions were excluded.
2. Simplified Issue business may be included and separately identified.

Not all companies were able to provide the data requested in the first year of the request.

The experience of prior years was restated to be consistent with the current method.

1.2 Size of standard segment and excluded segments

Table 20 shows a summary of all the records submitted by the contributing companies for the current policy year, divided into segments. The first row of the table, the standard segment, represents the records included in most tables in this report. That row is followed by several rows, each representing segments of records excluded from the standard segment. The experience for the standard segment through to Simplified Issue is included in at least one table in this report; other segments are excluded.

Category	Records	Exposure		Deaths	
		Pols k	Amt M\$	Pols	Amt k\$
Standard segment	9,053,035	8,449.4	1,710,568	74,761	3,791,424
Attained age > 100	6,492	6.4	38	569	8,994
Renewal periods	329,813	219.0	52,238	1,096	223,320
Substandard	280,716	258.4	91,215	2,341	266,978
Converted	752,428	726.5	152,464	7,043	585,214
Simplified Issue	209,030	200.3	58,661	1,106	38,760
Guaranteed Issue	45,764	44.9	3,207	1,728	24,053
Joint	204,717	196.4	86,775	1,364	311,357
Multiple exclusions	106,628	89.5	29,574	699	141,622
Other exclusions	93,268	89.1	23,938	996	113,613
All submitted	11,081,889	10,280.0	2,208,678	91,702	5,505,336

1.3 Policies and amounts

Policies can be counted only approximately. Records identified as riders have no policy count associated with them. Some companies submit multiple records for a policy. An attempt is made to count each policy only once, but the process is not perfect. The current algorithm combines into one record a group of records having all the same identifying fields (excluding amounts, which are summed). For example, if there are two distinct issue dates for the same life and the same policy number, these would be counted as two policies. Conversely if there are three records for base policies all with the same policy number and other identifying fields, these would be counted as one policy. The same algorithm applies to both exposure and deaths.

1.4 Policy year and duration

By tradition, policy years are referred to as ordinals – first, second, third, etc. – relative to the issue date or collectively as the calendar years in which the policy year starts and ends, as in 2018-2019. Durations are referred to as the exact number of years since issue, or as cardinals – 0, 1, 2, etc. – referring to entire years beginning at issue or on anniversaries of issue. Both terms are used in this report, although “policy year” is more common.

A policy year is taken as starting on a policy anniversary and ending just before the next anniversary. One might call this an “on-before” definition. This definition is consistent with how durations are defined, how annual premiums are billed and how we typically refer to our own age (we go to the next number on our birthday).

However, some companies submit data on the basis of an “after-on” definition; that is, the policy year begins after an anniversary and ends exactly on the next anniversary. That is significant for the study because some deaths would be submitted on the first day of the next policy year (by the standard definition). The record is accepted nonetheless. It is counted as in force for the entire current duration, and a death is recorded for the next duration, with all being reported in the policy year under study.

Note that the issue date is specified on the records provided by the contributing companies. But that date is not always, strictly speaking, the issue date of the policy; it could be a later effective date for the coverage described by the record. For example, if a term rider were added subsequently to the issue of the policy, the “issue” date on the record would be the date that the new rider becomes effective; it would not necessarily be a policy anniversary.

Deaths reported too late to be included in one study are submitted in the next. They are counted as deaths at the appropriate duration for the date of death, but there is no exposure in the current study at that duration, because the exposure was captured in an earlier study. There is no adjustment made to exposure for deaths reported several years late.

1.5 Age nearest and last birthday

Age nearest birthday is used throughout this report. If the record indicates that age last birthday was used, age nearest birthday is calculated from the date of birth and the date of issue. If the record indicates age last birthday and the date of birth is not given, then the stated age at issue is used, and half of the exposure and deaths are assigned to the stated age, and the other half assigned to the next age. The policy year is calculated from the date of issue and is the same regardless of the calculation of issue age.

1.6 Exposure and expected

Exposure is calculated using the Balducci hypothesis, as is traditional for mortality studies of the CIA. Therefore, exposure on deaths continues to the next anniversary. Exposure on non-death terminations stops at the date of termination. That is, exposure is calculated as the number of days plus one from the anniversary on or last before termination to the date of termination, divided by 365. (February 29 is ignored in this calculation.)

Expected mortality is calculated in all cases on CIA2014 and in some cases also on CIA9704.⁹

1.7 Standard deviations

Several tables in this report show standard deviations in the actual-to-expected ratios. When comparing two ratios, it is important to note the standard deviation for each to determine if the difference between the ratios is significant. Generally, we expect that the true mean lies within one standard deviation of the observed mean about two-thirds of the time.

These standard deviations are calculated on the assumption that the exposure of each life to death in the next year is independent of the exposure for all other lives, that the number of deaths for any group of lives with the same sex-smoke-age-duration is binomially distributed, and that the mean of the distribution is given by a multiple of the mortality table used for expected deaths. The formula for standard deviation is shown below, by face amount, where A_i is the face amount, n_i is the number of policies exposed with that face amount and that sex-smoke-age-duration, q_i is the mortality rate for that cell, and m is the ratio of actual to expected claim amounts separately for each sex-smoke over all ages and durations, not for each cell or a subset of the whole. The sum is over all records under consideration. The same formula may be used by policies except that A_i is 1 in all cases.

$$\text{Standard deviation of A/E by amount} = \frac{\left(\sum_i A_i^2 n_i (1 - m q_i) m q_i \right)^{0.5}}{\sum_i A_i n_i q_i}$$

⁹ CIA9704 was published to issue age 80 in publication 210028. The table has an unofficial extension to issue age 85. It has been further extended to issue age 105. Select rates for issue age 105 were taken as 20% of the corresponding ultimate rate at duration 0, increasing by 10% each duration to 100% for durations 10-14. Rates for issue ages 86-104 were calculated by fitting an exponential to the rates for ages 85 and 105 for each duration. The minimum issue age published was 16 for smokers and non-smokers. The table is extended for all issue ages and durations using the rates for combined. Rates over attained age 100 are not used. Rates for smokers and non-smokers under attained age 16 are not used.

The factor m ensures that the standard deviation is reasonable even though the mortality table used for expected deaths may differ substantially from the actual. There is a separate calculation of m for each policy year, for each segment (standard, term renewals, substandard, converted and simplified) and for the standard segment only for each sex and smoking class. There is also a separate calculation when the last five policy years are combined.

1.8 Prior reports

Prior annual mortality studies are available on the CIA website. Accession numbers for the last several reports are rp222119 for 2019-2020, rp221113 for 2018-2019, rp220101 for 2017-2018, 219099 for 2016-2017, and 218110 for 2015-2016.

Appendix 2 Oldest ages

The exposure in the ultimate period is substantial over age 100, but it is difficult to believe that it can be accurate. It is likely that too much of the exposure results from deaths that have not been reported.¹⁰ Tables 21 and 22 show exposure, deaths and mortality rates for each attained age 95 to 120, for females and males, respectively. The mortality rates look reasonable until about age 100, but after that they decrease precipitously, especially for males. The reader is *strongly cautioned against using data over age 100 for any purpose*.

¹⁰ There is more discussion on this matter in the 2018-2019 report, CIA publication rp221113, Section 4.9.

Table 21. Female experience by attained age, policy year 2020-2021. WARNING: Data over age 100 is not considered reliable and should not be used for actuarial assumptions

Attained age	Exposure		Deaths		Mortality rate	
	Pols	Amt k\$	Pols	Amt k\$	Pols	Amt
95	4,322	113,098	701	22,060	0.162	0.195
96	3,474	88,003	610	18,131	0.176	0.206
97	2,675	72,697	468	11,484	0.175	0.158
98	1,908	32,877	364	5,918	0.191	0.180
99	1,515	30,231	248	7,114	0.164	0.235
100	1,110	22,080	168	3,847	0.151	0.174
101	708	9,163	127	3,870	0.179	0.422
102	537	6,545	66	2,389	0.123	0.365
103	399	2,144	64	258	0.159	0.120
104	321	1,648	51	508	0.157	0.308
105	240	950	19	51	0.077	0.054
106	198	546	13	67	0.063	0.123
107	128	246	9	19	0.066	0.076
108	113	263	6	6	0.049	0.025
109	90	114	1	1	0.011	0.004
110	76	109	2	8	0.026	0.077
111	81	145	4	19	0.049	0.133
112	64	104	1	1	0.016	0.005
113	74	102	0	0	0.000	0.000
114	49	66	1	1	0.021	0.008
115	11	58	0	0	0.000	0.000
116	11	17	1	4	0.095	0.211
117	11	17	0	0	0.000	0.000
118	14	30	0	0	0.000	0.000
119	8	13	0	0	0.000	0.000
120	15	41	0	0	0.000	0.000

Table 22. Male experience by attained age, policy year 2020-2021. WARNING: Data over age 100 is not considered reliable and should not be used for actuarial assumptions

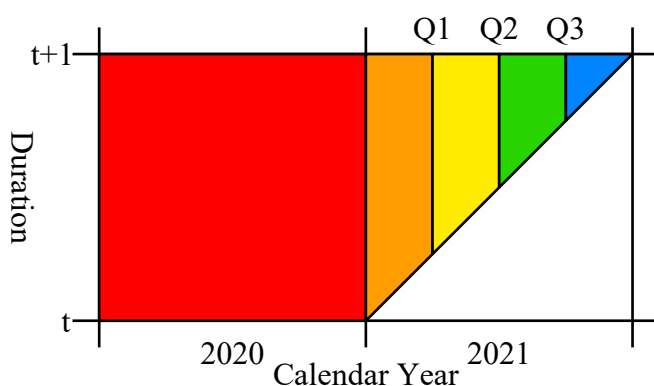
Attained age	Exposure		Deaths		Mortality rate	
	Pols	Amt k\$	Pols	Amt k\$	Pols	Amt
95	3,609	85,421	789	18,657	0.219	0.218
96	2,688	62,225	541	11,938	0.201	0.192
97	2,036	46,286	420	15,061	0.206	0.325
98	1,506	31,680	307	12,800	0.204	0.404
99	1,069	18,339	176	5,511	0.165	0.300
100	765	11,735	111	2,217	0.144	0.189
101	549	4,833	66	1,105	0.119	0.229
102	473	3,331	39	301	0.081	0.090
103	393	1,441	46	180	0.117	0.125
104	329	1,438	19	19	0.058	0.013
105	292	1,331	14	100	0.046	0.075
106	258	686	10	33	0.037	0.048
107	176	586	2	1	0.011	0.001
108	164	467	4	2	0.024	0.003
109	113	214	3	29	0.027	0.137
110	99	193	0	0	0.000	0.000
111	87	169	1	1	0.012	0.003
112	82	218	0	0	0.000	0.000
113	80	175	1	0	0.012	0.000
114	59	95	2	1	0.034	0.005
115	30	111	0	0	0.000	0.000
116	21	118	0	0	0.000	0.000
117	18	64	0	0	0.000	0.000
118	19	55	0	0	0.000	0.000
119	31	322	2	23	0.066	0.071
120	28	243	0	0	0.000	0.000

Appendix 3 COVID-19

This appendix provides additional information on COVID-19 deaths and related information to give it proper context. All data in this appendix is drawn only from those companies that provide cause of death information.

3.1 Policy year vs calendar year

The waves of COVID-19 have been marked on the calendar, and they have no correlation with the time since the last policy anniversary. Accordingly, all the experience of this appendix is presented for the calendar year, quarter or month in which it happened without regard to policy years. Of course, the data is submitted on a policy year basis,¹¹ and therefore, we do not have full information on the calendar year 2021. The experience stops just prior to the policy anniversary in 2021. The diagram below shows approximately the data that is available to us. The calendar year



2020, shown in red, is fully present, half of it coming from the 2019-2020 policy year, and the other half from the 2020-2021 policy year. Only half of the experience of calendar year 2021 has been submitted, and it is strongly weighted to the beginning of the calendar year. The proportion of data that we have in each quarter is represented by orange, yellow, green and blue components.

3.2 Distribution of deaths

The following charts show the number of policies terminating in death in the indicated month, starting with January 2020. The policy counts for 2021 are normalized to what they might be expected to be if we had data for the full calendar year. Thus, the actual policy count for January 2021 is divided by 23/24, the policy count for February 2021 by 21/24, etc. Nothing is shown after September 2021 because the normalizing process does not have enough actual data to be reliable.

Chart 6 shows COVID-19 deaths. It shows considerable variability, reflecting the COVID-19 waves. Chart 7 shows deaths for all causes. It shows much less variability, and some of the variability that it does show is related to the variability of COVID-19 deaths.

¹¹ The use of policy year is traditional for the study. When the annual mortality study began in 1950, the tabulation methods of the time made a policy year study feasible, but a calendar year study would have been infeasible. Now that data is submitted on a seriatim basis, we need not be limited to policy years.

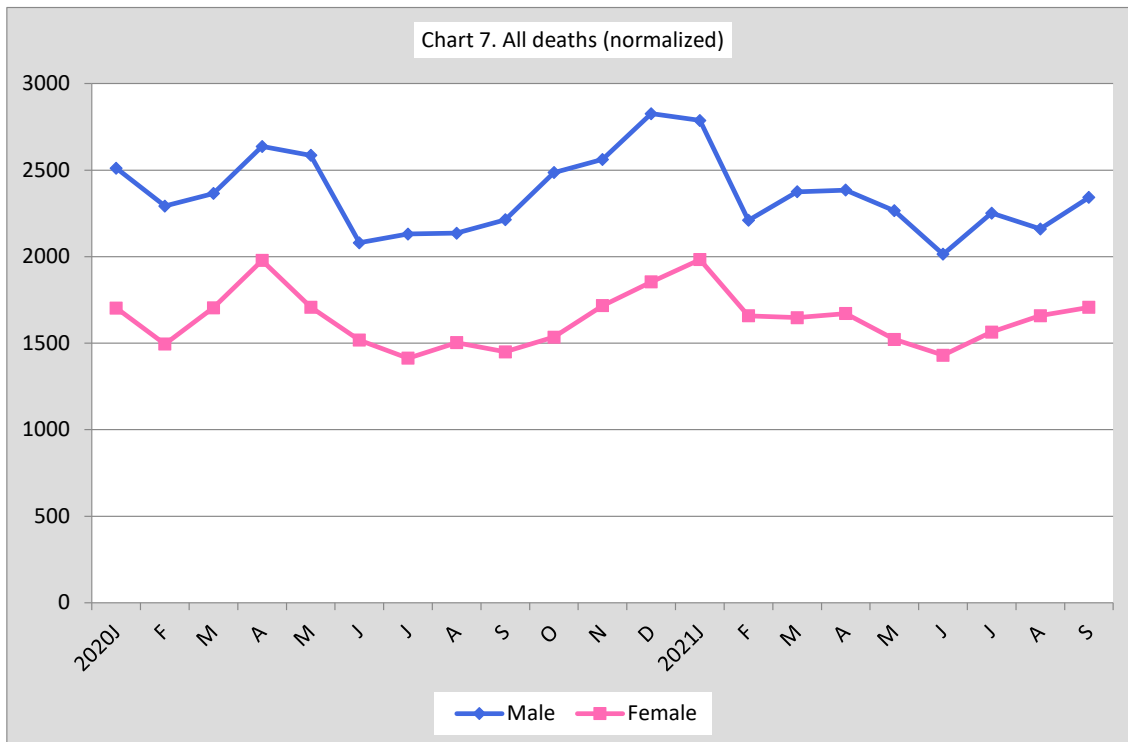
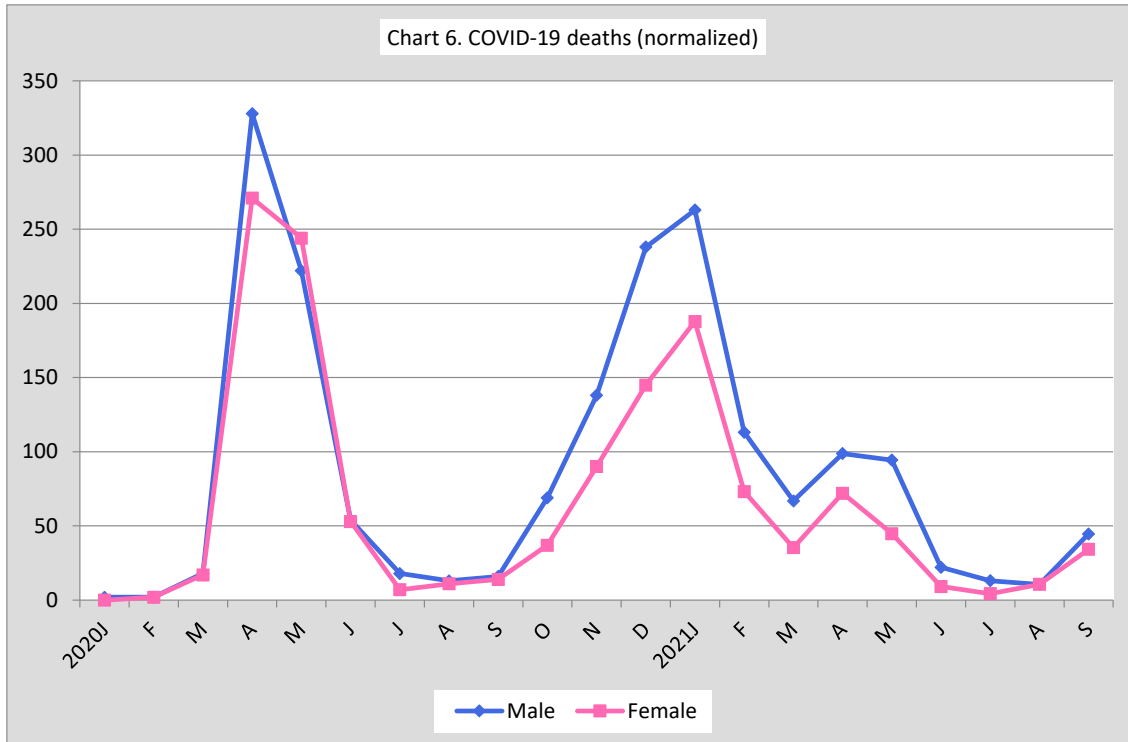
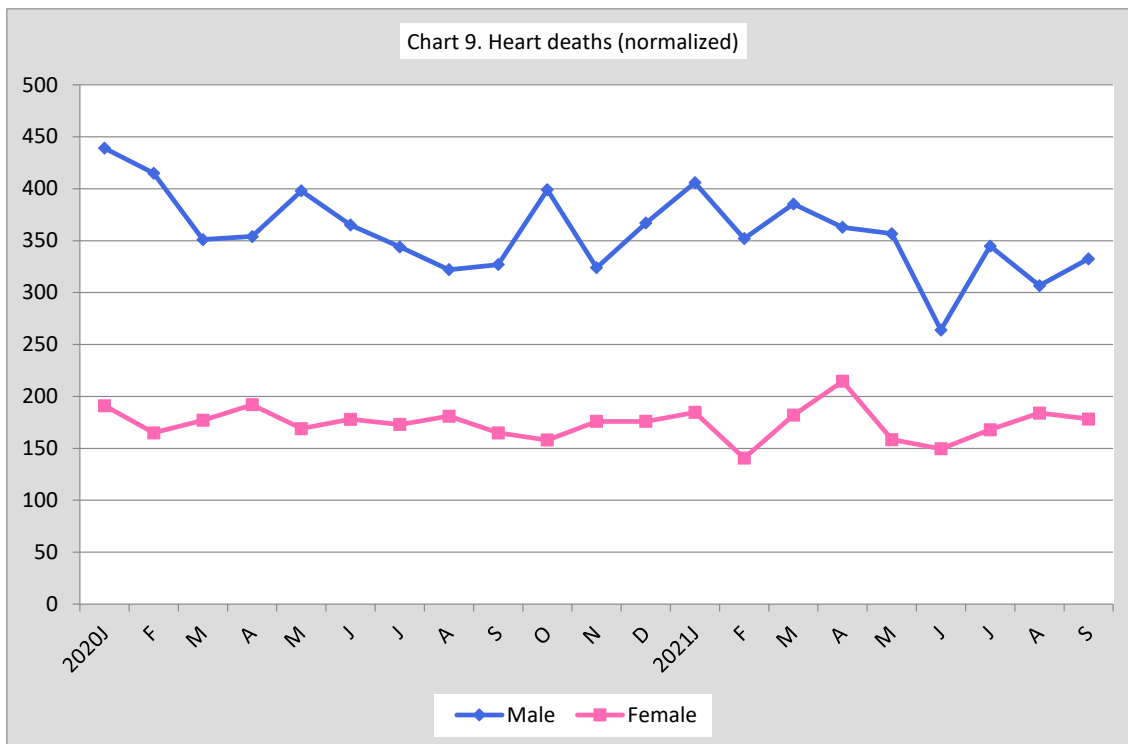
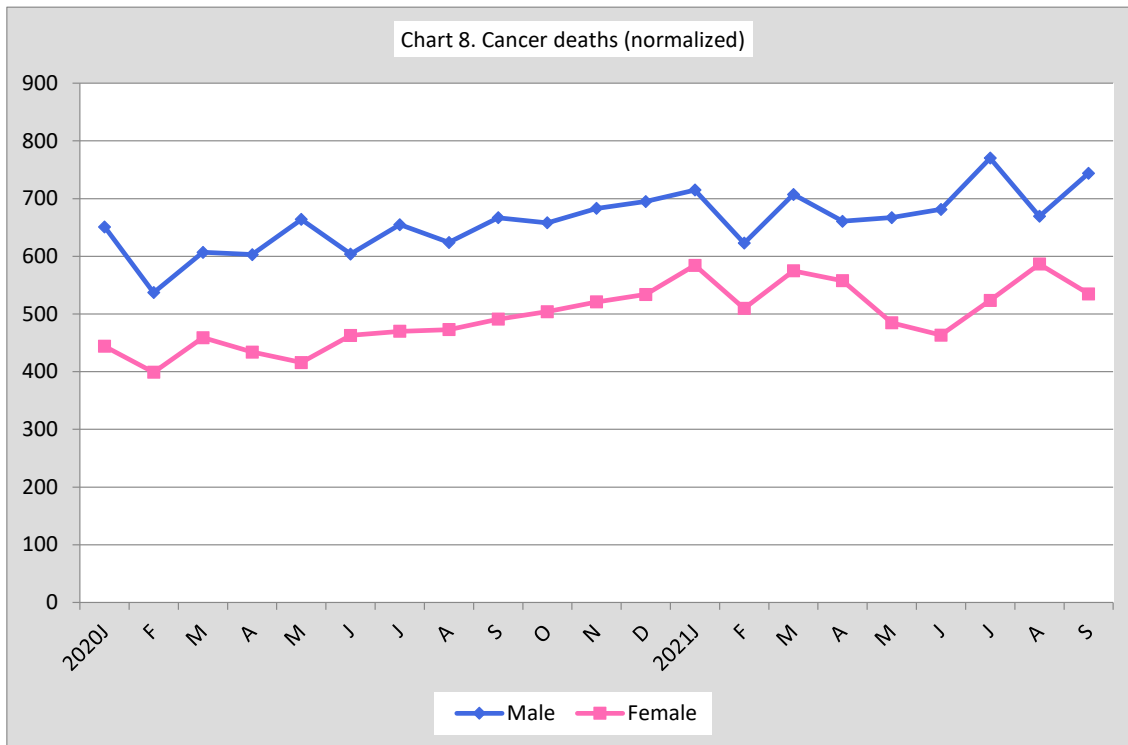


Chart 8 and Chart 9 are not directly about COVID-19, but they provide important context. There is a clear upward trend in cancer deaths during the period, and downward for heart disease deaths for males. Some have speculated

that the limited access to cancer screening and to medical procedures during the pandemic may have resulted in increased rates of cancer deaths. The chart cannot confirm the speculation.



3.3 Cause-specific mortality rates

The following two tables show raw mortality rates for selected causes. The rates are annual per thousand, averaged over the experience from 2020Q2 to 2021Q4. (2020Q1 is excluded because COVID-19 had little impact on Canada at that time.) Unlike the charts shown above, the deaths of 2021 are as reported and not normalized. The mortality rates by policies for COVID-19 increase steeply with age, more so than either cancer or heart disease, and female mortality rates are steeper than male mortality rates.

Table 23. Female raw mortality rates per thousand for 2020Q2-2021Q4 in groups of attained ages

Attained ages	All		COVID-19		Cancer		Heart disease	
	Pols	Amt	Pols	Amt	Pols	Amt	Pols	Amt
0-49	0.41	0.28	0.01	0.00	0.17	0.14	0.04	0.01
50-59	1.75	1.13	0.05	0.04	1.02	0.70	0.17	0.08
60-69	5.04	3.38	0.13	0.07	2.77	2.04	0.60	0.32
70-79	14.89	9.48	0.59	0.35	5.80	3.69	1.73	1.11
80-89	50.88	40.16	3.03	2.01	11.18	8.18	5.66	4.26
90-100	136.53	133.77	9.40	6.43	20.40	13.64	11.98	13.36

Table 24. Male raw mortality rates per thousand for 2020Q2-2021Q4 in groups of attained ages

Attained ages	All		COVID-19		Cancer		Heart disease	
	Pols	Amt	Pols	Amt	Pols	Amt	Pols	Amt
0-49	0.76	0.47	0.02	0.01	0.15	0.12	0.13	0.09
50-59	2.36	1.37	0.09	0.04	0.82	0.46	0.50	0.24
60-69	7.05	4.33	0.25	0.16	2.88	1.85	1.39	0.79
70-79	21.27	15.45	0.89	0.64	7.74	5.99	3.52	2.30
80-89	70.34	62.70	3.83	3.35	16.79	14.40	9.08	7.36
90-100	165.54	178.87	9.08	7.10	25.44	20.59	17.49	21.24

For comparison, the next two tables show annual mortality rates for each of the last three calendar years. (The rates for 2021 have only half a year of experience, and the first quarter, which tends to have the highest mortality, is more heavily weighted than the other quarters.) The age ranges up to 79 mostly show an increasing trend over the three years.

Table 25. Female raw mortality rates per thousand for all causes by calendar year

Attained ages	2019		2020		2021	
	Pols	Amt	Pols	Amt	Pols	Amt
0-49	0.40	0.30	0.40	0.27	0.44	0.29
50-59	1.72	1.10	1.72	1.14	1.78	1.05
60-69	4.67	2.97	4.86	3.24	5.29	3.39
70-79	14.21	10.58	14.91	9.24	15.07	9.57
80-89	49.61	33.61	51.66	44.73	51.01	38.92
90-100	136.37	125.49	139.64	130.35	133.80	153.55

Attained ages	2019		2020		2021	
	Pols	Amt	Pols	Amt	Pols	Amt
0-49	0.65	0.45	0.74	0.44	0.78	0.49
50-59	2.24	1.32	2.22	1.32	2.50	1.43
60-69	6.48	3.98	6.97	3.89	7.28	4.97
70-79	20.68	14.47	21.29	15.46	21.38	15.93
80-89	67.37	53.66	73.13	63.25	67.04	58.70
90-100	164.04	160.78	172.48	170.31	157.52	200.59

3.4 COVID-19 and “excess” deaths

Some actuarial studies have attempted to compare COVID-19 deaths with what might be inferred as excess deaths compared to the trend of deaths in recent years. Table 27 shows this type of analysis.

The trend of deaths is obtained by a death-weighted least-squares linear regression line on the logarithms of the A/E ratios for the seven calendar years 2013-2019 and extrapolated for 2020 and 2021. The extrapolated ratios are distributed over calendar months using the actual distribution of deaths by month for the seven years, using policy counts only. The monthly extrapolated A/E ratios are applied to expected deaths for each month to calculate the trended deaths in each month.

Note that the exposure drops off about linearly through 2021 because the underlying data is based on policy years.

The trend is calculated independently for each row of the table. The monthly distribution is from the overall data, not merely the data for that row.

	Number of deaths				Amount of death claims			
	A/E	Trended A/E	COVID-19	Excess	A/E	Trended A/E	COVID-19	Excess
All	100.5%	95.9%	4.3%	4.8%	94.5%	87.1%	3.6%	8.6%
Male	101.8%	95.8%	4.2%	6.2%	95.6%	86.6%	3.8%	10.4%
Female	98.6%	96.0%	4.4%	2.7%	92.4%	88.0%	3.2%	5.0%
Smoker	95.1%	91.1%	3.3%	4.4%	91.4%	86.6%	2.6%	5.6%
Non-smoker	109.3%	101.9%	4.8%	7.3%	94.8%	86.5%	3.7%	9.5%
Unknown	93.9%	91.8%	4.2%	2.3%	97.4%	93.4%	4.2%	4.3%
*Attd age 0-44	110.1%	109.3%	2.1%	0.8%	89.3%	100.9%	1.8%	-11.6%
Attd age 45-64	103.4%	96.0%	2.7%	7.7%	87.6%	81.3%	2.9%	7.8%
Attd age 65-84	103.3%	99.2%	3.9%	4.2%	94.5%	89.1%	3.6%	6.1%
Attd age 85-100	96.2%	92.4%	5.3%	4.1%	104.3%	87.1%	5.0%	19.7%
Select	114.8%	105.1%	4.7%	9.2%	88.6%	82.9%	3.2%	6.8%
Ultimate	98.6%	94.8%	4.2%	3.9%	98.6%	90.3%	3.8%	9.2%
< 100k	101.3%	96.8%	4.4%	4.7%	106.3%	99.1%	4.3%	7.2%
100k+	95.4%	90.7%	3.6%	5.2%	89.8%	82.5%	3.2%	8.9%

A/E = (actual deaths from all causes) / (expected deaths on CIA2014)

Trended A/E = (trended deaths using prior seven years A/E) / (expected deaths on CIA2014)

COVID-19 = (deaths due to COVID-19) / (trended deaths)

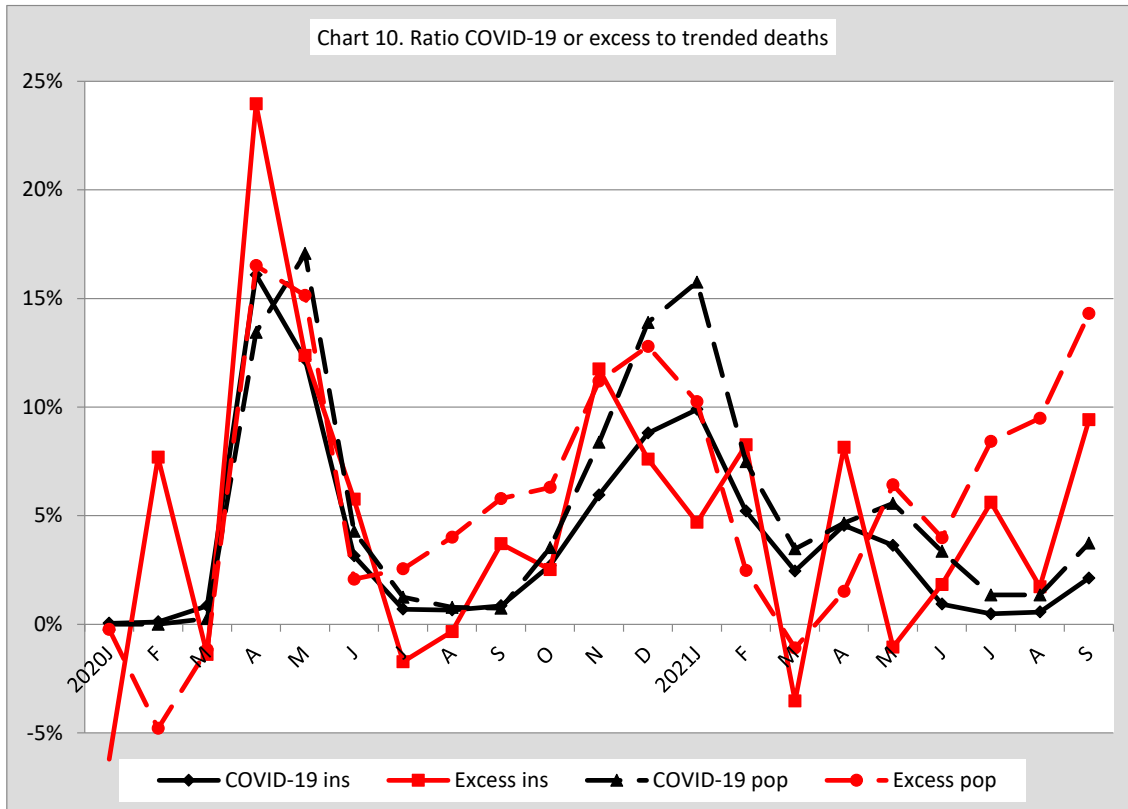
Excess = (actual deaths – trended deaths) / (trended deaths)

* note that this row includes only 31 COVID-19 deaths; all other rows have more than 200 COVID-19 deaths


Deaths due to COVID-19 account for most of the excess deaths. However, the amount of COVID-19 deaths claims is generally much less than the amount of excess death claims. This is because COVID-19 claims are much smaller on average than all death claims combined as they tend to be for policies in later policy years, which have smaller face amounts than policies issued recently. It cannot be concluded from this table whether the difference in amount between excess and COVID-19 (8.6% compared to 3.6%) is a result of more than normal non-COVID-19 death claims during the pandemic, inaccuracy of COVID-19 death data due to the high % of unknown cause, a limitation in the method of trending deaths or something else. Next year’s study will be important in determining whether a new trend in mortality is emerging.

It may be of interest to compare the COVID-19 and excess deaths of insured lives to those in the population, as determined by Statistics Canada.¹² Chart 10 shows the ratio of COVID-19 or excess deaths to the trended (not actual total) deaths by month. COVID-19 is shown in black, and excess in red. Solid lines are for insured lives, and dashed lines for the Canadian population. The insured data is by number of policies, not amount.

The four lines track fairly closely together for most of 2020, but afterwards are less consistent. The two COVID-19 lines are closer together than the two excess lines. Because the insured data is derived from policy year data, the last few months are more subject to volatility. Note that the distribution by sex and age may be quite different between insured lives and the population.



¹² COVID-19 deaths for general population were retrieved from the Government of Canada website: Government of Canada. COVID-19 epidemiology update: Key updates, Canada.ca <https://health-infobase.canada.ca/covid-19/#tiles>. Excess deaths for general population were retrieved from Statistics Canada: Statistics Canada. Table 13-10-0784-01 Provisional weekly estimates of the number of deaths, expected number of deaths and excess mortality. Both were retrieved on March 31, 2023.



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