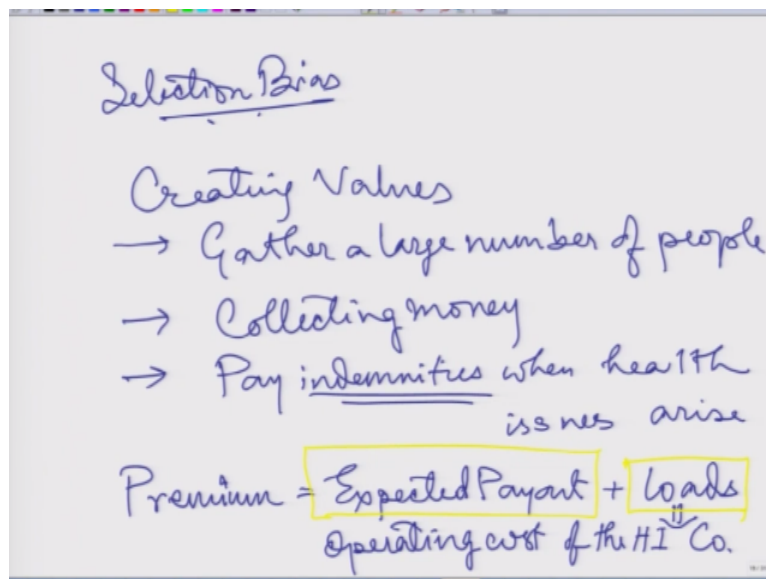


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**Lecture - 29**  
**Important Concepts of Health Insurance**

So what insurance companies do basically they will create a value for their insurance for their products. So how they create the values, so first one creating values here.

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So they will gather a large number of people and try to sell them their insurance. It can be individually they gather them, it can be they go to an organization and give them a group insurance but they have to gather a large number of people because it is a risk pool. If we are 10 people here, 9 of them are absolutely fine, I have fallen sick. All 10 are paying their insurance.

I do not know you know who is falling sick. I fell sick, I went to the hospital, their all health insurance premiums are taken together to pay for my you know for my treatment. So it is known as a risk pool. If they cannot gather a lot of people to cover my insurance, then they are not really you know doing a sustainable business. So they have to cover a lot of people so that the percentage falling sick is lower.

And as well as they have enough capital to pay for a particular person's morbidity or disability and they also have their operating cost, so we will come to that. The second is after gathering these people they collect their money in terms of the payment I mean premium. They collect their money and then pay the indemnities when the I will define what is indemnity.

Pay indemnities when you know health issues arise. That is the amount they are supposed to pay. These health insurance companies are supposed to pay for the patients or those patients those certainly have the insurance with that particular company. Now the premium they estimate is=the expected payout+loads. Now loads are nothing but the operating cost of the health insurance company.

Now what is this operating cost? They do not only you know if they collect 1000 rupees from me, 1000 rupees from 9 other people, so total 10,000 rupees and if I am falling sick they cannot give me all 10,000 rupees right and because they also need to pay the salaries to their employees, they also need to pay for the rent for the building, electricity, transportation, all other things you know.

So these all other things are known as loads, expenditures towards the operations you know to the operating cost and the expected payout are the payout towards the insurance claims because I claim my insurance back when I am sick right. So the expected payout is the total payment they will make against the claims which have arise during a particular period out of their customer base.

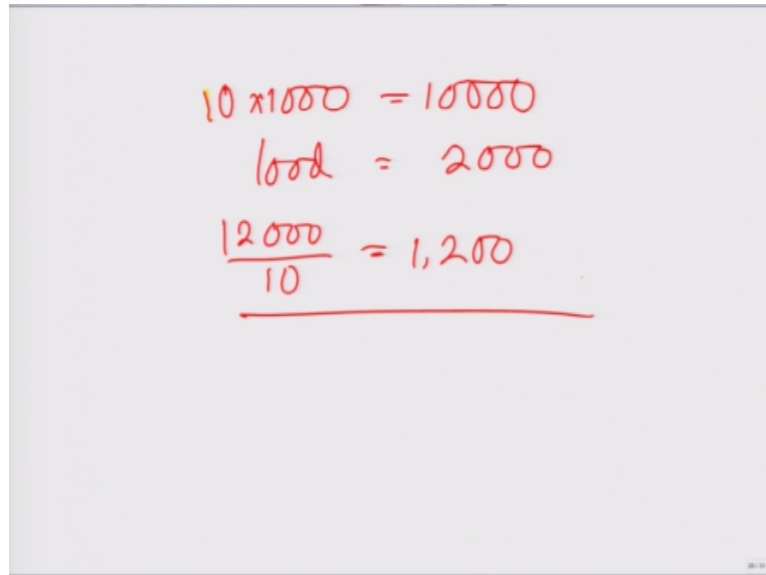
So this expected payout is they can expect okay fine this person Angan who has to pay 10,000 rupees who has to you know who will claim an amount of 10,000 rupees. There is somebody else ABCD, they may also claim 5,000 rupees. So if my expected claim is higher, I will charge the insurance (()) (04:20) premium higher because now we 2 out of 10 will ask for 15,000 rupees and the insurance company cannot keep 1000 rupees.

Because if they expect us we ask we do not ask different story altogether but they expect us that based on our profile we can ask for a payment 15,000 rupees and but they are only collecting 10,000 rupees, so they may go into a trouble a loss making business. So they have

to understand that what is their expected payout, on top of that what is their operating cost right.

If it is just me 10,000 rupees and then they have charged all 1000 rupees from 10 people and then I ask 10,000 they are giving me all, now if in that way they are collecting a premium of 1000 thousand rupees.

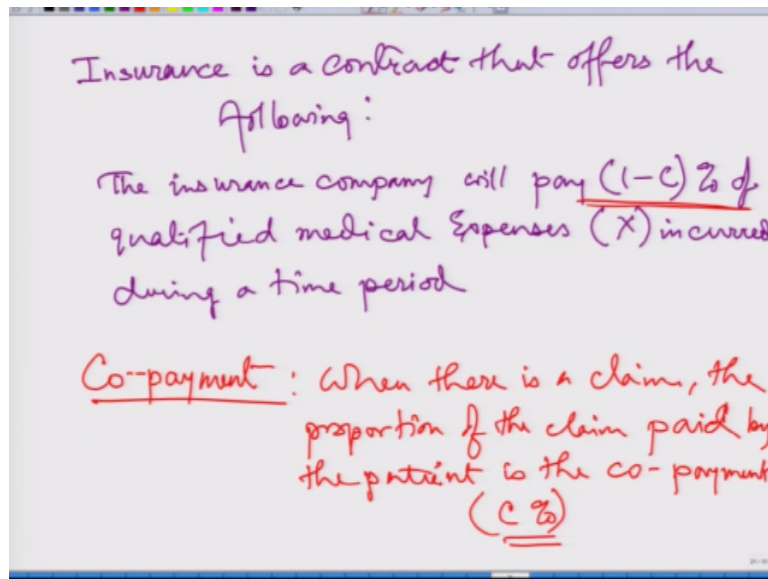
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$$\begin{aligned} 10 \times 1000 &= 10000 \\ \text{load} &= 2000 \\ \hline \frac{12000}{10} &= 1,200 \end{aligned}$$

So 10 people are paying a premium of 1000 rupees and total is 10,000 rupees yes and then that should be added with load which is 2000 rupees right and that is how they can collect to us 1000 from 10 people and can ask for a premium of 1200 rupees. We will discuss this again in detail just 5, 10 minutes after you know 5, 10 minutes later. So when we are talking about insurance there are four things we must remember.

You know in terms of when we are buying an insurance. The first thing is what is an insurance?

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So the insurance is a contract or a piece of paper you know which offers a contract between the patients and the health insurance company which offers the following, so the contract is between the patient and the health insurance company. What is the following? That the insurance company will pay  $1-C\%$  of  $1-C\%$  that means not 100%. What is this  $1-C\%$  I will tell you of qualified medical expenses which can be denoted as  $X$  which is the total expense incurred during a time period.

Now I will go one by one, yes  $1-C\%$ , this  $C$  is known as the co-payment. This  $C$  is known as the co-payment, co is together again co-payment. Now what is co-payment? When there is a claim from the patients to get that insurance money back because they are sick somebody in that family household or that particular individual is sick when there is a claim, the proportion of the claim paid by the patient is the co-payment.

That means this is the  $C\%$  right. This is the  $C\%$  and this  $C\%$  if one is 100 so if the patient is paying 20% then this is 80% which the insurance company is supposed to pay yes. So that means the insurance company is not going to pay the entire amount. In some cases, it is 100% but not all often because certain things say ambulance, the medicines they are not charged, I mean they are not covered right.

That the patient has to pay or some medical appliances say these are wheelchair or stick all these you know the patient has to pay. So this is what the insurance company will pay of qualified medical expenses. Now what is this qualified medical expenses? In that document,

the contract it clearly mentions which are the medical expenses will be covered, which are the diseases will be covered, how far it will be covered.

You know whether pregnancy will be covered, childbirth or a delivery will be covered, whether my ophthalmology, my eye problems you know optometric problems will be covered. So it clearly mentions whether my dental problems will be covered. So only that 80% of those which is qualified in my insurance will be incurred during a time period of in one year yeah.

So what the insurance contract says and then I need to pay a certain price for that and then that price is known as premium.

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Premium : Price ( $P$ ), paid by the consumer when they are purchasing the contract from the insurance company

Indemnities : The total amount the insurance companies will pay to the patient or healthcare provider.

$(1 - C)\% \times X$

Revenue :  $\sum P$        $\sum P - \sum (1 - C) \times X$

Expenses :  $\sum (1 - C) \times X$       ↑ < ↑

To get that contract I need to pay a price per year, so this price is known as the premium often given as in terms of  $P$  which is paid by the consumer. It is not right to write patient because they are not patient all the time or most of the time when they buy an insurance. So paid by the consumer, price be paid by the consumer when they are purchasing the contract from the insurance company yeah and they are purchasing a contract.

And then we have discussed about this indemnity right, over here indemnities. Now what is this indemnity? These indemnities are finally what the insurance companies are paying. They are paying  $1 - C\%$  right. So indemnities are the total amount the insurance companies will pay to the healthcare provider or to the patient, pay to the patient or health care provider yes and it is  $1 - C\%$  of the total expenditure  $X$  that is the total medical expenditure right.

So this is what this is the 80% of the total medical expenditure what they have to pay, the insurance companies have to pay that is the indemnity. How they estimate the revenue? The revenue for an insurance company is estimated in terms of this is again my income-my costs right. So if my income or my revenue sorry my revenue is the so this is the profit story. The profit is the revenue-cost.

So if my revenue is summation of all the premiums right that is my revenue that is my earning. Even those who are not falling sick they are paying me the premium. So this is my revenue and the expenses is summation  $1-C*X$ . Why summation? It is say I have asked for 10,000, somebody ABCD has asked for 5000, so this is my expenses. So this revenue-expenses is my profit as an insurance company.

This is my profit or earning. Yeah the insurance company will go bankrupt if they are playing more, so this is more than the premium. So if the indemnities or the expenses what they are paying for say 5, 10, 15 patients is more than the total premium they are earning you know. So for say out of 100, 90 may not ask for any indemnities or any claim, 10 have asked for the claims.

So together all these claims if it is more than the premium, total premium they have earned from all these 100 people then the insurance company will go bankrupt because they are making losses. There comes the idea about actuarially fair premium or actuarial fairness.

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Actuarial Fairness

Actuarially Fair Premium : The average value of indemnity payments

For a population of (N) insured people

$$P = \frac{\sum (i-c)x}{N} \leftarrow \frac{\text{Total indemnity}}{\text{Total \# of insured people}}$$

$P_{\text{out}} = \frac{\sum (\text{expected payout} + \text{loads})}{N}$

What loosely we discussed just few slides back actuarial fairness. What is actuarial fairness? It is defined in terms of actuarially fair premium. Now what does this means, this is the average value of indemnity payments for a population of  $N$  which is their customer base, population of  $N$  or of  $N$  insured people which is their customer base right. So this is nothing but total indemnity.

So your average value is nothing but your total indemnity of that particular, so it is nothing but the total indemnity/total number of insured people yes. So your total indemnity is summation  $1-C*X/N$ , this is my average indemnity right and if that insurance company charges this actuarially fair premium, then they are paying all their revenue out to meet the claims from the patients and then they do not have any money to pay for their stuffs.

So therefore this actuarially fair premium is very, very risky because then in this case your  $P$  is this. The total payment you are making for the treatment/the total number of people and this is summation  $P$  which is like  $P_i*N$ , all this you know summation  $P_i*N$  all these individuals together. So that means this total  $P$  should be more than the total premium should be more than the total indemnity.

And that is where they will not go bankrupt right. If this summation  $P$  should be more than  $1-CX$  and if  $1-CX/N$  is more than the individual premium. If we are estimating this individual premium based on total expected payout/the total number of population that is average expected payout, then I am not actually accounting for the payment for my stuffs. Therefore, we have to keep in mind what is the load.

So when we are estimating the premium that should be expected payout+loads. That is the amount we are giving to the you know for my operation cost towards my operation cost you know so and you can keep them together and divide it by  $N$  that should be my actual premium yeah. Otherwise I may run into losses. How I can estimate the actuarial fair premium in terms of probability.

Because when we talk about expectation that is actually expected payout that is actually based on the probability of a person of falling sick right. A person falling sick will have you know the higher the probability of a person falling sick will be higher my probability to pay

for that particular person you know and lesser the probability is closer to zero that means that person is doing quite well.

He is like his background says he is physically quite well, so I am not actually going to make a payment for this person during next one year yes and we never say that that is zero you know but close to zero, low or high so it is not certain or it is not uncertain anything.

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The image shows a whiteboard with handwritten text in purple and blue ink. At the top, 'Actuarially Fair Premium' is written and underlined, with 'Actuarially' circled in green. Below this, 'P<sup>S</sup> = Probability of falling sick' and 'C = Cost of illness.' are written. The formula 'Actuarially Fair Premium = P<sup>S</sup> × C.' is shown with the product boxed. At the bottom, 'Actual Premium = AFP + load' is written.

$$\text{Actuarially Fair Premium} = P^S \times C$$
$$\text{Actual Premium} = \text{AFP} + \text{load}$$

So when we estimate the actuarially fair premium in terms of probability, we must take into account the probability of falling sick which should be multiplied by C which is cost of sickness or of that illness of that particular disease you know cost of treatment. So you can actually then estimate this actuarially fair premium as our product of the probability of falling sick\*the cost of that treatment for that particular disease.

And an insurer needs to estimate these  $P^S \times C$  for every individual customer they do have yes and then take an average to get this actuarially fair premium because this is an average estimate, this is the premium for one individual, this is not the target total right. So every individual has you know has a probability say different probability for falling sick and based on those probabilities they have a different estimate or expected cost to be paid.

Multiply that that is the payment you are going to make for that particular customer, together you get the total expected payout. Again total expected payout not load, so whenever you are not estimating load, it just gives you the actuarially fair premium. So again as I said so your total premium actual premium, actual and actuarial, actuarial is you know it is a part of it is a



discipline of mathematics and statistics which basically deals with the risks and uncertainties probabilities.

So here they are understanding the risk, they are studying the risk of a person falling sick or studying the payment an inch make based on certain parameters, certain probabilistic nature of certain parameters, certain variables and that is why they have given it a name of actuarially but when we estimate not actuarially, ria is not there, just actually so when I estimate the actual premium, we must take actuarially fair premium+load.

If we do not account for the load, the insurance company is going bankrupt yes. So therefore we need to keep this, do this estimate and then try to understand you know that what is the load.

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The image shows a whiteboard with handwritten mathematical calculations. A red box encloses the main derivation:

$$10 \times 1000 = 10000 +$$
$$\text{load} = 2000$$
$$\frac{12000}{N \text{ [10]}} = 1,200$$

To the right of the box, there is a note: "Exp Payout = 10,000 (Ps \* C)" with an arrow pointing to the "10000" in the first equation.

So this is the load which we estimate with this actuarially fair premium 10,000 or the premium I am getting expecting a you know expected payout of 10,000 which comes from the you know these  $P_s * C$ , this is nothing but the  $P_s * C$  and if you have got that if you have got this value just add 2000 with this.

And then you get our total you know expenditure what as an insurance company you are going to you know incur during a particular period of time/this  $N$  which is the number of insured patients, well insured customers whom you know you have covered and this is your actual premium, your actuarially fair premium is 1000, your actual premium should be 1200 considering 2000 rupees as the load. Thank you.