Health Care Costs in the Last Year of Life
Impact on Present Values from Changes in Mortality

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1.0 Introduction

1.1 With the issuance of SFAS 106 "Employers' Accounting for Postretirement Benefits Other Than Pensions" much attention has been paid to the measurement of retiree health care benefits. The Statement had a big impact in 1992. Fortune magazine reported that the Fortune 500 industrial companies reported a total profit for 1992 of only $10 million compared to $60 billion in 1991. SFAS 106 reduced the 1992 profit total by over $70 billion.

1.2 Cognizant of the significant impact that the measurement and accounting for these future benefits has on corporate balance sheets and company profits, the actuarial profession developed an Actuarial Standard of Practice (No. 6) - *Measuring and Allocating Actuarial Present Values of Retiree Health Care and Death Benefits* and more recently an Actuarial Compliance Guideline (No. 3 - for SFAS 106). These standards list factors and assumptions that the actuary should consider when developing a model to measure the benefits.

1.3 The fundamental building block of the measurement process is the baseline health care cost. The ASB guideline lists several factors that should be considered in developing separate baseline costs for separate homogeneous groups:

- health status (disabled retirees separate from non-disabled retirees)
- gender (males separately from females)

1.4 Although these groups exhibit different health care costs, the variation from highest to lowest is generally less than 50%. In contrast the health care costs in the last year of life (LYOL) exhibit far greater variation from the average health care costs for a particular age and failure to take this into account can distort financial projections when companies revise their demographic assumptions -- particularly mortality.

1.5 This paper looks specifically at the issues of measurement of retiree health care costs when the baseline health care costs are measured in terms of last-year-of-life costs and maintenance costs. Maintenance costs are defined as health care costs in a year other than the last-year-of-life. The paper shows the sensitivity of results to changes in expected mortality under two models: using an average health care cost model and using a maintenance/LYOL cost model.

1.6 The valuation model that uses average health care costs develops the expected cost in year t for a single retiree now age x as:

(1) $\frac{l_{x+t}}{l_x} \cdot AH^m_{x+t} \cdot CT_t \cdot v^t \cdot AF_{x+t}$

where
- l_x = number alive at age x
- AH^m_x = average health care cost for a single male retiree age x
- CT_t = cumulative trend to year t
- v^t = discounted value of 1 payable at end of year t
- AF_x = adjustment factor reflecting timing of payments during the year

For a valuation model that uses LYOL claims cost, the expected cost in year t is developed as the sum of two components.

Last year of life costs,

(2) $\frac{l_{x+1}}{l_x} \cdot LH^m_{x+t} \cdot CT_t \cdot v^t \cdot q_{x+t}$

plus, maintenance costs

(3) $\frac{l_{x+t}}{l_x} \cdot MC^m_{x+t} \cdot CT_t \cdot v^t \cdot p_{x+t}$

where
- LH^m_{x+t} = health care cost incurred by a male retiree age x who dies before age x + 1
- MC^m_{x+t} = health care cost incurred by a male retiree age x who does not die before age x + 1

Similar formulae can be developed in the case of joint life function.

2.0 Mortality Assumption

2.1 Few companies have a large enough number of retirees to be able to develop a company specific mortality table reflecting recent experience. Therefore, for the majority of companies, actuaries rely on standard mortality tables, then adjust that table to reflect company-specific experience and/or expected experience.

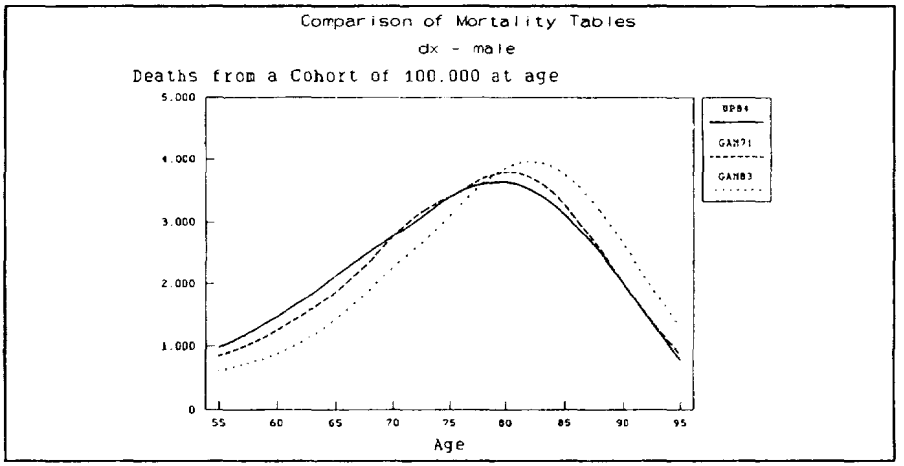
2.2 This section looks at the range in valuation results that can be expected from the use of three standard mortality tables. The tables studied are:

The UP 1984 Mortality table, hereafter referred to as UP84
GAM 1971
GAM 1983

Unless otherwise stated the paper uses the standard setbacks for sex-specific mortality. The values used are shown in the table below.

Setbacks applied to obtain sex-specific mortality rates Table 1		
Mortality table	Setback for Males	Setback for Females
UP84	+1	-4
GAM71	0	-6
GAM83	0	-6

2.3 The graph below shows the curve of d_x for a radix of 100,000 at age 55 for each table.



From this graph it can be seen that under the UP84 and GAM71 tables the peak number of deaths occurs at age 80, while under the GAM83 table it occurs at age 82.

2.4 One simple measure of a mortality table is the life expectancy. The table below shows values of $e^{\circ}x$ at ages 55, 65, and 75. These would be indicative values for early retirees, normal retirees, and average retired life populations.

Life Expectancies Under UP84, GAM71, and GAM83 — Table 2

Mortality Table	Age 55		Age 65		Age 75	
	Male	Female	Male	Female	Male	Female
UP84	22.7	26.0	13.3	16.5	5.8	8.3
GAM71	23.5	27.8	14.0	18.1	6.2	9.5
GAM83	25.7	30.1	16.0	20.3	7.7	11.4

2.5 A simple measure of the increase in life expectancy from a change in mortality can be derived from the above measures. The table below shows the percentage increase in life expectancy moving from UP84 to GAM71 and from UP84 to GAM83.

Percentage Increase in Life Expectancies From Changing Mortality Assumptions — Table 3

Mortality Table	Age 55		Age 65		Age 75	
	Male	Female	Male	Female	Male	Female
UP84 to GAM71	4.4%	6.9%	5.3%	9.7%	6.9%	14.5%
UP84 to GAM83	14.2%	15.8%	20.3%	23.0%	32.8%	37.3%

2.6 A company may be interested in assessing the impact on its postretirement benefit obligation from a change in assumed mortality for a number of reasons

2.7 Firstly, through the annual valuation process companies can readily compare actual death benefits with projected death benefits. If the actual death benefits paid are consistently less than the projected amount from the prior year's valuation, then this might indicate that the mortality assumption lags experience and the company might improve its mortality assumption by conducting a mortality study.

2.8 Secondly, when a company sells a division, it is standard business practice for the acquiring company to value the seller's postretirement benefit plan using the acquiring company's assumption set - including mortality. After acquisition the purchaser would likely value all benefits using the same mortality set. In this situation the sale price might be affected by the value placed on the postretirement benefit obligation, which in turn depends on the assumptions used to measure the obligation.

3.0 Baseline Health Care Costs

3.1 The table below shows sample values, net of Medicare, for hospital, surgical, and medical plan costs in 1992 for male retirees. Acute care costs exhibit the largest variation in cost between a maintenance year and the last year of life for a retiree at a particular age. Prescription drug costs exhibit a smaller but noticeable increase in costs in the last year of life. This paper analyzes results for just the hospital, surgical, and medical plan costs.

Table 4 Annual Health Care Costs for a Male Retiree in 1992

Age	Average	Maintenance	LYOL
57	$ 2,745	$ 2,314	$ 25,306
62	3,958	3,243	27,378
67	866	734	3,704
72	987	777	3,834
77	1,120	840	3,515
82	1,095	766	2,889
87	1,117	758	2,297
92	1,155	595	2,196

3.2 For post-65 retirees, note that from age 72 the LYOL cost decreases with advancing age while for several years the maintenance cost increases before peaking around age 77.

4.0 Impact on Valuation Results from Changes in Mortality

4.1 Table 5 below shows the expected postretirement benefit obligation (EPBO) for retirees using both the average health care cost valuation approach and the maintenance/last year of life valuation approach.

EPBO for Single Retirees Age 65 (UP84 Mortality)		Table 5
Valuation Approach	Male	Female
Average health care costs	$10,793	$10,789
Maintenance/LYOL costs	10,236	11,070
M/LYOL as a % of Average	94.8%	102.6%

4.2 The EPBO for male retirees age 65 is 5.2% lower using the maintenance/LYOL approach and 2.6% higher for female retirees. This result is due principally to smoothing of claims. So long as the maintenance costs and last year of life costs in aggregate match the total claims then for a large group of retirees smoothing of claims will not result in any material difference in valuation results between valuation approaches.

4.3 Table 6 below shows the EPBO for male and female retirees age 65 using the three mortality tables.

EPBO for Male Retirees Age 65		Table 6
Mortality Table	Average Health Care Costs	Maintenance/LYOL Costs
UP84	$10,793	$10,236
GAM71	11,077	10,384
GAM83	12,150	10,981

4.4 Table 7 below shows the percentage increase in EPBO when the mortality assumption is changed form UP84 to GAM71 for male and female retirees age 55, 65, 75, and 85, using both the average health care cost valuation approach and the maintenance/LYOL valuation approach.

Table 7
Percentage Increase in EPBO from a Change In Mortality Table from UP84 to GAM71

	Males		Females	
Age	Average Costs	M/LYOL Costs	Average Costs	M/LYOL Costs
55	1.9%	0.2%	2.9%	0.9%
65	2.6%	1.4%	6.6%	4.1%
75	2.3%	1.1%	6.0%	3.7%
85	6.2%	2.5%	7.4%	4.1%

4.5 Table 8 below shows the percentage increase in EPBO when the mortality assumption is changed form UP84 to GAM83 for male and female retirees age 55, 65, 75, and 85, using both the average health care cost valuation approach and the maintenance/LYOL valuation approach.

Table 8
Percentage Increase in EPBO from a Change In Mortality Table from UP84 to GAM83

	Males		Females	
Age	Average Costs	M/LYOL Costs	Average Costs	M/LYOL Costs
55	6.6%	1.4%	6.5%	2.3%
65	12.6%	7.3%	15.6%	9.9%
75	11.3%	6.2%	15.8%	9.8%
85	13.6%	6.2%	16.0%	9.2%

5.0 Conclusion

5.1 As noted in 3.2 above, the health care costs in the last year of life decline with advancing age. This empirical data makes sense. Doctors assess the risks of aggressive treatments against the benefits to the patients. For older retirees, the risks of aggressive surgery may be higher and the doctor counsels against heroic effort, in the best interest of the patient.

5.2 Projecting lighter mortality defers the last year of life so that when it is reached the health care costs are lower. Valuation using a discount rate greater than the trend rate will further decrease the present value of the last year of life costs. These two forces act to counter the cost increase associated with adding additional maintenance year costs.

5.3 Current health care costs by age are a mix of claims. Some high cost claims are associated with retirees who incurred large costs in what turned out to be their last year of life. Using the average health care cost valuation approach when deciding to change the mortality assumption implicitly assumes that the last year of life costs will be incurred for a longer period.

5.4 The results in Tables 7 and 8 show that using the average claims cost valuation approach overstates the liability when changing mortality assumption from UP84 to GAM71 by between 1% and 3% and when changing from UP84 to GAM83 by between 4% and 7%.