Mortality under Standard Individually Life Insurance Between 1999 and 2002 Anniversaries

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The MEX-2000 basic table was based on insured data from the AMIS-AMA 1995-1998 study of standard ordinary insurance, for durations 5 years and over.

After this study, each year the Asociación Mexicana de Instituciones de Seguros (AMIS) has presented an annual study of mortality under standard ordinary insurance.

The following formulas were used to cover the intercompany (México) mortality experience by amount of life insurance under standard individually underwritten issues.

$$q^{(m)}_{x:x+5} = \frac{\theta'^{(m)}_{x:x+5}\left(1+\pi\right)}{E'_{x:x+5}\left(1+\pi\right)} = \frac{\theta^{(m)}_{x:x+5}}{E_{x:x+5}}$$

$$q^{(s)}_{x:x+5} = \frac{\theta'^{(w)}_{x:x+5}(1+\pi)}{E'_{x:x+5}(1+\pi)} = \frac{\theta^{(w)}_{x:x+5}}{E_{x:x+5}}$$

$$q_{x:x+5} = 1 - \frac{q^{(m)}_{x:x+5}}{q^{(\tau)}_{x:x+5}} \log p^{(\tau)}_{x:x+5}$$

TABLE I

This Table shows the mortality for experience between 1996-1998, 1996-1999, 1996-2000, 1996-2001, 1996-2002, during policy years 5 and over.

MALE

Exposures	702,282	544,339	403,542	257,528	213,195
Deaths	1,872,882	1,039,814	833,015	658,561	521,295
Attained	qx*1000	qx*1000	qx*1000	qx*1000	qx*1000
Ages	**2002**	**2001**	**2000**	**1999**	**1998**
10 a 14	0.33	0.22	0.20	0.21	0.26
15 a 19	0.76	0.83	0.86	0.92	1.07
20 a 24	0.82	1.01	0.83	0.83	0.78
25 a 29	0.78	0.86	0.79	0.83	0.74
30 a 34	0.95	1.10	1.06	1.18	1.11
35 a 39	1.18	1.27	1.14	1.19	1.27
40 a 44	1.98	2.01	2.09	2.10	2.11
45 a 49	3.07	2.96	3.23	3.40	3.25
50 a 54	3.68	3.42	3.67	4.00	4.31
55 a 59	6.99	5.77	6.90	7.38	8.11
60 a 64	13.14	11.24	15.31	16.72	17.84
65 a 69	22.60	15.56	17.99	19.84	21.91
70 a 74	33.13	25.85	25.53	23.84	28.83
75 a 79	63.68	49.61	69.76	63.61	82.27
80 a 84	187.31	125.10	203.36	227.12	251.08
	2.57	2.38	2.57	2.71	2.8

1998 Mortality ratios

	92%	85%	92%	97%	100%

FEMALE

	2002	2001	2000	1999	1998
Exposures	182,695	146,055	123,743	72,004	67,768
Deaths	276,903	207,687	152,930	92,744	82,091
10 a 14	0.14	0.06	0.01	0.01	0.01
15 a 19	0.16	0.14	0.12	0.14	0.10
20 a 24	0.35	0.39	0.18	0.20	0.18
25 a 29	0.30	0.33	0.32	0.35	0.35
30 a 34	0.84	0.88	0.81	0.95	0.99
35 a 39	0.54	0.56	0.58	0.54	0.43
40 a 44	1.14	1.10	0.89	0.92	1.01
45 a 49	1.88	1.79	1.75	1.49	1.46
50 a 54	3.60	3.61	3.50	3.70	4.06
55 a 59	5.99	5.07	3.92	4.13	4.34
60 a 64	6.34	6.47	5.91	4.80	4.58
65 a 69	11.05	11.41	10.37	9.18	9.54
70 a 74	14.18	15.23	21.04	16.29	18.34
75 a 79	6.44	4.59	11.16	5.99	4.49
80 a 84	15.87	16.40	3.04	3.66	6.13
	1.36	1.33	1.21	1.19	1.22

1998 Mortality ratios

111%	109%	99%	98%	100%

(Deaths in $1000 units. Exposures in $1,000,000 units)

TABLE II
ULTIMATE EXPERIENCE

Attained Ages	MALE BASICS MORTALITY TABLES (1000*qx)							Pondered average at 2005	% MEX 95-98	increase or disminution
	EM 62-67*	EM 82-89*	MEX 95-98	MEX 95-02	MEX 99-02	CAN82-88	EU 83-88			
10 a 14	0.85	0.60	0.35	0.33	0.38	0.22	0.31	0.35	0.99	0.00
15 a 19	0.88	0.64	0.73	0.76	0.43	0.81	0.87	0.71	0.97	-0.02
20 a 24	0.97	0.72	0.82	0.82	0.89	1.12	1.03	0.93	1.13	0.11
25 a 29	1.16	0.86	0.68	0.78	0.84	0.92	0.98	0.85	1.25	0.17
30 a 34	1.50	1.10	1.07	0.95	0.74	0.94	1.21	0.98	0.92	-0.09
35 a 39	2.11	1.81	1.14	1.18	1.02	1.10	1.50	1.23	1.08	0.09
40 a 44	3.16	2.65	2.12	1.98	1.80	1.66	2.19	2.00	0.94	-0.12
45 a 49	4.97	3.99	3.12	3.07	2.78	2.80	3.43	3.11	1.00	-0.01
50 a 54	7.16	6.12	4.58	3.68	3.09	4.87	5.17	4.33	0.95	-0.25
55 a 59	12.02	9.49	8.16	6.99	5.96	8.36	9.38	7.80	0.96	-0.36
60 a 64	19.77	14.76	17.84	13.14	9.90	14.01	14.16	13.57	0.76	-4.27
65 a 69	33.70	22.96	24.67	22.60	22.47	22.91	22.58	23.15	0.94	-1.52
70 a 74	52.31	34.33	32.08	33.13	33.83	36.70	35.42	34.67	1.08	2.59
75 a 79	83.51	54.02	55.12	63.68	56.04	57.73	61.32	59.39	1.08	4.27
80 a 84	134.71	83.37	90.93	187.31	140.36	89.34	92.25	124.13	1.37	33.20
Pondered	0.02	0.04	0.13	0.22	0.22	0.18	0.18	1.00		

* Male and Female Lives Combined

FEMALE BASICS MORTALITY TABLES (1000*qx)

Attained Ages	EM 62-67*	EM 82-89*	MEX 95-98	MEX 95-02	MEX 99-02	CAN82-88	EU 83-88	Pondered average at 2005	% MEX 95-98	increase or disminution
10 a 14	1.15	0.60	0.37	0.14	0.32	0.14	0.22	0.24	0.65	-0.13
15 a 19	1.18	0.61	0.40	0.16	0.23	0.31	0.34	0.29	0.72	-0.11
20 a 24	1.20	0.67	0.46	0.35	0.60	0.31	0.43	0.41	0.88	-0.05
25 a 29	1.22	0.77	0.57	0.30	0.21	0.41	0.67	0.42	0.74	-0.15
30 a 34	1.29	0.94	0.75	0.84	0.59	0.59	0.70	0.66	0.89	-0.09
35 a 39	1.71	1.47	1.05	0.54	0.61	0.87	0.83	0.74	0.71	-0.31
40 a 44	2.37	2.10	1.57	1.14	1.16	1.35	1.32	1.23	0.79	-0.34
45 a 49	3.70	3.11	2.46	1.88	2.11	2.13	2.10	2.00	0.81	-0.46
50 a 54	5.83	4.73	5.35	3.60	2.98	3.40	3.64	3.49	0.65	-1.86
55 a 59	8.70	7.29	6.00	5.99	6.95	5.47	5.18	5.46	0.91	-0.54
60 a 64	14.78	11.32	8.37	6.34	7.52	8.82	7.64	7.27	0.87	-1.10
65 a 69	24.50	17.62	13.90	11.05	13.28	14.23	12.67	12.17	0.88	-1.73
70 a 74	40.65	27.39	25.80	14.18	17.81	22.95	20.66	18.78	0.73	-7.01
75 a 79	62.37	41.29	42.01	6.44	20.12	36.92	35.83	25.75	0.61	-16.26
80 a 84	101.28	64.39	72.84	15.87	124.85	59.15	65.35	57.01	0.78	-15.83
Pondered	0.02	0.04	0.13	0.22	0.22	0.18	0.18	1.00		

*Femele = male - 3 years

Select Mortality

It was developed four-year selection mortality factors from the experience 1999-2002.

For each company *i*, during de years *j*, we have the probability

$${}_{ij}q_{[x:x+10]}$$ for $i = 1,2,3,$ and $j = 1,2,3\,(2000,2001,2002)$

The expected value (μ) was estimated as the result of multiplying the Selection Factors of the CSO 80 by the ultimate probabilities of the experience 1999-2002.

To estimate $\hat{v}$ from Bühlmann – Straub formulas

$$\hat{v}_i = \frac{1}{2}\sum_{j=1}^{3} \theta_{ij}^{(m)}\left(_{ij}q - _i\overline{q}\right)^2$$

and

$$\hat{v} = \frac{\sum\limits_{i=1}^{3} \hat{v}_i}{3}$$

the estimator for is $\hat{a}$

$$\hat{a} = \sum_{i=1}^{3} \frac{\theta_i^{(m)}}{\theta^{(m)}} \left(_i\bar{q} - \mu \right)^2 - \frac{3}{\theta^{(m)}} \hat{v}$$

then

$$k = \frac{\hat{v}}{\hat{a}}$$ **and** $$Z = \frac{\theta^m}{\theta^m + k}$$

And the estimated credibility mortality is

$$q_{[x:x+10]} = z\overline{q} + (1 - z)\mu$$

TABLE III

M A L E — POLICY YEAR 1

Ages at Issue	Average	Ultimate	%	Expected Value %	Credibility Factor %
0 - 19	0.00057	0.00040	1.42	1.00	1.26
20 - 29	0.00082	0.00085	0.97	0.80	0.81
30 - 39	0.00101	0.00092	1.09	0.72	0.72
40 - 49	0.00213	0.00224	0.95	0.67	0.67
50 - 59	0.00282	0.00401	0.70	0.58	0.61
60 - 69	0.00826	0.01323	0.62	0.50	0.50
70 - 79	0.00876	0.03737	0.23	0.47	0.40
Actual Deaths		268,320,755			

TABLE III

F E M A L E — POLICY YEAR 1

Ages at Issue	Average	Ultimate	%	Expected Value %	Credibility Factor %
0 - 19	0.00028	0.00045	0.63	1.00	0.90
20 - 29	0.00085	0.00034	2.49	0.96	0.96
30 - 39	0.00032	0.00060	0.54	0.90	0.58
40 - 49	0.00101	0.00157	0.65	0.82	0.69
50 - 59	0.00289	0.00427	0.68	0.74	0.73
60 - 69	0.00705	0.00921	0.77	0.66	0.74
Actual Deaths		40,515,111			

M A L E — POLICY YEAR 2

Ages at Issue	Average	Ultimate	%	Expected Value %	Credibility Factor %
0 - 19	0.00052	0.00040	1.29	1.00	1.00
20 - 29	0.00080	0.00085	0.94	0.85	0.85
30 - 39	0.00064	0.00092	0.69	0.77	0.77
40 - 49	0.00123	0.00224	0.55	0.73	0.62
50 - 59	0.00248	0.00401	0.62	0.63	0.63
60 - 69	0.00646	0.01323	0.49	0.54	0.54
70 - 79	0.01126	0.03737	0.30	0.52	0.35
Actual Deaths		130,545,522			

F E M A L E — POLICY YEAR 2

Ages at Issue	Average	Ultimate	%	Expected Value %	Credibility Factor %
0 - 19	0.00018	0.00045	0.39	1.00	0.53
20 - 29	0.00045	0.00034	1.33	0.96	1.16
30 - 39	0.00051	0.00060	0.85	0.90	0.90
40 - 49	0.00078	0.00157	0.50	0.82	0.75
50 - 59	0.00223	0.00427	0.52	0.74	0.74
60 - 69	0.00751	0.00921	0.82	0.66	0.73
Actual Deaths		25,544,466			

M A L E — POLICY YEAR 3

Ages at Issue	Average	Ultimate	%	Expected Value %	Credibility Factor %
0 - 19	0.00083	0.00040	2.04	1.00	1.00
20 - 29	0.00092	0.00085	1.08	0.90	0.90
30 - 39	0.00075	0.00092	0.82	0.82	0.82
40 - 49	0.00107	0.00224	0.48	0.78	0.50
50 - 59	0.00247	0.00401	0.62	0.68	0.68
60 - 69	0.00635	0.01323	0.48	0.58	0.50
70 - 79	0.01885	0.03737	0.50	0.56	0.56
Actual Deaths	104,478,110				

F E M A L E — POLICY YEAR 3

Ages at Issue	Average	Ultimate	%	Expected Value %	Credibility Factor %
0 - 19	0.00039	0.00045	0.86	1.00	1.00
20 - 29	0.00047	0.00034	1.38	0.96	1.21
30 - 39	0.00051	0.00060	0.84	0.94	0.94
40 - 49	0.00105	0.00157	0.67	0.86	0.86
50 - 59	0.00253	0.00427	0.59	0.78	0.70
60 - 69	0.00796	0.00921	0.86	0.70	0.70
Actual Deaths	23,474,607				

M A L E — POLICY YEAR 4

Ages at Issue	Average	Ultimate	%	Expected Value %	Credibility Factor %
0 - 19	0.00049	0.00040	1.20	1.00	1.00
20 - 29	0.00124	0.00085	1.46	0.95	0.95
30 - 39	0.00117	0.00092	1.27	0.87	1.21
40 - 49	0.00084	0.00224	0.38	0.83	0.45
50 - 59	0.00270	0.00401	0.67	0.73	0.68
60 - 69	0.00616	0.01323	0.47	0.63	0.63
70 - 79	0.01449	0.03737	0.39	0.59	0.59
Actual Deaths	89,239,625				

F E M A L E — POLICY YEAR 4

Ages at Issue	Average	Ultimate	%	Expected Value %	Credibility Factor %
0 - 19	0.00172	0.00045	3.81	1.00	2.71
20 - 29	0.00039	0.00034	1.14	1.00	1.00
30 - 39	0.00037	0.00060	0.62	0.96	0.96
40 - 49	0.00080	0.00157	0.51	0.90	0.64
50 - 59	0.00531	0.00427	1.24	0.82	1.08
60 - 69	0.00529	0.00921	0.57	0.71	0.71
Actual Deaths	23,135,515				

TABLE IV
SELECTION FACTORS   2005

Ages at Issue	CRUDE FACTORS Policy year				MALE	SMOOTHED FACTORS Policy year			
	1	2	3	4		1	2	3	4
0 - 19	126%	100%	100%	100%		100%	100%	100%	100%
20 - 29	81%	85%	90%	95%		81%	85%	90%	95%
30 - 39	72%	77%	82%	121%		72%	77%	82%	87%
40 - 49	67%	62%	50%	45%		67%	70%	75%	80%
50 - 59	61%	63%	68%	68%		61%	63%	68%	68%
60 - 69	50%	54%	50%	63%		50%	54%	56%	63%
70 - 79	40%	35%	56%	59%		40%	43%	56%	59%

Ages at Issue	Policy year				FEMALE	Policy year			
	1	2	3	4		1	2	3	4
0 - 19	90%	53%	100%	271%		90%	95%	100%	100%
20 - 29	96%	116%	121%	100%		96%	97%	98%	100%
30 - 39	58%	90%	94%	96%		89%	90%	94%	96%
40 - 49	69%	75%	86%	64%		69%	75%	86%	88%
50 - 59	73%	74%	70%	108%		73%	74%	76%	85%
60 - 69	74%	73%	70%	71%		68%	69%	70%	71%

More than 10 points.
JRE

Factors developed.
Factors smoothed.