Community Medicine
Risk

We are going to talk today about 3 measures of risk:
1- Attributable risk% (AR),
2-Population attributable risk % (Pop AR)
3- Relative risk (RR).

To be able to understand these three measures we have to go back to prospective cohort studies (which is a follow up study) so for example:

Note: the ultimate goal of cohort study is to find out the IR of a disease and investigate cause effect relationship.

If I want to conduct a cohort study of bronchitis and smoking, we would take a group of smokers (100) people and a group of non-smokers (200) people [remember they are not exposed to the risk factor unlike the smokers]. In cohort studies we are looking for new cases in the community, therefore any old case should be excluded, like if any smoker or non-smoker has bronchitis at the beginning should be excluded in order to effectively find the correlation and the incidence rate of the disease. So we will do a follow up for these two groups for 2 months to find out whom of these two groups got bronchitis in this period. At the end of the 2 months period we would be able to construct this table:

	Bronchitis			
	Positive	Negative	Total	Incidence Rate (%)
Smokers	10	90	100	10%
Non-smokers	10	190	200	5%
Total	20	280	300	6.7%

After two months of follow up it was discovered that some of the people got bronchitis as seen in the table above: From the smokers group 10 cases developed bronchitis out of the 100. While in the non-smoke group 10 also developed out of the 200.

First question would be: *What is the incidence rate of bronchitis in smokers?*

This would be calculated as follows:

$$\frac{10(\,no.of\ new\ casesof\ bronchitis\ in\ smokers)}{100(\,total\ no.of\ smokers)} \times 100\% = 10\%$$

In *non-smokers:*

$$\frac{10\ (no.\ of\ new\ casesof\ bronchitis\ in\ non-smokers)}{200\ (total\ no.\ of\ non-smokers)} \times 100\% = 5\%$$

The incidence rate in the <u>whole population:</u>

$$\frac{20(total\ no.\ of\ new\ cases)}{300\ (total\ pop\ of\ the\ study)} \times 100\% = 6.7\%$$

From any study you conduct you will be able to calculate the 3 incident rates above.

Now we will move on to calculating the relative risk, which is the degree of association between smoking and bronchitis (which are the variables in our study):

Relative risk: $\frac{\text{Incidence rate in smokers}}{\text{incidence rate in non-smokers}} = \frac{10\%}{5\%} = 2$ degree of association in this example.

What is the explanation of this risk factor?

After calculation we found that it is 2, which means that the risk of incidence of bronchitis in a smoker is double that of a non-smoker.

If for instance the P value was= 0.02 then we would conclude that the relationship between smoking and bronchitis is **significant.**

- If the two incidence rates in another study were <u>equal to each other</u> then there will be **no association** between the two variables.
- However if the numerator is larger which means <u>the relative risk > 1</u> like the example that was given above then this is **positive association.**
- The last case would be if <u>the relative risk <1</u> which means the denominator is larger ex $\frac{5\%}{10\%} = 0.5$ this is called **protective association.** An example on this would be oral contraceptives and osteoarthritis it was found that taking the

oral contraceptive pills protected against osteoarthritis.

Attributable risk (%):

Going back to our example about the association between smoking and bronchitis. If you are giving a lecture to smokers about the positive association of smoking to bronchitis explaining that the incidence rate of having bronchitis in a smoker is higher (10%) when compared with a non-smoker (5%) therefore smokers should quite smoking in order to decrease the incidence rate.

If one of the smokers asked you how much the decrease in the risk of bronchitis if he stopped smoking, then as if he is asking you *what is the attributable risk (AR)?*

$$\text{AR}= \frac{\boldsymbol{Incident\ rate\ (IR)\ of\ bronchitis\ in\ smokers - IR\ of\ bronichitis\ in\ \ nonsmokers}}{\boldsymbol{IR\ of\ bronchitis\ in\ \ smokers}} * 100\%$$

If we applied this equation to the previous example then:

$$\frac{10\%-5\%}{10\%} \times\ 100\% = 50\%$$

So, if the person stopped smoking the incidence rate of bronchitis will drop by 50%, therefore it would be 5% the same incidence rate of a non-smoker.

Once a study was made to investigate the effect of continuous exposure to noise and its effect on loss of hearing in employees working at a factory. After calculating the attributable rate it was 96%. So the incidence rate of loss of hearing to those exposed to the noise in the factory could be decreased by 96% if we protect their ears (there are several protective methods for the employees against the continuous exposure).

Finally we can calculate the **population arributable risk** through this equation:

$$Pop\ AR\% = \frac{IR\ of\ bronchitis\ in\ the\ population - IR\ of\ bronchitis\ in\ non\ smokers}{IR\ of\ bronchitis\ in\ the\ population} * 100\%$$

$$= \frac{6.7\%-5\%}{6.7\%} \times 100 = 25\%$$

** (How the population incidence rate was calculated

$\frac{10+10}{300} \times 100\%=6.7\%)$

Looking at the population incidence risk, which indicates that that the incidence rate in smokers and non-smokers will decrease by 25%.

In all studies the attributable risk would be higher than the population attributable risk [AR > Pop AR], because it is only concerned with the group exposed to the risk factor, while the population attributable risk is the percent of the incidence of a disease in the population (exposed and unexposed) that is due to exposure. It is percent of the incidence of a disease in the population that would be eliminated if exposure was eliminated.

Sorry for any mistake. ☺