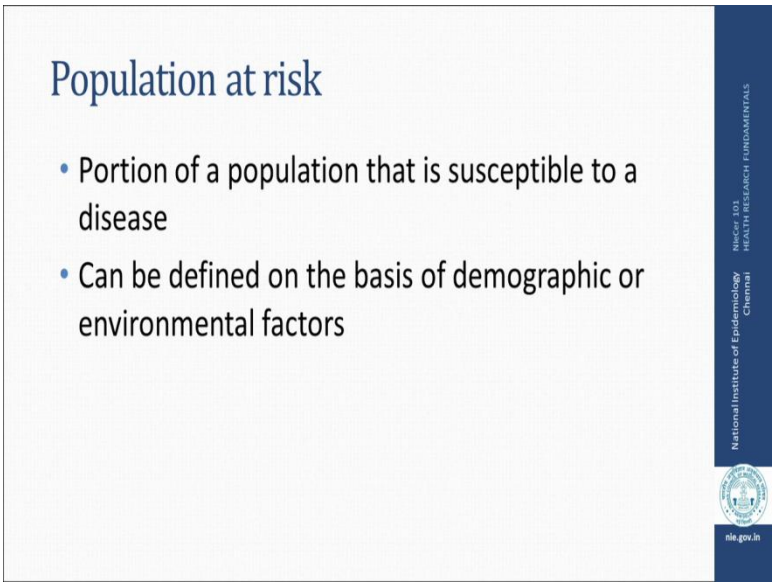
Health Research Fundamentals
Dr. R. Ramakrishnan

ICMR-National Institute of Epidemiology, Chennai

Lecture - 04
Measurement of Disease Frequency

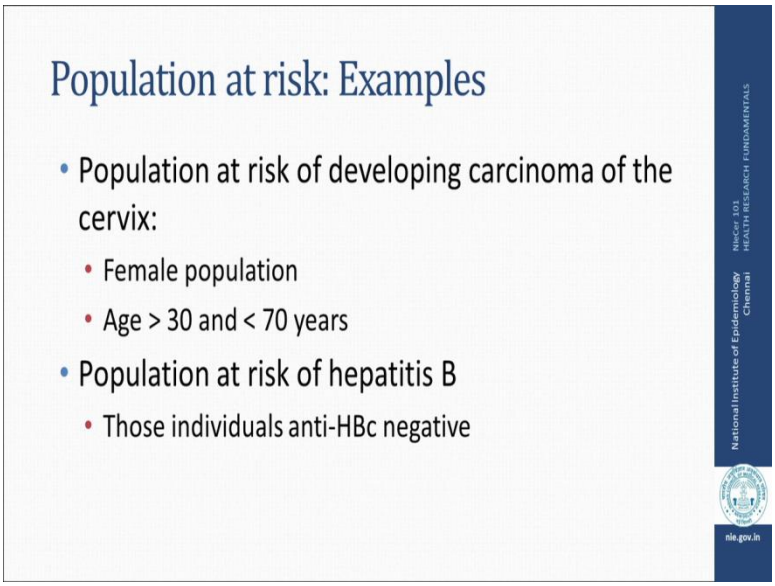
Welcome to this session of Health Research Fundamentals. In this session, we are going to see some measurements we commonly use to measure the Disease Frequency.

(Refer Slide Time: 00:20)



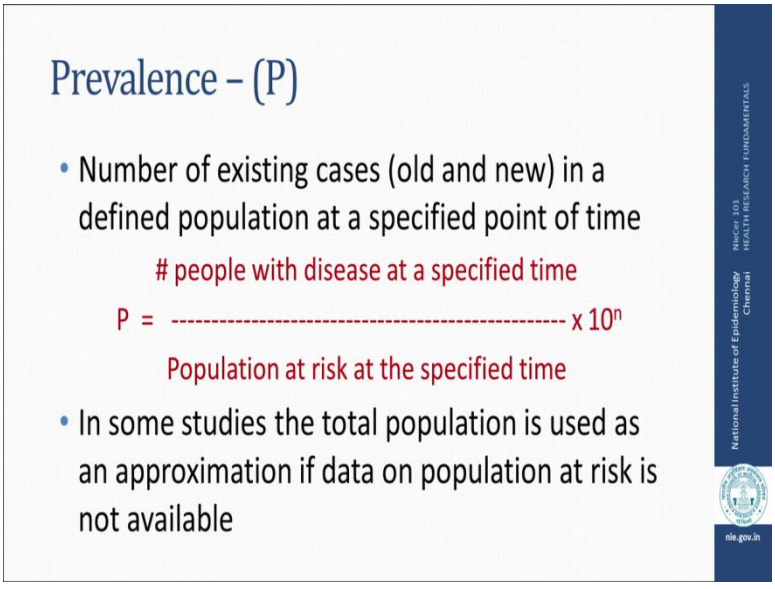
Before we go in for appropriate measurement of disease frequency, we need to understand certain concepts like a Population at Risk. The population at risk are the portion of population that is susceptible to a disease. That can be defined on the basis of demographic or environmental factors.

(Refer Slide Time: 00:49)



Now, let us look at some example. The population at risk of developing carcinoma of cervix is female population and in the age group of 30 to 70 years. A Population at risk of hepatitis B are those individuals who are at risk of developing hepatitis B, but were negative.

(Refer Slide Time: 01:14)

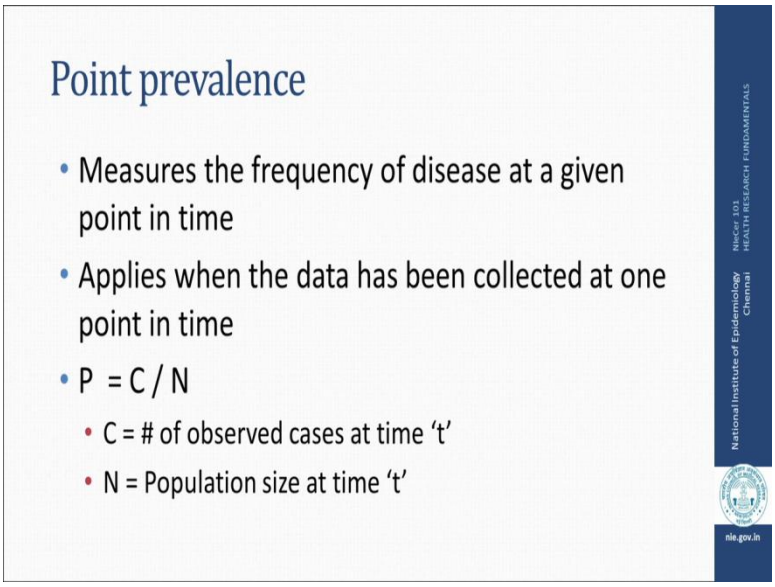


Now, let us look at a measure which is very often used in epidemiology in any health research. As called prevalence, what you mean by prevalence? The prevalence is the number of existing cases both old and new, in a defined population at a specified point of

time. P is equal to is the number of people with disease at specified time and that is divided by the population at risk at this specified time and that quantity is multiplied by a factor by 10 or 10^n.

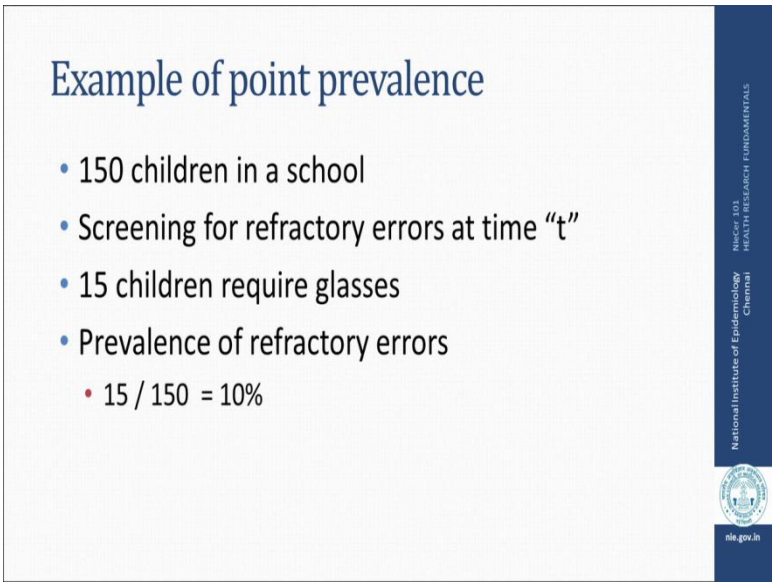
In order to make that as, suppose whenever your population at risk is very large and you have number of cases were small, you will get a value P as 0.001. So, in order to make into a round number you multiplied by 1000, 10000 or 100000 depending on what the value of P you get. So in some studies, the total population used as in approximation if data on population at risk is not available because with the philosophy that everyone in the population are at risk of developing a particular disease.

(Refer Slide Time: 02:39)



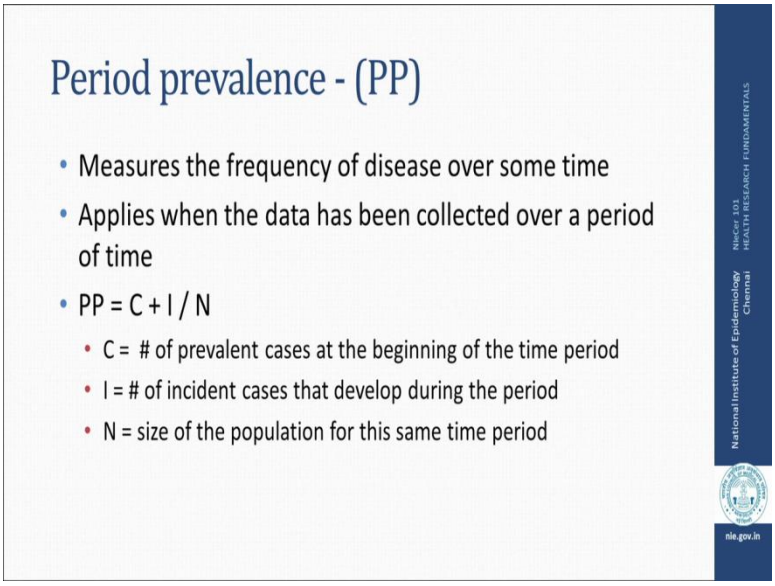
Again, this prevalence are broadly classified into say 2 different categories. We called as one as a Point Prevalence and another one as a Period Prevalence. By point prevalence what we mean is, this measures the frequency of disease at a given point of time, it is like a snapshot. This applies when the data has been collected at one point in time. It is denoted as P is equal to C by N, where C is the number of observed cases at that particular point of time t and N is the population size at time point t.

(Refer Slide Time: 03:21)



The example of point prevalence is supposed, if there are 150 children in a school and you are screening them for refractory errors, at a particular point of time t. And you find 15 children they require glasses, they have problem. Then the prevalence of refractory errors is 15 divided by 150 which is equal to 10 and called a 10 percent of the school children they have refractory errors or the point prevalence of refractory error in this particular school is 10 percent.

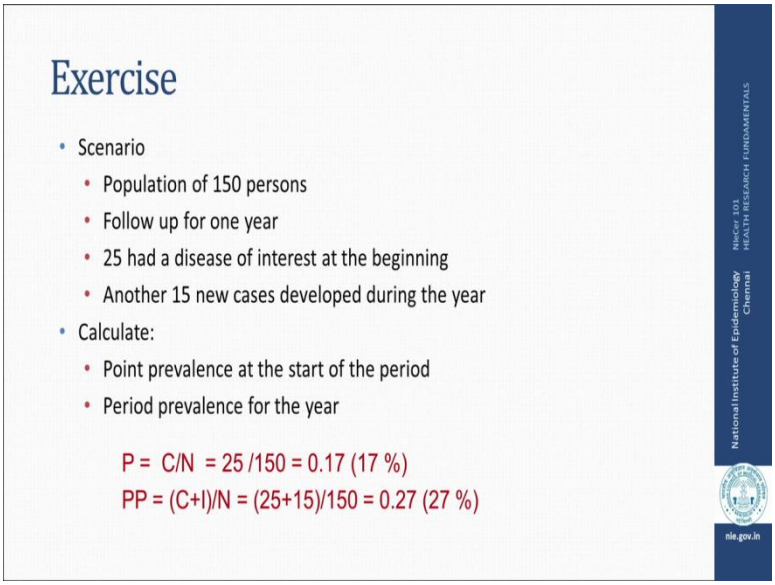
(Refer Slide Time: 03:56)



The Period Prevalence is that measures the frequency of disease over a period of time.

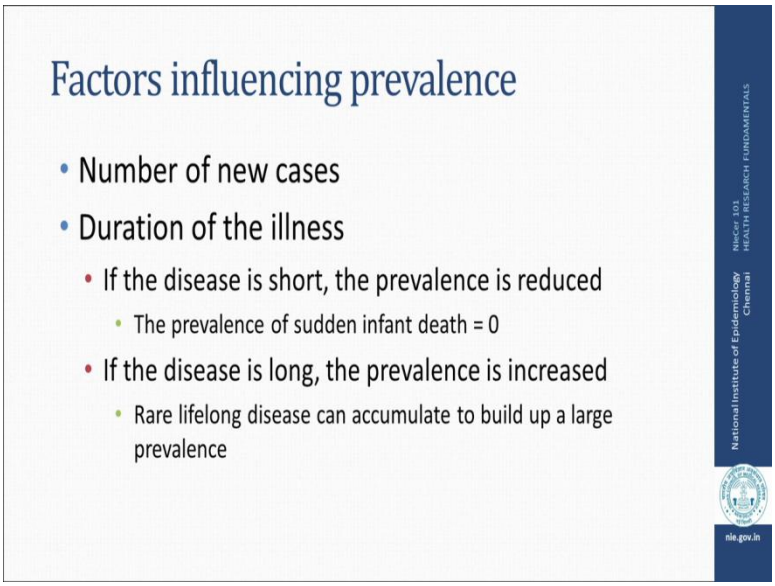
This applies when the data has been collected over a period of time and it is denoted as PP, which is equal to C plus I divided by N. What is C? C is the number of prevalent cases at the beginning of the time period and I is the incident cases, that is the new cases that develop during the period of your survey and sum of these two are divided by N which is the size of the population for this same time period point.

(Refer Slide Time: 04:39)



Example of this period prevalence is you know, you take a scenario of a population of 150 persons and you follow up for 1 year. At the beginning of your survey the 25 had disease of interest and another 15 new cases developed during the year. When we calculate it point prevalence at the start of the period and period prevalence over the period of time. Point prevalence is given by C divided N there is 25 by 150 or 0.17 or 17 percent. Period prevalence is 25 plus 15 there is 40 over 150 it comes 0.27 that is 27 percent.

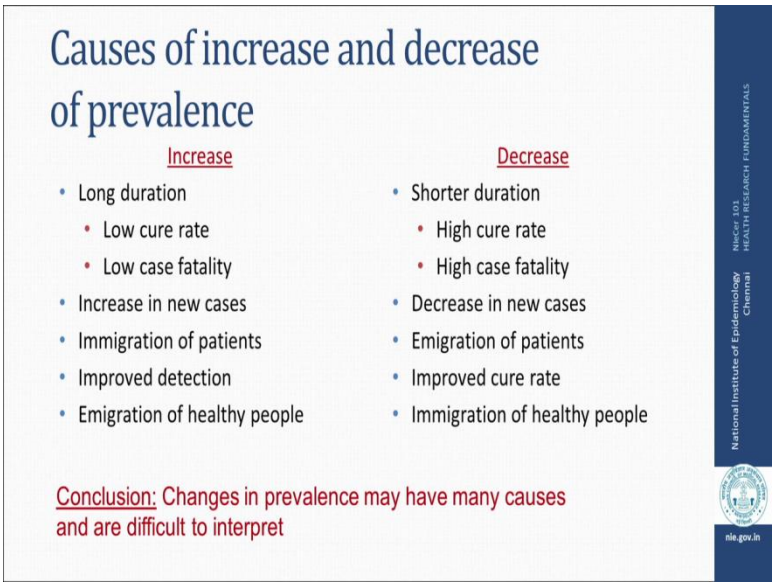
(Refer Slide Time: 05:21)



So, now there are several factors that influence the value of prevalence, the number of new cases, the duration of illness. Suppose, if the duration of illness is short, the prevalence is reduced. Say suppose, somebody gets disease and immediately you know either it cures or it dies then it goes out of our calculation, with thus when we go there are no disease persons. So, the prevalent of sudden infant deaths cut by times would be even 0 because when you go if there are no deaths that are there, all the children who had the disease had died. So, there are no cases at that particular point of time, so your prevalence may be 0.

And if disease is of very long duration, the prevalence you know it goes on suppose it is in chronic diseases, a rare lifelong diseases it can accumulate to build up a very large prevalence.

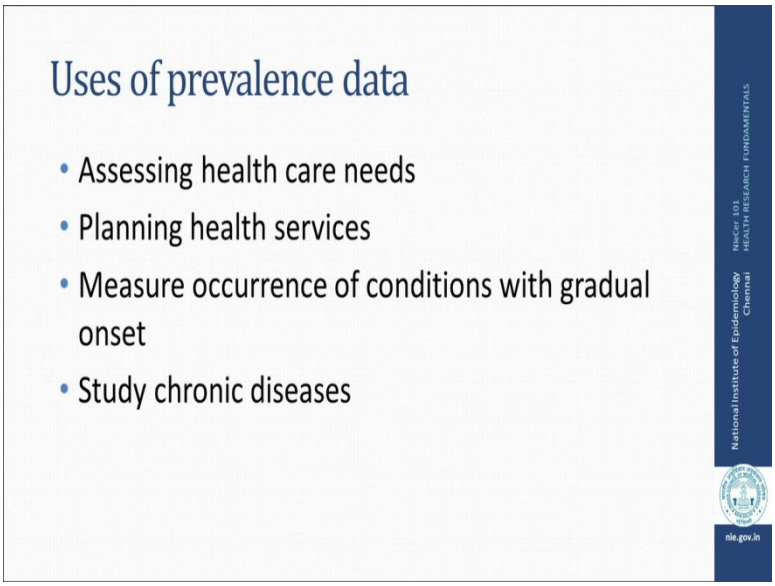
(Refer Slide Time: 06:15)



We have to be rather careful, what causes an increase or decrease in prevalence? An increase in prevalence could be caused by long duration, just low cure rate or low case fatality. And there are more number of new cases that have come back or there are some immigration population patients who have with particular disease, if they immigrate into a particular area they could rather enhance the prevalence. Prevalence could also be increased, if there are new improved detection mechanism you try to you know detect more cases because you have more sensitive test in your hand.

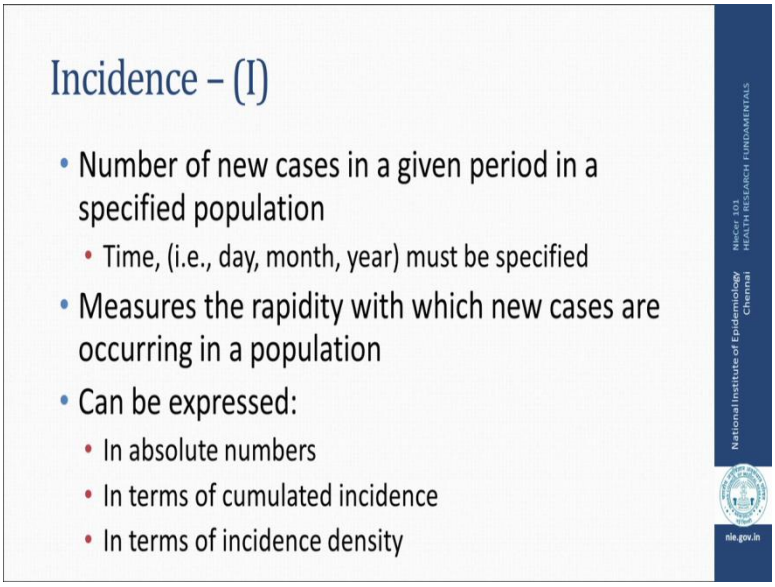
And prevalence could also increase, if there are healthy people going out of a particular region. So that your denominator is low and your numerator is all unhealthy or disease people are there and so your prevalence may increase. The decrease in the prevalence could happen exactly you know the opposite causes, the shorter duration, high cure rate, high case fatality, the decrease in new cases, immigration of patients, improved cure rates and immigration of healthy people. All these could bring down the prevalence. So, to conclude the changes in prevalence may have many causes and are difficult to interpret. So better we need to have a checklist of all these items and then look at them all before we try to rather say that the prevalence has increased or decreased over a period of time in a particular region.

(Refer Slide Time: 07:56)



What are the uses of prevalence data? Prevalence of data is used to assess health care needs. It is very useful in planning health services because it measures the burden of disease, and it measures occurrence of conditions with gradual onset and prevalence is very useful in the study of chronic diseases.

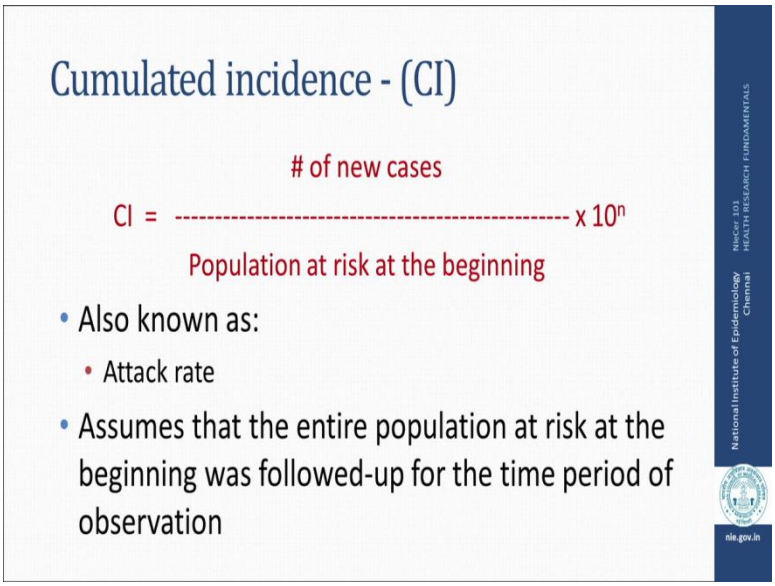
(Refer Slide Time: 08:18)



Another important measure in epidemiology is the Incidence. The incidence is defined as the number of new cases in a given period in a specified population that is time is an important component, whether measure it by day or month or year, that must be specified

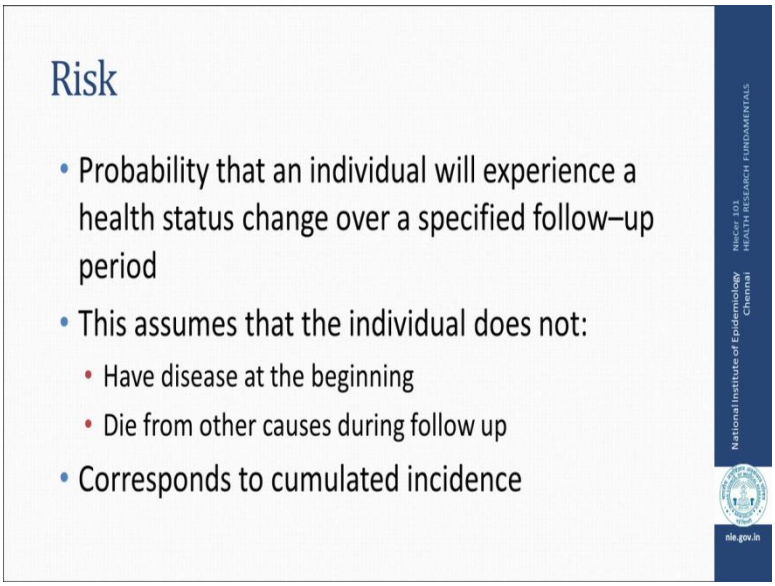
when you are mentioning the incidence. This measures the rapidity with which or the speed of occurrence with which new cases are occurring in a population. This can be expressed in absolute numbers, in terms of cumulated incidence or in terms of incidence density.

(Refer Slide Time: 09:00)



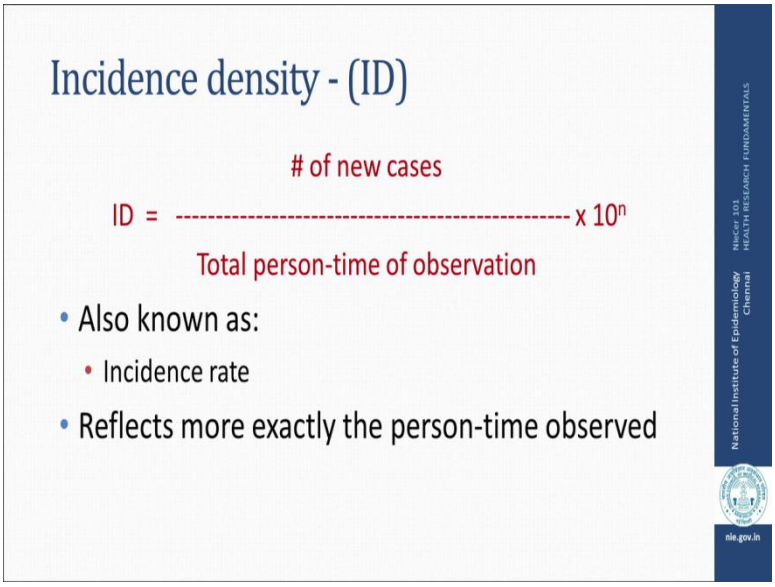
Let us rather look at the different aspects of the incidence. Let us rather take the cumulated incidence first. The cumulative incidence is CI, is a number of new cases divided by population at risk at the beginning that is multiplied by a factor of 10. This is known as attack rate and it assumes that the entire population at risk at the beginning was followed-up for the time period of observation.

(Refer Slide Time: 09:39)



Now, let us look at what do you mean by Risk? The risk is the probability that an individual will experience a health status or change over a specified follow-up period. This assumes that the individual does not have disease at the beginning and die from other causes during follow-up. This corresponds to a cumulated incidence.

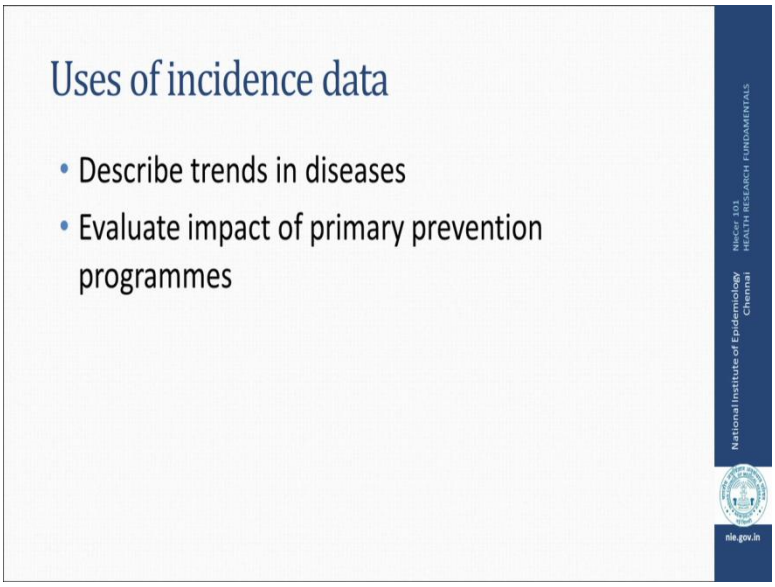
(Refer Slide Time: 10:01)



Now, let us look at the other measure which is called incidence density, denoted as ID. The incidence density is the number of new cases divided by total person-time of observation and that is multiplied by a factor of 10. This is also known as incidence rate.

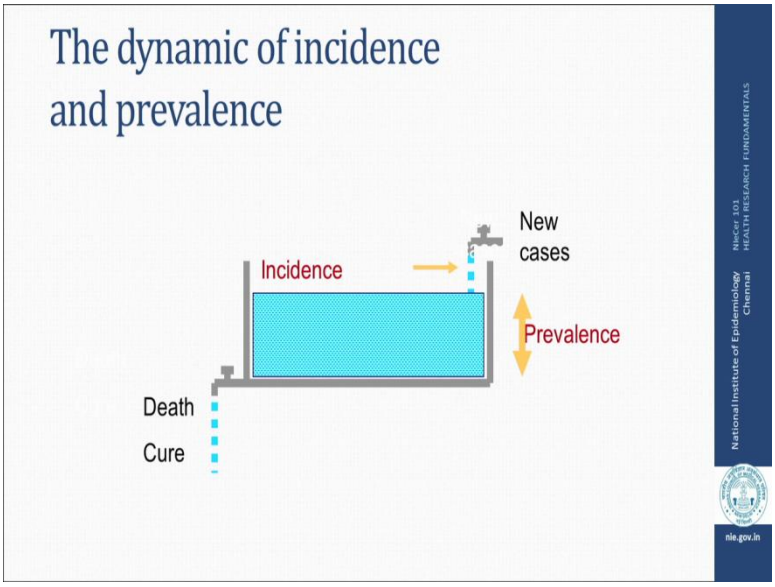
This reflects more exactly the person-time observed.

(Refer Slide Time: 10:25)



Uses of this incidence data is, this incidence data describes trends in diseases, whether they trend over a period of time, how the particular disease changes? And it evaluates impact of primary prevention programs.

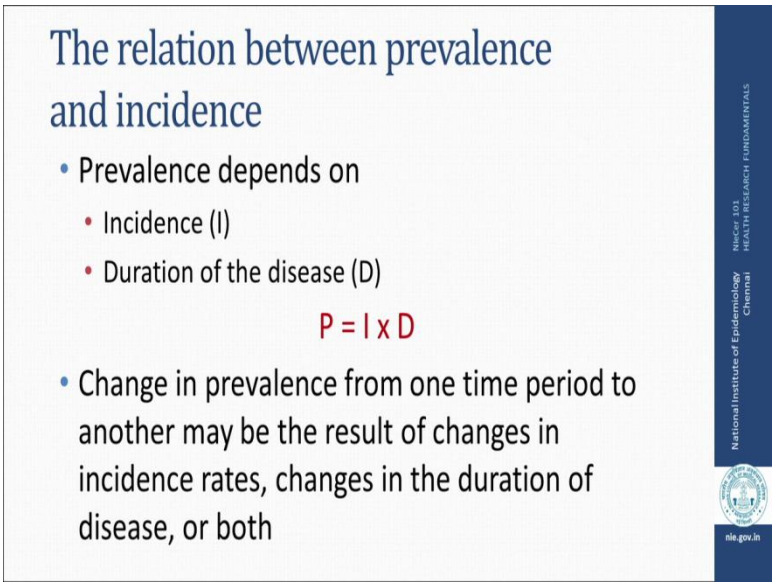
(Refer Slide Time: 10:44)



The dynamic of incidence and prevalence can be depicted with a diagram like this see. There are new cases pouring in, there are cases going out because they are dying or they are getting cured. The incidence cases are the new cases and the cases which are

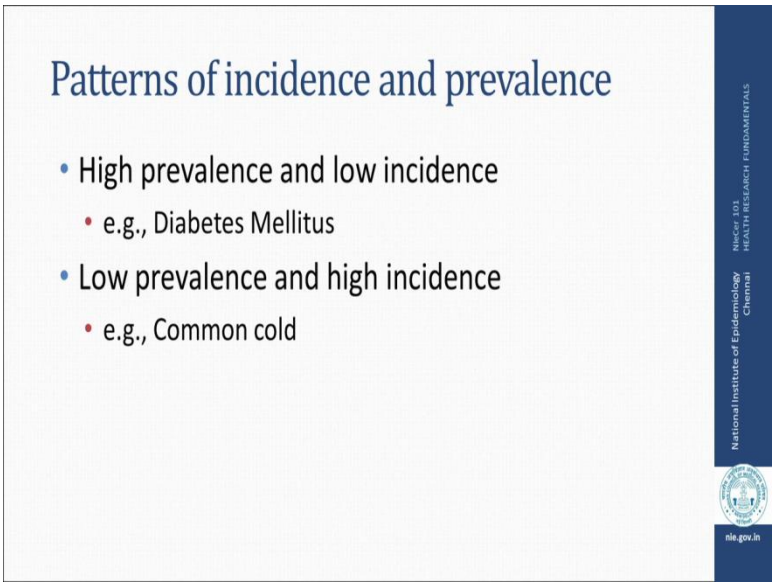
remaining in the tap are the prevalence cases.

(Refer Slide Time: 11:13)



The relationship between the prevalence and incidence could be the prevalence depends on the incidence and the duration of disease and it is denoted as prevalence is equal to incidence into duration, P = I multiplied by D. Change in prevalence from one time period to another may be the result of changes in the incidence rates, changes in the duration of disease or could be both.

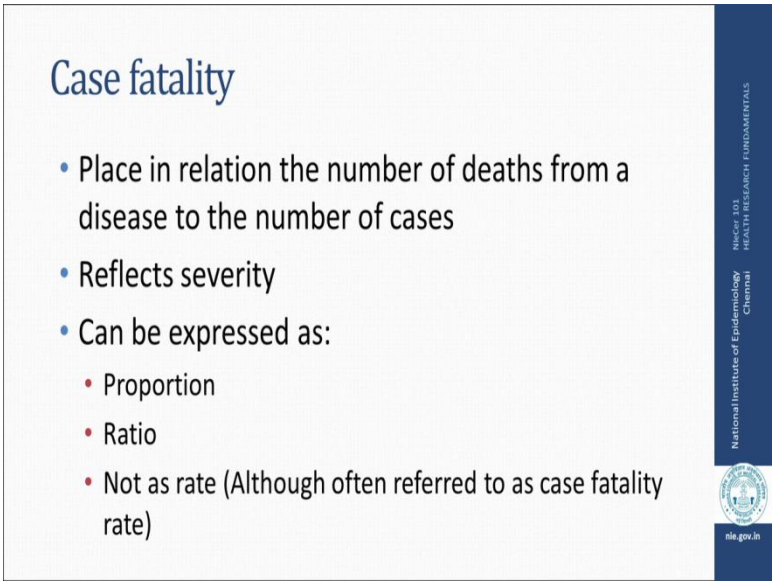
(Refer Slide Time: 11:43)



Now, let us look at the patterns of incidence and prevalence. High prevalence and low

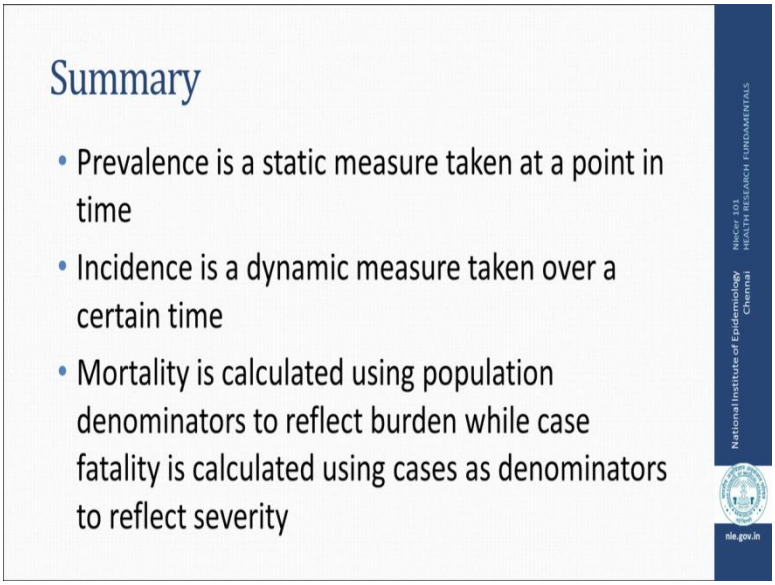
incidence, there are disease like Diabetes Mellitus. Low prevalence and high incidence are the examples are common cold.

(Refer Slide Time: 11:57)



Now, let us define a term called say the Case Fatality. In case fatality the place in relation to the number of deaths from a disease to the number of cases, how many cases you have? And how many of them they died? It reflects the severity of the case. This can be expressed as a proportion or a ratio not as a rate, though its often referred to as case fatality rate.

(Refer Slide Time: 12:30)



So, let us summarize these basic disease frequencies that we are finishing, one is the prevalence and prevalence is a static measure taken at a point in time or over a period of time. If you take it at a point in time it is called Point Prevalence, over a period of time it is called the Period Prevalence. Incidence is a dynamic measure taken over a certain time and the mortality is calculated using population denominators to reflect the burden, while the case fatality is calculated using cases as denominators to reflect severity. These are all the measures of a disease frequency.