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Chairperson's Corner

by Daniel L. Wolak

My phone rang at about 9:25 that day at my office in Stamford, Connecticut, located 40 miles from lower Manhattan. I was just beginning to reply to an e-mail requesting catastrophic claim coverage for a group life program. On the phone was my sister. She said "Good, you're here". I asked why she was relieved. She responded "The World Trade Center has just been hit by two planes." I was stunned, said good-bye, and informed

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A Brief Note About Pricing Aggregate Stop-Loss Coverage

by Robert G. Mallison, Jr.,

Overview

When an employer chooses self-funding as the vehicle for providing healthcare benefits for employees, he will typically purchase stop-loss coverage. Specific stop-loss protects against catastrophic costs resulting from individual claims, whereas aggregate stop-loss protects against high-cost claim experience for the group as a whole.

In medical stop-loss insurance, most of the premium (approximately 90%) is

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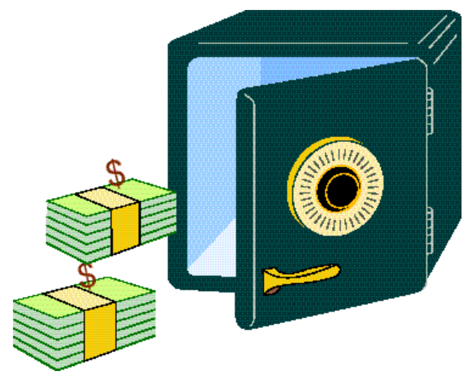

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generated by the specific stop-loss coverage. Therefore, most of the analysis is focused on accurately determining the specific stop-loss premium and the aggregate attachment point. Relatively minor emphasis is placed on determining the aggregate stop-loss premium. However, as David Olsho and Mark McAllister observe at the end of their article in HSN no.38, “With aggregate claims expected to be frequent, the aggregate premium calculation becomes as important as the aggregate attachment point calculation.”

The development of a pricing model for specific stop-loss coverage can be accomplished by examining a large volume of individual claims, developing a claim probability distribution, and determining the cost for specific stop-loss at various deductibles from the distribution. There are other factors to consider such as age and sex, area, trend (leveraged), possible savings due to claim management, etc. But the point to be grasped is that the exposure unit for specific stop-loss coverage is the individual, and finding a large population of individuals with similar characteristics (age, sex, area, etc.) is not unfeasible.

In contrast, the exposure unit for aggregate stop-loss coverage is the group. Finding a large population of groups with similar characteristics (group size, demographic profile, benefit design, etc.) is not practical. Therefore, the most common approach for the development of a pricing model for aggregate stop-loss coverage is Monte Carlo simulation. The key parameters used in the simulation are 1) group size, 2) specific stop-loss deductible, and 3) aggregate attachment point (expressed as a percentage of expected claims) or the aggregate corridor. The purpose of this note is to identify a fourth key parameter which is often overlooked: benefit design. As we will see, this can have a significant (and perhaps unexpected) impact on the cost of aggregate stop-loss coverage.

Scope and Methodology

As previously mentioned, the purpose of this note is to examine the impact of benefit design on the cost of aggregate stop-loss coverage. Other items, beyond the scope of this note, will be briefly discussed in the conclusion.

To investigate the effect of benefit design on aggregate stop-loss pricing, we start with a claim probability distribution. We modify the distribution for the benefit plan we wish to examine, cap it for specific

	Case Size		200	500	1,500	200	500	1,500
Probability	Plan ==>	Full Cost	Rich	Rich	Rich	Lean	Lean	Lean
	Specific=>		$40,000	$100,000	$250,000	$40,000	$100,000	$250,000
0.24000		-	-					
0.09000		60	-	-	-	-	-	-
0.08000		135	28	28	28	-	-	-
0.06000		225	100	100	100	-	-	-
0.04500		325	180	180	180	-	-	-
0.03900		400	240	240	240	-	-	-
0.03500		500	320	320	320	-	-	-
0.03300		650	440	440	440	120	120	120
0.03000		800	560	560	560	240	240	240
0.02800		1,000	720	720	720	400	400	400
0.02600		1,200	880	880	880	560	560	560
0.02400		1,400	1,040	1,040	1,040	720	720	720
0.02200		1,600	1,200	1,200	1,200	880	880	880
0.02000		1,800	1,360	1,360	1,360	1,040	1,040	1,040
0.02000		2,000	1,520	1,520	1,520	1,200	1,200	1,200
0.02000		2,200	1,680	1,680	1,680	1,360	1,360	1,360
0.02000		2,500	1,920	1,920	1,920	1,600	1,600	1,600
0.02000		3,000	2,400	2,400	2,400	2,000	2,000	2,000
0.02000		3,500	2,900	2,900	2,900	2,400	2,400	2,400
0.01800		4,500	3,900	3,900	3,900	3,200	3,200	3,200
0.01600		5,500	4,900	4,900	4,900	4,000	4,000	4,000
0.01500		6,500	5,900	5,900	5,900	5,000	5,000	5,000
0.01400		7,500	6,900	6,900	6,900	6,000	6,000	6,000
0.01200		9,000	8,400	8,400	8,400	7,500	7,500	7,500
0.01000		12,000	11,400	11,400	11,400	10,500	10,500	10,500
0.00800		15,000	14,400	14,400	14,400	13,500	13,500	13,500
0.00600		18,000	17,400	17,400	17,400	16,500	16,500	16,500
0.00500		21,000	20,400	20,400	20,400	19,500	19,500	19,500
0.00400		25,000	24,400	24,400	24,400	23,500	23,500	23,500
0.00350		28,000	27,400	27,400	27,400	26,500	26,500	26,500
0.00325		32,000	31,400	31,400	31,400	30,500	30,500	30,500
0.00300		37,000	36,400	36,400	36,400	35,500	35,500	35,500
0.00280		41,000	40,000	40,400	40,400	39,500	39,500	39,500
0.00260		48,000	40,000	47,400	47,400	40,000	46,500	46,500
0.00235		60,000	40,000	59,400	59,400	40,000	58,500	58,500
0.00150		80,000	40,000	79,400	79,400	40,000	78,500	78,500
0.00070		125,000	40,000	100,000	124,400	40,000	100,000	123,500
0.00024		260,000	40,000	100,000	250,000	40,000	100,000	250,000
0.00004		500,000	40,000	100,000	250,000	40,000	100,000	250,000
0.00002		1,200,000	40,000	100,000	250,000	40,000	100,000	250,000
Total Expected Cost		2,591	2,083	2,268	2,330	1,847	2,025	2,086

stop-loss coverage, and simulate various group sizes. We examine two comprehensive major medical benefit plans (rich and lean) and three group sizes (200, 500, and 1500). The rich benefit plan has a $100 deductible with 80/20 coinsurance up to $2,500 (max out-of- pocket of $600); the lean plan has a $500 deductible with 80/20 coinsurance up to $5,000 (max out-of-pocket of $1,500). The specific stop-loss deductibles for the groups are $40,000, $100,000, and $250,000 for 200 lives, 500 lives, and 1,500 lives respectively. The modified distributions are shown on page 4.

For each combination of group size and benefit plan, we simulated 100,000 groups. The results are as follows:

1. For the 200-life group with rich benefits, the cost of aggregate stop-loss coverage, with a 25% corridor, is 1.222% of expected claim costs; with lean benefits, the cost is 1.699% of expected claim costs.
2. For the 500-life group with rich benefits, the cost is 0.382% of expected claim costs; with lean benefits, the cost is 0.573% of expected claim costs.
3. For the 1500-life group with rich benefits, the cost is 0.038% of expected claim costs; with lean benefits, the cost is 0.073% of expected claim costs.

These results may seem somewhat counterintuitive. In an attempt to try to understand these results conceptually, consider the following argument:

When benefits are reduced, the expected claims level is also reduced, but individual claims may be affected in different ways. For example, in moving from our rich plan to our lean plan, the benefit cost of $300 of medical expenses goes from $160 to $0, a reduction of 100%; for $30,000 of medical expenses, the benefit cost goes from $29,400 to $28,500, a reduction of only 3%. In total, the expected benefit cost in moving from the rich plan to the lean plan is reduced by approximately 11%. However, the circumstances leading to an aggregate stop-loss claim are not ‘expected’. In fact, there are more large claims (with smaller impact of benefit reduction); and thus, by reducing the expected claim level (and thus the aggregate attachment point), by an ‘expected’ amount, more risk is shifted to the stop-loss insurer.

Another explanation can be based on the observation that when benefits are reduced, the standard deviation of the claim distribution is reduced by an amount much less than what the mean is reduced (thus increasing the coefficient of variation).

A significant conclusion of this discussion is to note that if premiums for aggregate stop-loss coverage are determined as a constant percentage of claims (without recognizing changes to benefits), then aggregate stop-loss premiums will be **reduced** when benefits are reduced, but aggregate stop-loss costs will be **increased**.

Conclusion

The approach used in this brief note is admittedly simplistic. In a more extensive study, much more complexity could be considered. For example, the claim probability distribution could be adjusted for the appropriate age/sex mix, for area factors, for expected savings from claim management, etc. The benefit designs reviewed are also quite simplistic. A more thorough discussion could address the impact of office visit co-pays, multi-tier co-pays for prescription drugs, and other benefit design features.

As previously noted, the purpose here is to demonstrate that there is an impact (which is significant) of benefit design on aggregate stop-loss costs.

Another challenge involves the ability to adequately reflect benefit design when developing the aggregate stop-loss pricing model. Monte Carlo simulation can be time-consuming and expensive. By including benefit design as another parameter, we have multiplied the number of required simulations by a significant amount. Interpolation could possibly be used, but linear interpolation may not be the most effective. One could develop a formula from the claim distribution using a well understood statistical distribution to estimate the cost of aggregate stop-loss coverage, and then use the formula to interpolate between points identified in the Monte Carlo simulations. The author has found the lognormal distribution to be a useful tool in this respect.

We may be approaching an environment of increasing medical cost trend. We also seem to be in the midst of an economic slowdown. With this in mind, we should expect employers to consider benefit buy-downs as an alternative to help control the growth of benefit costs. The results of this discussion indicate that aggregate stop-loss costs could increase in this environment. Including benefit design as one of the parameters in aggregate stop-loss pricing models can help in maintaining the appropriate relationship between premiums and costs for aggregate stop-loss coverage.

Editor’s Note: At the time this article was submitted I was doing some similar work on aggregate claim distributions with Monte Carlo techniques. My model was also simple, and I did it with macros in an Excel spreadsheet. Thus, I did not have the luxury of doing 100,000 trials. However, my results duplicated those discussed herein. Results do vary substantially, so 100,000 trials are an important resource in pricing aggregate stop loss.

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