1st Capacity Building Seminar in Health Insurance

Pricing of Family Floater Health Insurance Products

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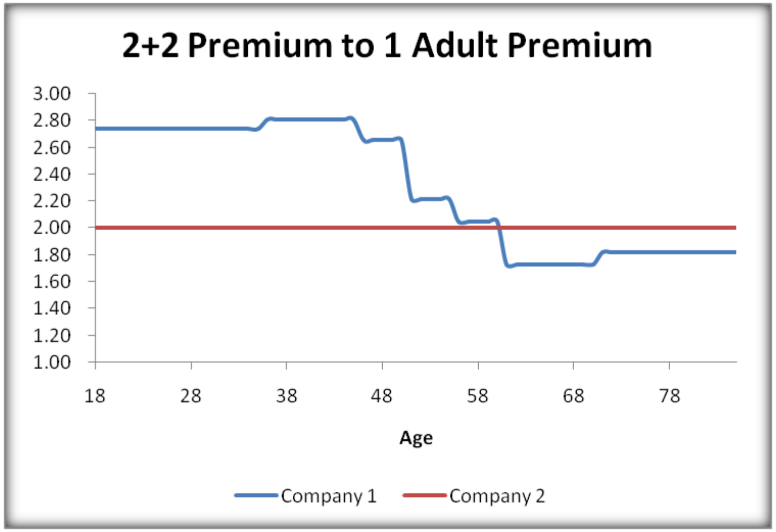
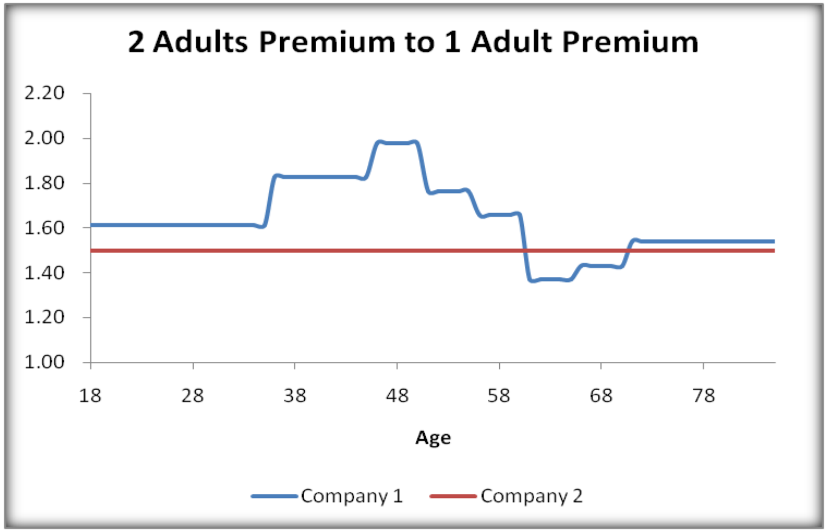
How much discount should be given on Individual premium rates for Family Floater plans?

Some examples





IRDA's focus in recent past

- The discount in floater products should be high enough for customers to clearly see the 'Value for Money'
- Significant discounts are possible in some cases
- But does this apply in ALL cases?

The level of discount depends on…

- Ages of the members
- Annual sum insured limit
- Number of members in the family
- Type of product – indemnity or fixed benefit
- Other pricing assumptions

Where does the discount come from?

- ‘Positive’ selection or lack of anti-selection
- Higher propensity to ‘burn out’ the sum insured limit
- Lower expense loading
- Better persistency?

Positive selection

Have you experienced lower claim incidence rate in floater plans compared to a similar individual plan?

Family Combination	Incidence rate relativity
1 Adult	100.0%
2 Adults	94.0%
2 Adults + 1 Child	70.0%
2 Adults + 2 Children	60.0%
Higher family sizes	50.0%

The effect of positive selection is expected to be higher at higher ages and become more prominent after the PED waiting period is over.

Our Individual experience will emerge later when PED coverage starts

Positive selection

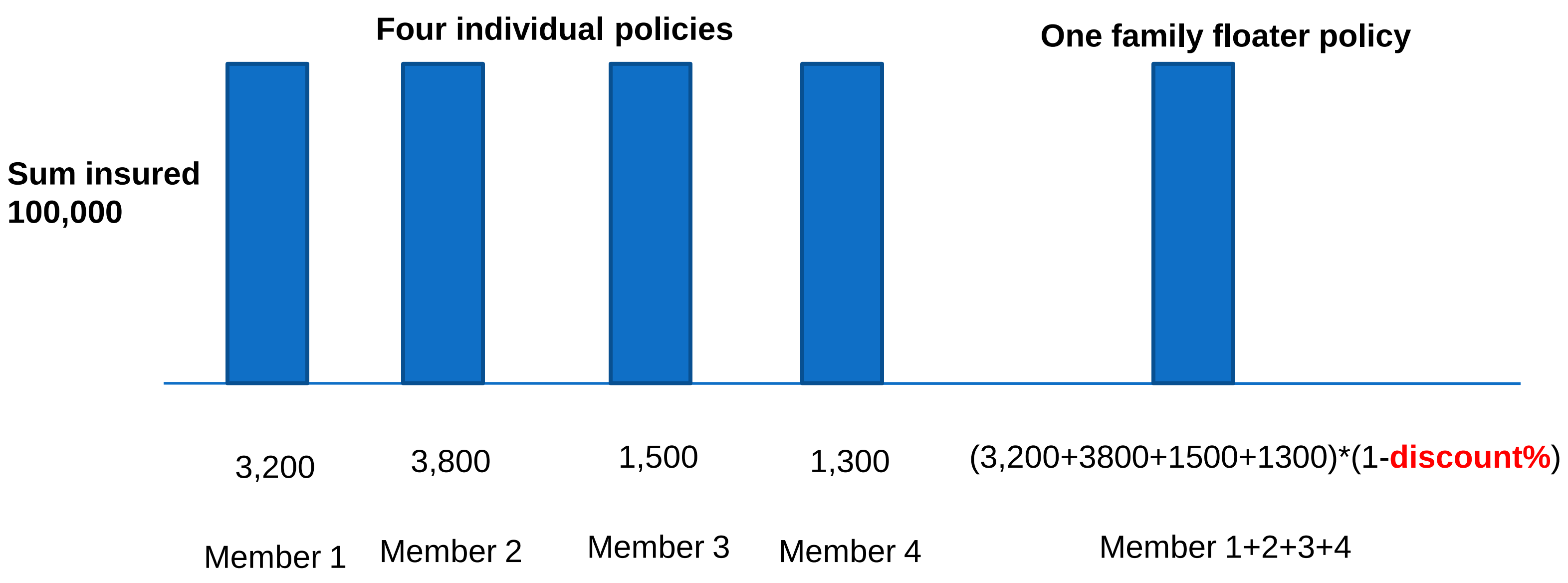
- Individual vs Group
  - For developed markets the Individual incidence rate is more than 50% higher than the Group incidence rate at higher ages
- Selection effect depends on the product coverage
  - Lower for accident only products
  - Higher for indemnity products with comprehensive cover
  - Highest for CI only products which covers chronic diseases

Positive selection

The lower incidence rate effect can be passed on to premium rates as ‘discount on individual premium rate’

Sum Insured Capping Effect

- Four individual policies with 100,000 sum insured (SI) vs 2+2 family floater policy with 100,000 SI
- Maximum payout possible in individual policy, ***albeit in a vey rare scenario***, is 400,000 while it is 100,000 for the floater policy
- How much discount should be given purely for this effect?



Sum Insured Capping Effect

- What are the chances that a claim is above 100,000?
  - It depends….
  - On product benefit e.g. room type allowed, benefits covered
  - On age, higher the age, more the chances of a claim above 100,000

Sum Insured Capping Effect

- What are the chances that more than one member in a 2+2 policy claim in the same policy year?
  - Again, it depends on age
  - For two lives in a policy, independent of each other with probability of claim P_1 and P_2, the probability of both claiming in the same year is $P_1 * P_2$
  - The higher the chances of multiple claims in a year, higher should be the discount.
  - So, the discount should be higher for higher ages

Sum Insured Capping Effect

- What are the chances that the total claim by all members in a 2+2 policy is more than 100,000?
  - The probability that total claims will go beyond 100,000 in a 2+2 policy is more than the sum of probabilities (of total claim beyond 100,000) of individual members.
  - The effect results into the discount due to sum insured capping effect.

Sum Insured Capping Effect

Claim Scenario	Member 1	Member 2	Member 3	Member 4	Total
1	-	-	-	-	-
2	-	-	-	-	-
3	-	-	-	-	-
4	-	-	-	-	-
5	-	-	-	76,050	76,050
6	-	-	-	-	-
7	-	-	-	-	-
8	-	55,014	-	93,089	148,103
9	-	-	-	-	-
10	-	-	-	-	-
11	-	-	-	-	-
12	-	-	-	-	-
13	-	-	-	-	-
14	-	-	-	-	-
15	-	-	43,560	-	43,560
16	-	-	-	-	-
17	-	-	-	-	-
18	32,150	-	-	-	32,150
19	-	-	-	-	-
20	-	-	-	-	-
21	-	-	-	-	-
22	-	-	-	-	-
23	-	-	-	-	-
24	-	-	-	-	-
25	-	-	-	-	-
26	-	-	-	-	-
27	-	-	115,500	-	115,500
28	-	-	-	-	-

Even if each claim is below 100,000, the total may be above 100,000

A claim above 100,000 for a member will mean a claim above 100,000 for the floater

The probability that total claims will go beyond 100,000 in a 2+2 policy is more than the sum of probabilities (of total claim beyond 100,000) for individual members.

Sum Insured Capping Effect

Example

- Fixed benefit product with sum insured 100,000
- Probability of a claim 20%
- Expected claim cost for Individual policy = 20,000
- For a 2 Adult policy:
  - What are the chances that both members will claim in the same year?
  - If the incidence rates are independent, it is 20% * 20% = 4%
  - Probability of a claim = 20% + 20% - 4% = 36%
  - The expected claim cost for 2 Adults = 36,000.
- This results into a 10% discount in this scenario

Sum Insured Capping Effect

- Scenario
  - Sum insured: Rs. 1,00,000
  - Family composition
    - Adult male - 51 years
    - Adult female - 45 years
    - First kid - 17 years
    - Second kid- 11 years
  - Benefits covered
    - Inpatient
    - Daycare
    - Maternity
- What should we the discount offered due to sum insured limit?
- Note that there may be additional discount due to positive selection and difference in margin

Sum Insured Capping Effect

	Pure claim cost without SI limit	Pure claim cost with SI limit
Adult Male	7,040	6,604
Adult Female	3,139	2,697
First Kid	1,948	1,927
Second Kid	1,129	1,119
Total of Individual	13,256	**12,347**
2+2 Family Floater	13,274	**11,038**
Discount		**10.60%**

The sum of unlimited claim costs of all members is similar to total unlimited cost in 2+2

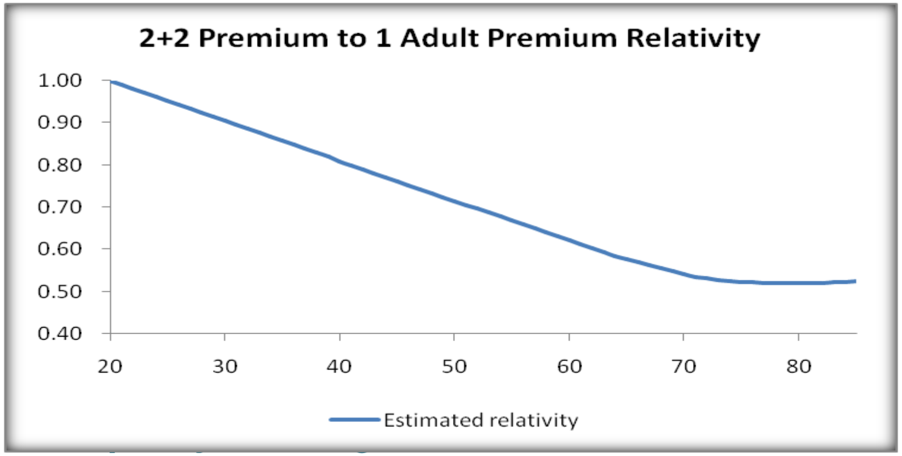
However with 100,000 limit, the claim cost for 2+2 is 10.6% lower than the sum of individual claim costs

Sum Insured Capping Effect

- If we combine this discount with the positive selection effect:
  - 2+2 incidence rates are at 60% of 1 Adult incidence rates on average
- The total discount on individual rates could be 50%

Total Discount in Pure Claim Cost

- As age increases, the effect of positive selection increases.
- With age,
  - Claim incidence rate increases AND
  - Average claim amount increases
  - So, the effect of sum insured capping also increases.
- Both effects suggest a higher discount for higher age
- So ideally, the curve for relativity of 2+2 with 1 Adult premium rates should be downward sloping with age.



Total Discount in Pure Claim Cost

How can we simulate the below scenarios?

Claim Scenario	Member 1	Member 2	Member 3	Member 4	Total
1	-	-	-	-	-
2	-	-	-	-	-
3	-	-	-	-	-
4	-	-	-	-	-
5	-	-	-	76,050	76,050
6	-	-	-	-	-
7	-	-	-	-	-
8	-	55,014	-	93,089	148,103
9	-	-	-	-	-
10	-	-	-	-	-
11	-	-	-	-	-
12	-	-	-	-	-
13	-	-	-	-	-
14	-	-	-	-	-
15	-	-	43,560	-	43,560
16	-	-	-	-	-
17	-	-	-	-	-
18	32,150	-	-	-	32,150
19	-	-	-	-	-
20	-	-	-	-	-
21	-	-	-	-	-
22	-	-	-	-	-
23	-	-	-	-	-
24	-	-	-	-	-
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27	-	-	115,500	-	115,500
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Total Discount in Pure Claim Cost

Probability Distribution of 'Total claim in Family Floater"

- If the pure claim cost follows compound Poisson – Gamma (right truncated) distribution, what distribution does the sum of independent random variables follow?
- What if the distribution is Tweedie?
- Unfortunately, it is difficult to find closed form distribution for sum of claim cost distributions with limits.
- The alternative solution to this problem is simulation.

Total Discount in Pure Claim Cost

- Solution approach using stochastic modeling
  1. **Simulate** the gross claim amount for each member in the individual plan
  2. Calculate the net claim for each member for SI cap of 100,000
  3. ***This gives the pure claim cost for each member for SI 100,000***
  4. For family floater plan, use a different incidence rate assumption to reflect the ‘positive selection’. **Simulate** the gross claim amount for each member.
  5. In step 1, summing the four gross amounts gives the gross claim amount for the family
  6. Get the net claim for the family by applying the SI cap of 100,000
  7. ***This gives the pure claim cost for floater SI 100,000***
  8. ***Comparing the pure claim cost in step 3 with the total of step 7 gives the discount% applicable***

Total Discount in Pure Claim Cost

	Individual plans				
	Member 1	Member 2	Member 3	Member 4	Total
Average cost with SI Limit	6,604	2,697	1,927	1,119	12,347
Average cost without SI Limit	7,040	3,139	1,948	1,129	13,256

	2+2 Family Floater plan				
	Member 1	Member 2	Member 3	Member 4	Total
Average cost with SI Limit	4,263	1,738	714	598	7,313
Average cost without SI Limit	4,502	1,975	719	604	7,800
				Discount	40.8%

Total Discount in Pure Claim Cost

Simulations considerations

- What should be simulated? Claim numbers and claim amounts (and get the total claim by multiplying the two) or the total claim from a member directly.
- Which distributions to use for claim number and claim amount simulation? Choice between empirical distribution and parametric distributions.
- Does the chosen distribution reflect the ‘humps’ and the ‘tail’ (extreme values) appropriately?
- How many age-bands should be considered?

Total Discount in Pure Claim Cost

Simulations considerations

- Empirical distribution may be based on
  1. '***claim incidence rate***' (expected number of claims per exposure) and '***claim amount per claim***'
  2. '***claim probability***' and '***total amount of claim per member given a claim***'

Total Discount in Pure Claim Cost

Type 1

Claim bands		Probabilities
Lower	Upper	Age-band 1
1	10,000	24.03%
10,001	25,000	30.00%
25,001	50,000	37.00%
50,001	100,000	6.00%
100,001	250,000	2.00%
250,001	500,000	0.60%
500,001	1,000,000	0.20%
1,000,001	5,000,000	0.17%
	Total	100.00%

Claim incidence rate **5.13%**

Distribution of amount per claim

Type 2

Claim bands		Probabilities			
Lower	Upper	Age-band 1	Age-band 2	Age-band 3	Age-band 4
0	0	95.00%	96.00%	93.00%	87.00%
1	10,000	1.20%	0.70%	0.80%	1.00%
10,001	25,000	1.50%	0.90%	1.00%	1.80%
25,001	50,000	1.85%			
50,001	100,000	0.30%			
100,001	250,000	0.10%			
250,001	500,000	0.03%			
500,001	1,000,000	0.01%			
1,000,001	5,000,000	0.01%			
	Total	100.00%			

Distribution of total amount of claim per person in a policy year

- 1) is easily available using only claim data by age.
- 2) is possible only when the exposure and claims can be linked by a ‘key’.
- Alternatively, using 1), 2) can be ‘simulated’ .How?

Numbers for illustration purposes only

Total Discount in Pure Claim Cost

Simulations considerations

- Which distributions to use for claim number and claim amount simulation?
  - Parametric claim amount distributions such as LogNormal may not reflect the 'actual' distribution behavior for example
    - Tail probabilities
    - Distribution humps at certain claim bands e.g. 100,000 to 300,000 for age bands 50-70 due to major surgeries at this age
  - Empirical distributions can be used so as to simulate from 'near real' scenarios
  - Judgmental smoothing may be required at the tail

Total Discount in Pure Claim Cost

- Scenario
  - Sum insured: Rs. 1,00,000
  - Family composition
    - One adult male - 51 years
    - One adult female - 45 years
    - One kid - 11 years
    - One Parent – 72 years
  - Benefits covered
    - Inpatient
    - Daycare
    - Maternity

Total Discount in Pure Claim Cost

- Calibration
  - Initial estimates obtained from ‘claims database’
  - Each claim mapped to benefit type using ICD
  - Mean and Standard Deviation calculated using historical data to be used for ***LogNormal***
  - We have used ***Poisson*** for claim number and ***LogNormal*** for claim amount simulation

Initial Estimates from Data				
	Inpatient			
	Adult 1 - Male	Adult 2 - Female	Kid 1	Parent 1
Frequency	4.96%	4.59%	3.15%	8.23%
Cost - Mean	60,956	53,069	28,476	78,476
Cost - SD	54,860	47,762	25,629	70,629
	Daycare			
	Adult 1 - Male	Adult 2 - Female	Kid 1	Parent 1
Frequency	0.96%	0.92%	1.20%	2.20%
Cost - Mean	30,693	30,327	14,325	45,325
Cost - SD	26,089	25,778	12,176	38,526
	Maternity			
	Adult 1 - Male	Adult 2 - Female	Kid 1	Parent 1
Frequency		15.00%		
Cost - Mean		31,244		
Cost - SD		18,746		

Model Parameters				
	Frequency Based on Poisson			
	Adult 1 - Male	Adult 2 - Female	Kid 1	Parent 1
Inpatient	4.96%	4.59%	3.15%	8.23%
DayCare	0.96%	0.92%	1.20%	2.20%
	Cost Based on Lognormal			
	Adult 1 - Male	Adult 2 - Female	Kid 1	Parent 1
Inpatient - Mean	10.72	10.58	9.96	10.97
Inpatient - SD	0.77	0.77	0.77	0.77
DayCare - Mean	10.06	10.05	9.30	10.45
DayCare - SD	0.74	0.74	0.74	0.74
Maternity - Mean		10.20		
Maternity - SD		0.55		

Total Discount in Pure Claim Cost

Simulation steps

- Claim numbers
  - Generate a random number from a uniform distribution, U(0,1)
  - Compare it with the cumulative probabilities of the calibrated Poisson distribution to generate the corresponding Poisson variate.
  - Repeat the process for each family member
- Claim amounts
  - Generate from Lognormal using any of the standard methods e.g. transformation of a Uniform random variate or using the Excel spreadsheet function.

Total Discount in Pure Claim Cost

- Results from one simulation
  - Claim incidence

Benefits	Frequency Simulation			
	Adult Male	Adult Female	Kid	Parent
Inaptient	1	-	-	-
Day Care	-	-	-	1
Maternity		-		
Total	1	-	-	1

  - Severity per Claim

Benefits	Cost Simulation											
	Adult Male			Adult Female			Kid			Parent		
	Claim 1	Claim 2	Total Severity	Claim 1	Claim 2	Total Severity	Claim 1	Claim 2	Total Severity	Claim 1	Claim 2	Total Severity
Inaptient	25,777.6	-	25,777.6	-	-	-	-	-	-	-	-	-
Day Care	-	-	-	-	-	-	-	-	-	19,985.5	-	19,985.5
Maternity				-		-						
Total	25,777.6	-	25,777.6	-	-	-	-	-	-	19,985.5	-	19,985.5

  - Severity per member (all claims)

	Adult Male	Adult Female	Kid	Parent
Total Severity	25,777.6	-	-	19,985.5

Total Discount in Pure Claim Cost

- Results from 10,000 simulations

Simulations					
Sr. No	Adult Male	Adult Female	Kid	Parent	Total
1	-	-	-	-	-
2	-	-	-	-	-
3	-	-	-	-	-
4	-	-	-	-	-
5	-	-	-	-	-
6	-	-	-	-	-
7	-	-	-	78,113	78,113
8	-	-	-	-	-
9	52,601	-	-	-	52,601
10	-	-	-	-	-
11	-	-	-	-	-
12	-	-	-	-	-
13	-	-	-	-	-
14	-	-	-	-	-
15	-	-	-	177,083	177,083
16	-	-	43,437	-	43,437
17	-	44,128	-	46,741	90,870
18	-	-	-	-	-
19	-	-	-	-	-
20	-	20,645	-	227,382	248,027
21	-	-	-	-	-
22	-	-	-	-	-
23	-	88,856	-	-	88,856
24	-	-	-	-	-
25	-	-	-	-	-
26	-	-	-	36,222	36,222
27	-	-	-	-	-
28	-	113,942	-	-	113,942

Once the gross simulated numbers are obtained, any formula can be applied to them to get the necessary results.

Discount due to margin difference

- Margin for operating expenses include:
  - Underwriting expenses
  - Policy fulfillment expenses – issuance, query handling, endorsements etc
  - Claim handling expenses
- Claim handling expenses per member may be lower due to lower claim incidence rate
- Policy fulfillment costs is also linked to number of policies. Hence per member cost should be lower in a floater policy than in an individual policy.
- Even underwriting cost may be lower if the rejection ratio in floater policies is lower than in Individual policies. Do we have such an experience?

Discount due to other reasons

- Better persistency
  - Customer life time value
  - Persistency increases as number of members in the family increase?
- Lesser frauds
- Discretionary discounts to make floater a better proposition for customers

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Q&A