One Health
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Lecture - 19
Principles of Survey Design and the Concepts of Sampling & Mixed Method Research

A very good morning to all of you. So, the topics of today's discussion is; the first topic is principles of survey design and the concepts of sampling and the second topic is mixed method research.

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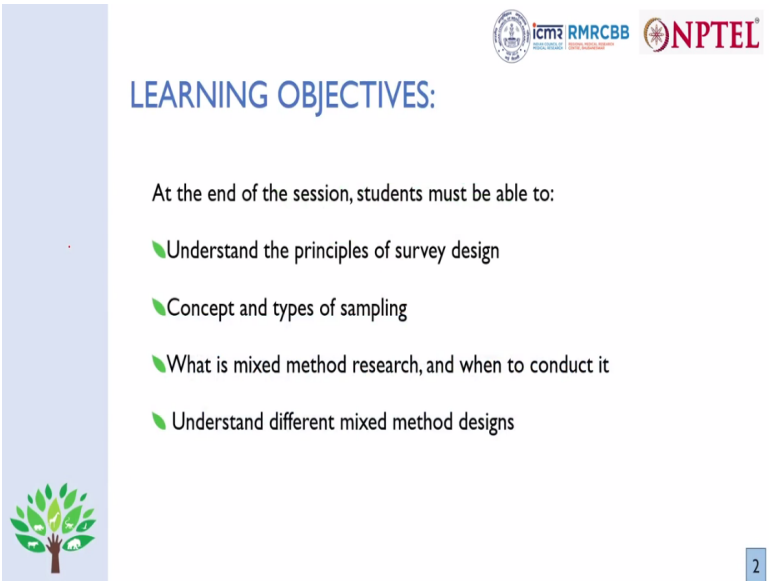

Now at the end of the session we will be all be trying to understand the principles of survey design and what are the concepts and types of sampling and in the second part of the session we will be trying to understand what is mixed method research, how to or when to conduct it and understand the different mixed method designs. So, coming to the first topic that is principles of survey design and concepts of sampling.

When all the individuals in the population are selected for any kind of measurement then the study is called census. We take from each of the individuals in the population so that is called the census, but when we collect data from only a subset or a sample of population of interest then we call it sample survey or most commonly just survey. Now why do we conduct this surveys?

The main advantage of conducting a survey over the census is that there is reduced cost and there is greater speed. Now why do we need to discuss this under One health research because information on characteristics of human populations, herds and environmental status is constantly needed by public officials responsible for planning health and social services.

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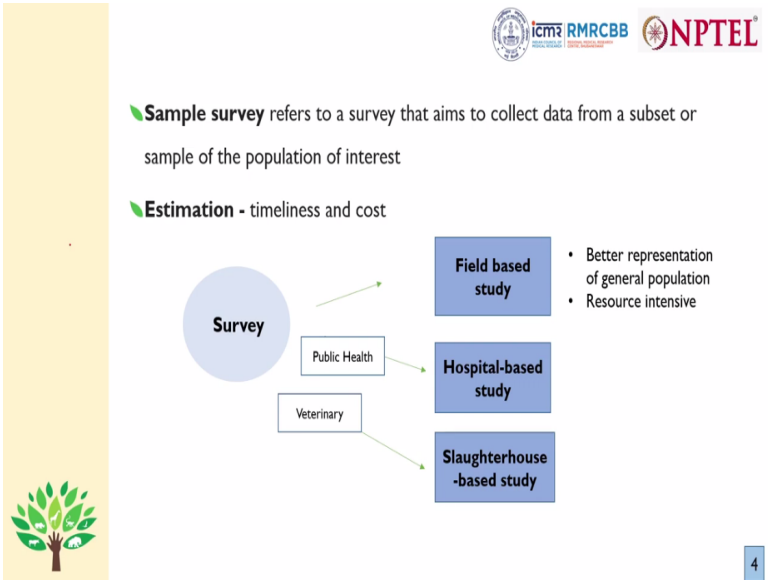

Now, we use the term estimation. The objective of a survey is to estimate parameters of the population. This word parameter is the value for population when we are trying to find the value for a population then we use the term parameter and when we are trying to find the value of us from a sample then we call it statistic. So, the objective of a survey is to estimate parameters of the population from that sample that we had collected.

So, that is why it is called estimate because we do not know the true value that is in the population that is unknown to us. So, this summary statistics, this sample statistics from that we try to extrapolate for the entire population. So, that is why we use the term estimate. Now service can be broadly classified into field based study or hospital based study when we are mostly concerned about public health.

But if we see through the lens of veterinary epidemiology then we can classify into field based study or slaughter based study. Now we know that field based studies have got better representation of the general population because in hospital based studies you have higher

prevalence of the diseases or the age distribution is different in hospital or in slaughter-based studies.

And there is also another limitation in slaughter based studies: we are not able to identify track down the animals that are there in slaughter house to their herd of original because mostly in low middle income countries we do not have the tracking system, but we have some disadvantages of field based studies also like it is resource intensive. So, we have constraint regarding cost, time and also administration costs.

So, coming to the principles of survey as I was discussing that the primary objective of a survey is to take a sample from the population and to estimate the population parameter from the sample statistic. So, how good is this estimation, how valid or reliable is this extrapolation that depends on mainly two things. First is how good or how well you have chosen the sample and second is how well the measurements are.

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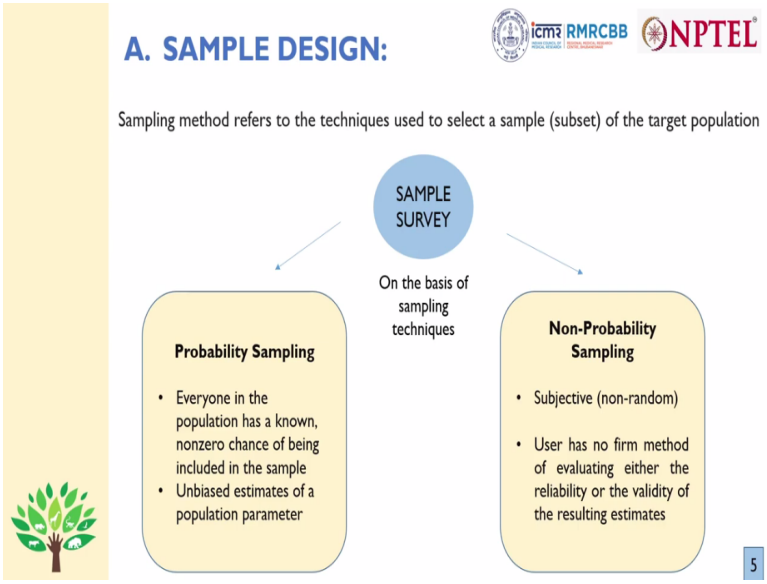

So, coming to the first principle that is how well you have chosen the sample so that is the sample design. Now sampling methods refer to the techniques used to select a sample from this target population we can divide it into two ways mainly that is probability sampling and non probability sampling. Now on the probability sampling everyone in the population has a known non-zero chance of being included in the sample.

And second, we again have unbiased estimates of the population parameter. Now keep this in mind we have here written known non-zero chance. So, everyone has got some chance of being selected which is known. So, let me explain it further. So, in probability sampling what we do is we take a list of all the individuals of the target population and so we will have a list of all the individuals of a target population. This is a target population.

So, we will have individual number 1, individual number 2, individual number 3, 4 like this maybe our target population is around 10,000 individuals. So, from this list we will be selecting some individuals or sample. So, this list is called the sampling frame and this sampling frame should have the property that each of them has got some chance of being selected.

It may not be equal, but it has got some chance and that chance should also be known and this selection of sample can be by any method. So, this is what is probability sampling and it will give us an unbiased estimate of the population parameter. Now coming to the second part of the classification that is the non probability sampling. Now why do we do non probability sampling mostly because probability sampling is time consuming, expensive.

And many a times it is not feasible also, it is subjective, it does not has that randomness concept in it, you know, based on your convenience whoever is your neighbor you will be selecting that sample and so the user has no firm method of evaluating either the validity or reliability of the final estimates that we are making.

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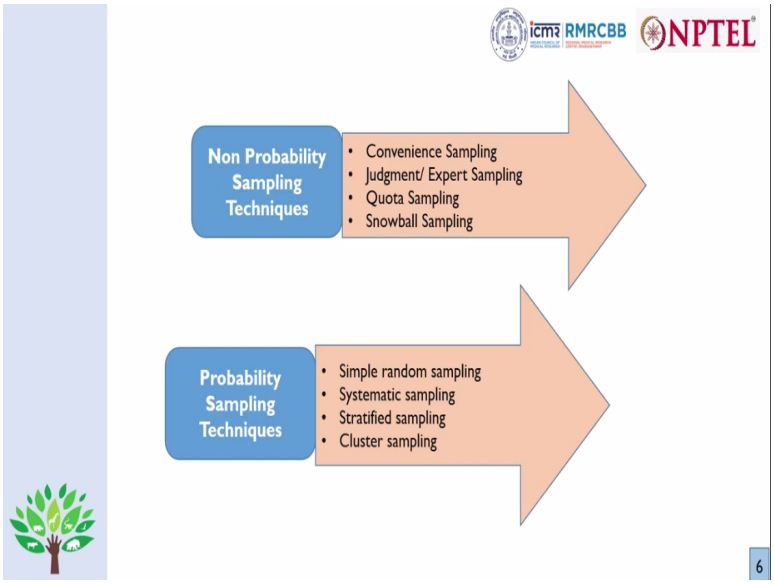

If you see elaborately the non-probability sampling techniques there are various types under it. First is convenience sampling that is how it is convenient to the researcher. So, suppose the audience that I am teaching right now from that I will be selecting and I want to select a sample I will be selecting only those individuals who are my neighbors. So, I will be selecting those that is convenience sampling. Next type we have this purposive sampling.

Now this is based on the experts judgment of what is the study objectives and what is the purpose for which we are going to take the sample. So, that depends on the expert and his or her own judgment. The third type is quota sampling. We have predetermined number of units that we will be taking from each of the sub population so that is called quota sampling I will be talking about it again in the further slides and then we have snowball sampling.

Now this is done when the respondents are very difficult to find or they are rare to find like suppose we want to do a study with 6 workers then we need to do a snowball sampling we will be asking them they will be telling us further where are the other if you need to find other 6 workers. So, these are the non probability sampling techniques. Next we have the probability sampling techniques.

Now, under this we have most commonly these are 4 types of probability sampling techniques simple, systematic, stratified and cluster. So, we will be talking about each of them.

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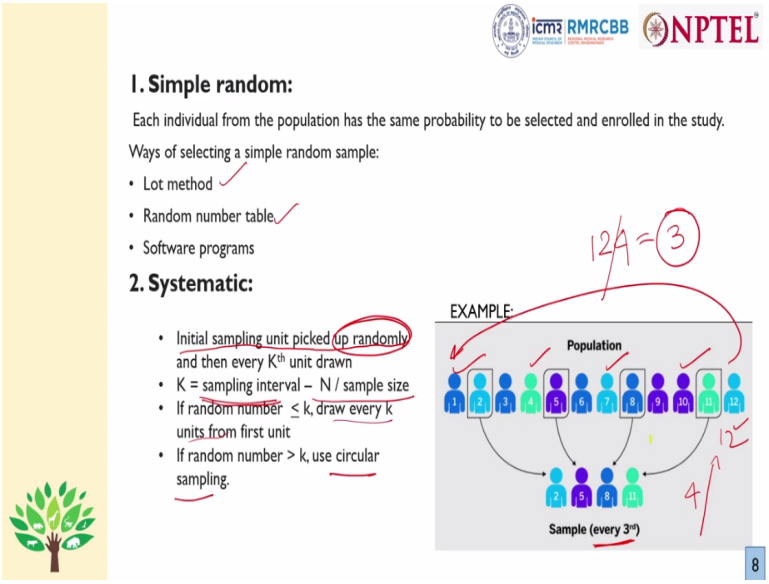

First is simple random sampling. Initially I told that each one has some probability sampling should have non zero and known chance I told that mark my word it is not equal, but in simple random sampling each individual from the population has the same probability. So, each one has the same chance of being equal probability of being selected and enrolled in the study.

We usually go with the software programs nowadays, but we also have random number table and lot method in selecting simple random sample. The major limitation of a simple random sample is we need as I was discussing before that we need a complete sampling frame for this, we need all the individuals most commonly the individuals can be if we see through the perspective of One health.

It can be human being or it can be animals also. So, I will be using the word units. So, we need each of the units, a list of all the units in the sampling frame and then from this sampling frame we will be using maybe a lot method and we will be selecting one or two or how many based on a sample size. So, the limitation here is we need this list otherwise we will not be able to do simple random sampling.

Second difficulty is if this sample suppose sample number 70 we have got here and 80 we have got, we have selected 70 and 50. If these samples are spread out maybe sample number 5 is in

North India and sample number 70 is in South India. So, you see if the samples are spread out then the cost increases in collecting the sample. So, for that also simple random sample usually we do not go with it.

So, this was the first simple random sample. Now next is Systematic sampling. So, as the name suggests that it has got some fixed plan systematic according to some fixed plan. So, the initial sampling unit is picked up randomly and then every kth unit is drawn and every nth or kth unit is drawn. So, let me show an example. So, here you have 12 individuals out of this my sample size is let us say 4.

So, we need 4 people from this 12 individuals. So, for this we need a sampling interval that is systematically we need to in methodical approach we need to pick up some individuals. So, for that we need a sampling interval. So, 12 here it is the formula is given capital N is the total target population that we have that is 12 individuals in our population divided by the sample size that is 4.

We need 4 people so it will be 12 divided by 4 it is 3. So, every third individual we need to pick up from the 12 individuals, but keep in mind the initial sampling unit picked up should be randomly. So, maybe you do a lot method or you do a random number table and the first individual that you selected was serial number 2. So, here we have discussed that every third unit you have to take.

So, serial number 2 you will be taking then serial number 5 you will be taking 8 and 11. So, now you have got your 4 individuals. So, that is point number 3 that is draw every K units from the first unit. Suppose, one disadvantage that I was talking in simple random sampling was that you need a complete sampling frame. Suppose, in this example you do not have the full sampling frame still you can do systematic sampling.

So, you have a rough idea that how many individuals are there maybe you know 12 individuals or 13 individuals something like that you have a rough idea then first unit that was randomly selected was serial number 4. So, then as we discussed every third you have to take. So, 4 plus 3

7, 7 plus 3 is 10 and then and then what we can do is something known as circular sampling we can again go back to the first individual.

And we will be selecting this individual. So, this is called Circular systematic sampling and this was the second type of sampling.

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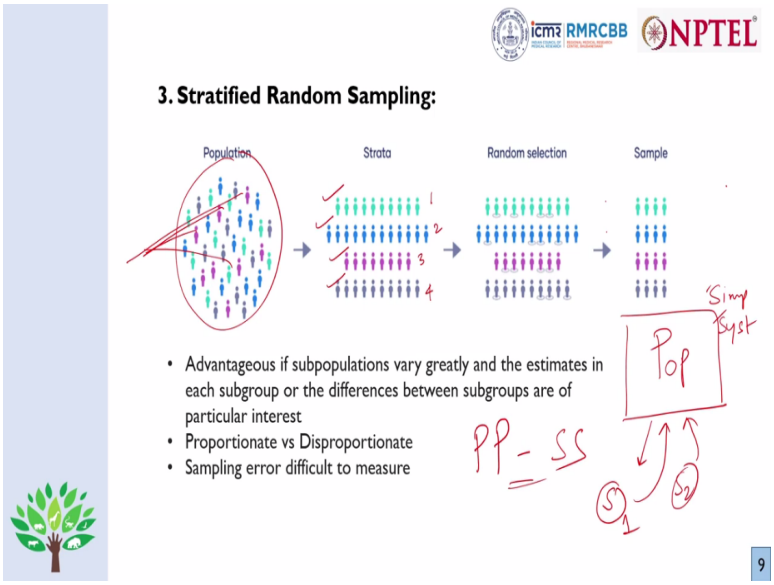

Now we have the third type of probability sampling known as Stratified random sampling. We classify the population into homogeneous subgroups. Here we can see homogeneous subgroups that is green individuals, blue, maroon and gray. So, this each of this strata 1, strata 2, stator 3, strata 4. So, we have got 4 strata and each of the strata are homogeneous. They are similar based on a certain condition here we have taken color as the condition.

So, in stratified sampling what we do we divide it into strata and then we draw a sample from each strata and the results of this sample are finally inferred for the whole population. Now when do we do stratified random sampling? When the sub populations vary greatly you can see they have different colour altogether and when we need separate conclusion for each of the subgroups.

And the differences between the subgroups are of some particular interest. So, that time we do a stratified random sampling because we can see, it is visible to us that this whole population has

got different colours. So, we can divide it into strata then if we select from the whole population itself maybe we will be only selecting the maroon ones in random number table if we do maybe only the maroons are being selected, but we do not want them.

We want representation from each of the strata, that time we do a stratified sampling. Now stratified sampling can be again now if you see here once we have divided into homogeneous subgroups based on, you know, non probability sampling or based on subjective I can choose only the first three individuals of each of the strata based on my own convenience then that is called quota sampling.

As I was discussing that I will be coming to this topic once more. So, here we have some predetermined units from each of the subgroups. I have decided I will be taking only the first three from each of the strata. So, the rest of the individuals do not have any known chance also that is zero chance and we do not know about the chance of each of them. So, that is come subjective.

So, this is called as quota sampling when from each of the strata you are from predetermined number that you would be taking without any randomness, but what we are discussing now is stratified random sampling. So, once we are divided into strata we can randomly select maybe suppose in the first strata we will randomly select these four individuals so they have come to a final sample.

Now from the second we will be taking 4 individuals using lottery method from the maroon also will be taking 4 individuals. So, from each of them we have taken 4 individuals irrespective of the size of the strata. So, when we are taking equal number is irrespective of the size of each of the strata then it is called Disproportionate stratified random sampling because it is not based on the proportion, it is based on equal number.

So, it is not proportionate, but in case if we want to do proportionate then we need to suppose let us take an example I will take 50 percent from each of the strata if I take 50 percent from each of the strata then from the first group 50 percent from first. So, in the first one we have 10

individuals so we will be taking 5. In the second one we have around 12 individuals so 50 percent of 12 is 6 individuals.

In the third we have around 50 percent of 8 is around 4 individuals. So, see here though the numbers are not equal, but we will be taking equal percentage from each of them. So, this is called proportionate stratified random sampling. Coming to the final point that is the main disadvantage of stratified random sampling is that the sampling error is very difficult to measure.

Now what do you mean by sampling error is that sampling error you can say is the difference between population parameter and the sample statistic. This difference is actually sampling error. So, when we have a population, this is a target population from this suppose you have taken a sample 1. Now we are trying to estimate from this sample the true value you are trying to estimate the value which is unknown to us that would not be accurate.

So, it will have some error so that error is the sampling error each time you take another sample, you will have a close to the estimate or a little further from the estimate of the true value. So, each time when you are taking samples there will be some error in the measurement of the actual value. So, that is accounted because of the sample that you have taken.

So, that is known as sampling error population parameter minus the sample statistic that we have. Now that can be measured in simple random sampling or in systematic sample sampling why because in that you have the whole population from that you are taking sample, but it is difficult to measure in stratified random sampling and also in the next type that is cluster sampling why because we have divided the population into some strata here. So, it is very difficult to estimate the sampling error here.

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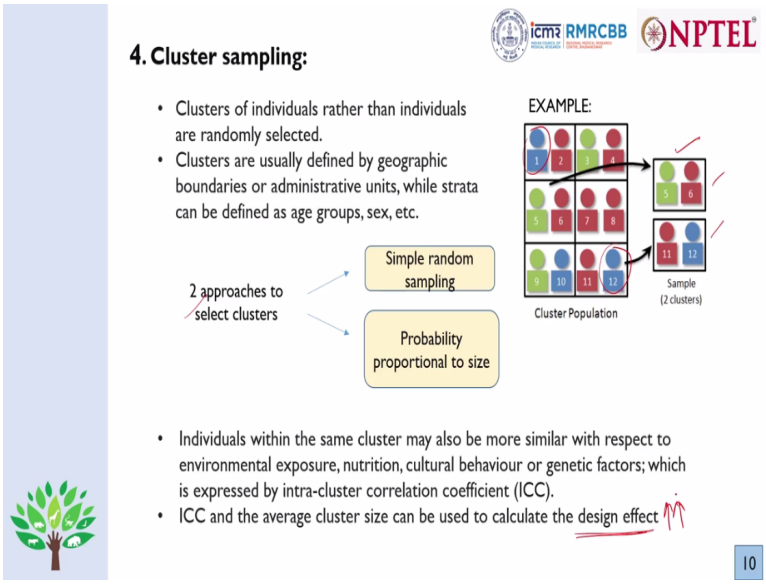

Now coming to the final sampling method that is Cluster sampling. Here we select clusters of individuals rather than individuals till the last three sampling we checked we were picking up individuals, here we will be picking up cluster. So, out of these 6 clusters, we have selected 2 clusters randomly. So, in case we would have selected serial number 1 and serial number 12 only that individual from this 12 individuals.

Then it would have been a not a cluster sampling. Here we have selected a cluster from individuals rather than individuals are randomly selected and clusters are naturally and these are like usually defined by geographic boundaries or administrative units like suppose sensors enumeration block or award these are like administrative units. Clusters can be based on some institutions also like hospital based or you can have schools that can also be a cluster or a community like a town.

So, these are like clusters whereas strata are defined by age groups or sex. So, a particular age so like the previous slide we saw we have divided the whole population because we saw that there are variation in their population based on colours you have divided it into some strata. If we see through the lens of veterinary epidemiology then cluster sampling is a natural sampling design because livestock population are typically clusters into herds or flocks.

Now again going through one health it is not only veterinary epidemiology, but also in through the one health you have herds as natural clusters, you have households or villages as natural clusters. So, if you have to go through one health research, cluster sampling will be a very ideal technique because again herds and households there are natural clusters. Now how are we going to select this two clusters from this 1, 2, 3, 4, 5, 6 clusters?

Now there are mainly two approaches; one is simple random sampling you know you do a lottery method or from random number table you select any 2 clusters from this 6 clusters or else we can do based on the size of each of the cluster that is known as PPS or probability proportional to size sampling method for clusters. Now we can see here that in the previous example we saw that the strata in each of the strata they were all of the same colour.

They were all similar, they were all homogeneous, but keep in mind that in cluster each of the clusters should be a reflection of the general population. The variability in each of the clusters should be just like in general population they should not be homogeneous. Though individuals within the same cluster may be similar with respect to environmental exposure, nutrition they are having the same cultural behaviour and genetic factors.

So, this similarity that they have within each of the cluster that is usually denoted by something known as ICC intra cluster correlation coefficient and this ICC and average cluster size that is the number of individuals in each of the clusters and here we have each cluster has got 2 individuals. So, this average cluster size and ICC can be used to calculate the design effect which helps us in finding out the final sample size that we need.

So, if the clusters are homogeneous if they look like a strata itself you know like in stratified that we saw then it may result in a large design effect. Design effect will increase and then your sample size will also increase and if you do not take care of this design effect from previously then there will be less precision. So, one thing we need to make sure is that the variability in each cluster should be a reflection of the general population.

Again the disadvantage is similar to stratified sampling is that we cannot find it is very difficult to find the sampling error in this type of cluster sampling.

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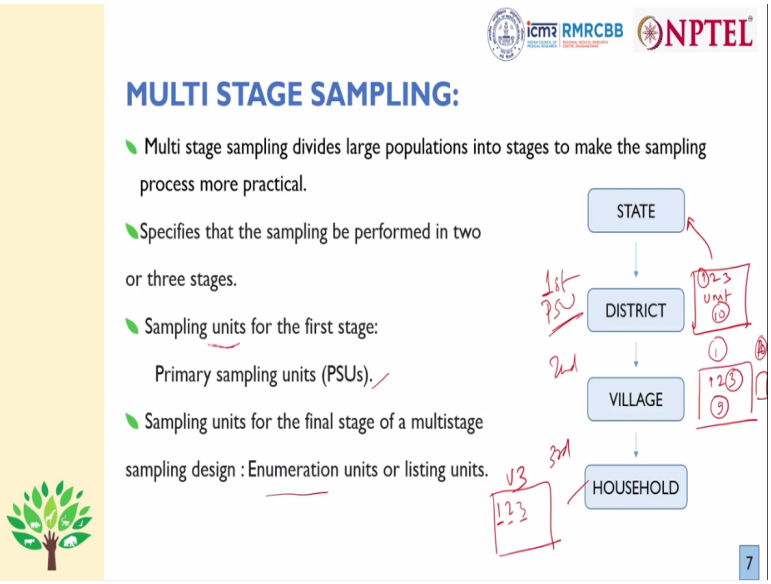

And finally we have something known as multi stage sampling. So, when sampling is performed in two or more than two stages then we use this type of sampling because the large population has to be divided into stages to make the sampling process a bit more easier and more practical. So, suppose we want to check the enumeration status of a large state. So, for that we cannot directly go to the individual level.

So, for that we need multiple stages for that. So, before coming to that let me tell you one more thing. So, we have discussed what is a unit in an sampling unit that is each of the individual that we are picking from the sampling frame that is what we are calling as sampling units. So, in the first stage when we are picking up the sampling units for the first stage that is called PSU, primary sampling unit in the first stage in this multi stage.

And in the final stage the sampling unit for the final stage that is called as enumeration unit the final one. So, coming to this example that we are talking about if you have to check the enumeration status of a large state we are doing a survey on that then the sampling frame for the first stage will be the list of districts the sampling frame will be the list of districts within the state.

So, each state will have a list of districts so that would be our first sampling frame in the first stage and then once we have and so each of the district will be a unit, each of the district will be a sampling unit and this is the sampling frame. So, once we have selected randomly the districts that we are going to assess on. So, next stage so second stage will be the list of villages in the selected district.

Suppose, we have selected district 1 and district 2. So district 1 will have all the villages that will be the sampling frame and district 10 will also have a sampling frame. So, in the second stage we see the list of villages within each of the districts that were selected at the first stage will be the sampling frame for the second stage and so each village will be a sampling unit and in the third stage what we see here is that the list of households.

There will be a list of household 1, 2, 3 suppose we have selected village number 3 and village number 9. So, village number 3 will have a list of households which will be the sampling frame for this final stage and each of the household will be the sampling unit here this will be our enumeration unit because this is the last stage of our this multi stage sampling and since we are starting with the district.

We are going to select from the sampling frame of the districts. So, this will be our first PSU this will be a primary sampling units and this will be our enumeration unit because this will be our final stage. So, we do this when we are conducting a large survey for practical issues. So, this is multi stage sampling. Now, as I was talking about in the first slide that is how good is the estimate depends on how well you have chosen the sample we have discussed about it. Now next is how good are the measurements?

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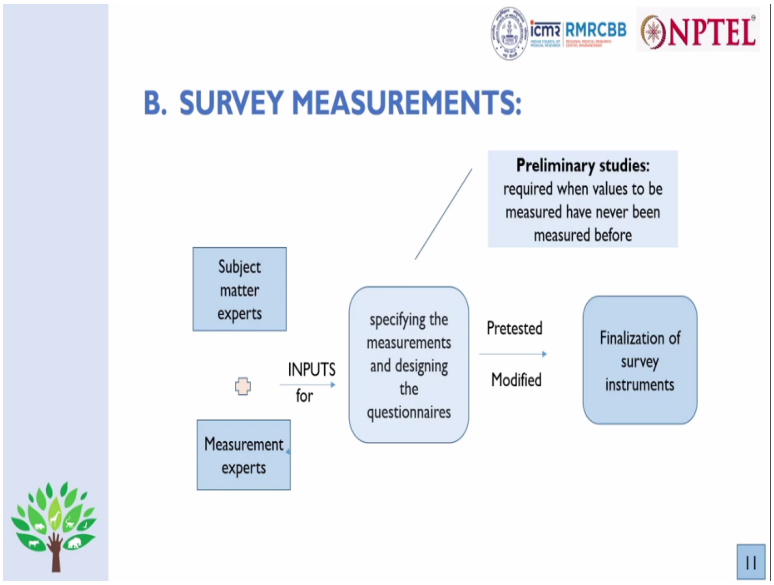

So, for the measurement part we have survey measurements that is the second principle of doing a survey, we have the subject matter experts, we have the measurement experts. Now they will give their inputs based on preliminary studies or they will conduct some study to find out the specific measurement values that are needed and they will design the questionnaire and based on that they will pre-test it, they will test it, they will modify it and finally a survey instrument will be prepared.

To give an example, let us see through the lens of One health let us take a study in which we want to assess or check the role of commensal bacteria of gut in the spread of antibiotic resistance. So, for that we need subject matter experts to tell us you know how this tool samples will be collected from children, from animals, from environment. We need measurement experts also who will be telling us that how the lab testing will be done.

What are the microbiological and molecular methods for isolation and conformation of suppose let us see e-coli. Now what antibiotic susceptibility methods are needed for you know to find like diffusion methods are needed or not, to find the resistance, approaches and procedures for quality control for all these states like checking out samples, checking out the swabs, the reference strains and reagents.

So, the experts need to go through all this literature and do some preliminary studies to finalize a tool. Now that tool they need to again pilot it once, a pilot study to field test those you know stool sampling kit that they have prepared or the stale containers that they purchased or the reagents in the lab they have they are collecting. So, they need to field test it once and not only that they need to train the research assistance or data collectors on how to do it.

And finally also the participants also may need to be trained on how to collect the sample from the children or the data collectors on how to collect it from the environment. So, all these procedures come under your survey measurements.

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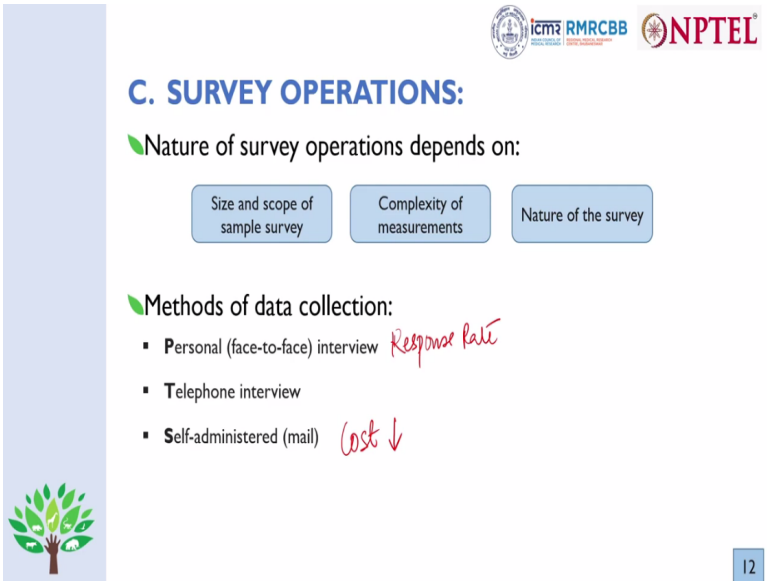

Once this is done, then finally we have our on field survey operations that is collecting of data. Now the operations totally depends on what is the scope of the survey, how big is the sample. How big is the complexity of measurements that we discussed right now, is it a one time survey or is it a continuous procedure in a continuous survey. Based on that we will be recruiting the staff.

Earlier we used to have mostly paper and pencil method, but nowadays we usually go with computer assistant interviews. So, each of them has got their own advantages and disadvantages. So, if you want to go with you know you want a high response rate which is high then we will

usually go with personal interviews, face-to-face interviews, but if you want cost to be as minimum as possible.

Then we usually go with the self administered one. You mail to all the participants they will reply on their own free time, but in that the response rate is very low and in the personal interview the cost is very high. So, in between comes the telephonic interviews in which you have moderate cost, moderate speed. So, these are the different types of ways in which you can collect data.

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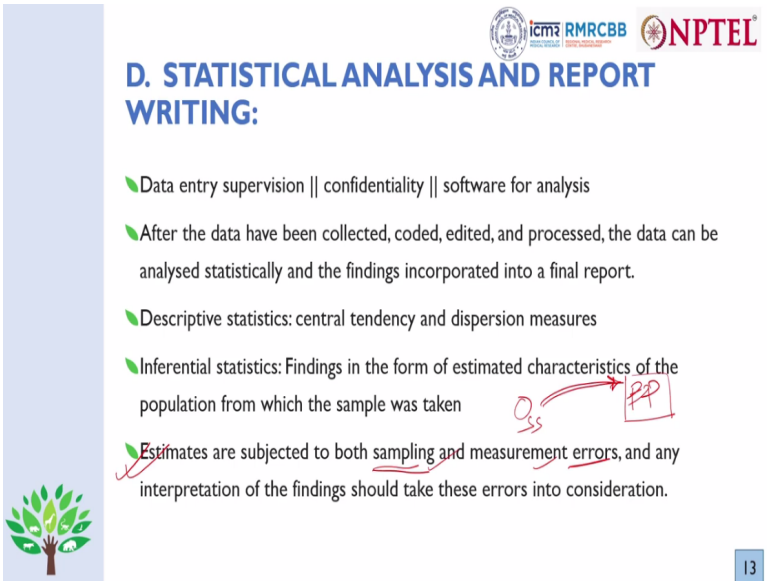

And the final principle of conducting a survey is the final output that has to be documented somewhere and that has to be statistically analyzed and written in the proper format. So, before that we need to always supervise the data entry that is happening from the field or in the after coming from the field. So, data entry supervision is important so is also important is the confidentiality of the data not only in collection of data of the participants.

And also during the data analysis time and appropriate software needs to be chosen for the data analysis after the data have been collected, coded, edited, processed finally the analysis is done statistically and we incorporate the findings into a final report. Initial part of the report the results we usually write about the what are the different measures of central tendency and dispersion in the sample that we have collected that is a descriptive statistics.

And based on the appropriate statistical tests, we do the inferential statistics and we estimate the characteristics of the population from the sample that we have collected. So, we try to estimate of the population from the sample that we have sample statistic population parameter. Now last point is very important. We need to be very cautious in interpreting why because this estimates that we have got from the sample statistics for the whole population they are subjected to both sampling error that we had talked before.

And also measurement error you know the instruments that we are using are they validated or not, are they checked or not before using. So, they are subjected to both sampling error and measurement errors. The main two points that I told are the key points for the validity or reliability of the sample that we have. So, they are subjected to this kind of errors and any interpretation on the findings should take into account this errors.

So, these are the four principles of survey that we were discussing till now. So, if you need to summarize it.

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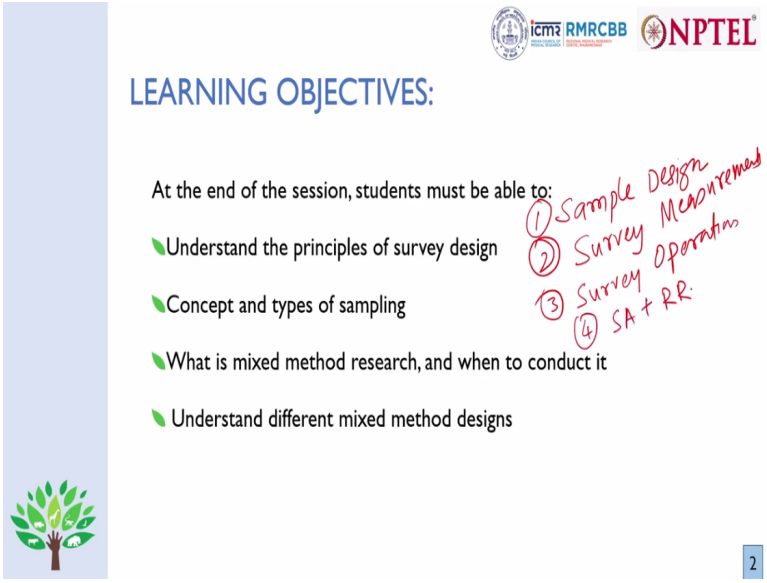

So I discussed that the students must be able to understand the principles of survey design. So, the principles of survey design if you have to see. So, first is how good the sample was chosen so sample design. Next is your how good the measurements were. So, survey measurements how

good the survey measurements they are validated and they are reliable or not third is your as we discussed the final operations that is the survey operations.

And finally is your statistical analysis and report writing. So, these are the main principles of a survey design and concept and types of sampling we had discussed it. So, these are mainly two types non probability and probability. Under non probability we have the purposes, convenience, quota and snowball and under the probability sampling you have simple random, systematic, cluster and stratified sampling. This is the summary for the first part of the session.

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Now let us come to the second part of today's discussion that is mixed method research. Nowadays it is usually called the new star in the social science sky or the third research paradigm because after the development of the quantitative and then qualitative research this mixed method research has come.

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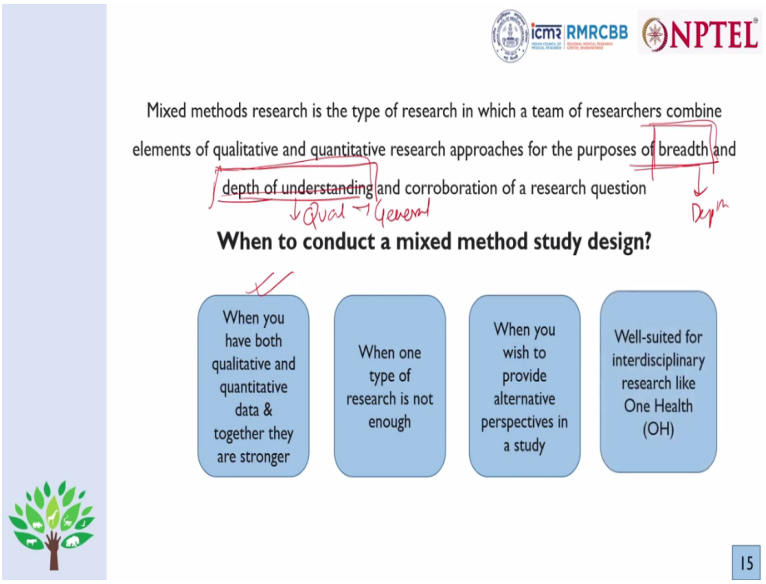

Usually it is defined as a type of research in which a team of researchers combine elements of both qualitative and quantitative research for the purpose of understanding both the breadth and depth of a research question on a hypothesis. So, to simply explain so in the researcher actually collects and analyzes rigorously both the qualitative and quantitative data giving priority to either both or one of this data set.

And then finally mixes it in concurrently or sequentially or image one within the other one. So, we have both quantitative and qualitative which either we give priority to each of them equally or we give priority to one more than the other and we conduct them either parallely or one within the another or we do it one after the another who will be talking about it more. So, when to conduct a mixed method study design?

First when you have both qualitative and quantitative data and together they are strong, you know, they are stronger when they are together. So, we know that qualitative data provide a detailed understanding of a problem because we are studying a few individuals. So, it gives us more of a depth as was the definition depth of understanding and quantitative data gives us more of a general understanding of a problem because we are examining a large number of people.

So, mostly it gives us the breadth of it. So, that is the first criteria when to conduct a mixed method design when we need both and both are stronger. Next is when one type of research is

not enough when you wish to have alternate perspectives in a study. So, there are times when qualitative study design is best when you need to explore a problem, give voices or honor the voices of participants, map the complexity of the problem.

Give a theoretical stance to the problem, then we need a qualitative study at other times we need quantitative research when we want to find the relationship among variables, to find out if one group is better than another group. So, we need mix method when we can we need to explain the quantitative study results when explanation in depth regarding the quantitative study results and when we need to generalize the exploratory findings.

So, when we need to generalize this depth of understanding that is the qualitative part when we need to generalize it to everyone we need breadth for this depth and when we need depth for this breath; that is when we need the results to be explained. We have this quantitative study we have found breadth of it and we need depth inside it we need to that explanation, the quantitative studies to be more explained.

Then in this kind of situations when we need alternative perspectives, when one set is not enough then we go for a mixed method design and finally this is very well suited for something like One health where we have interdisciplinary research. So, in one health we have scholars from so many other fields like epidemiologists, we need veterinarians, we need environmental engineers, we need ecologists, climatologists, botanists, microbiologists.

So, we have scholars from so many different fields of study in One health. So, mixed method is actually very suited for something like one health because it enables researchers to employ multiple philosophical perspectives that guide this research or a study.

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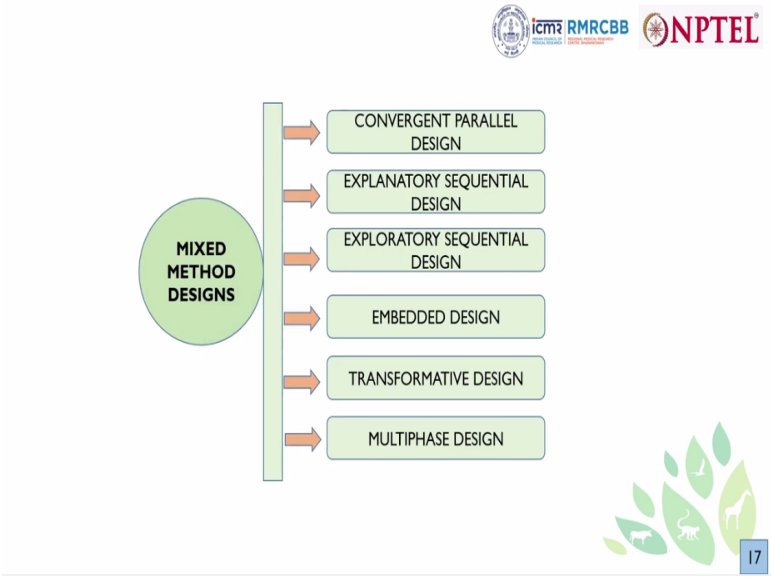

So, coming to the different types of mixed method designs that we have. The following are the 6 types of mixed method designs that we commonly encounter, we will be talking about each of them now.

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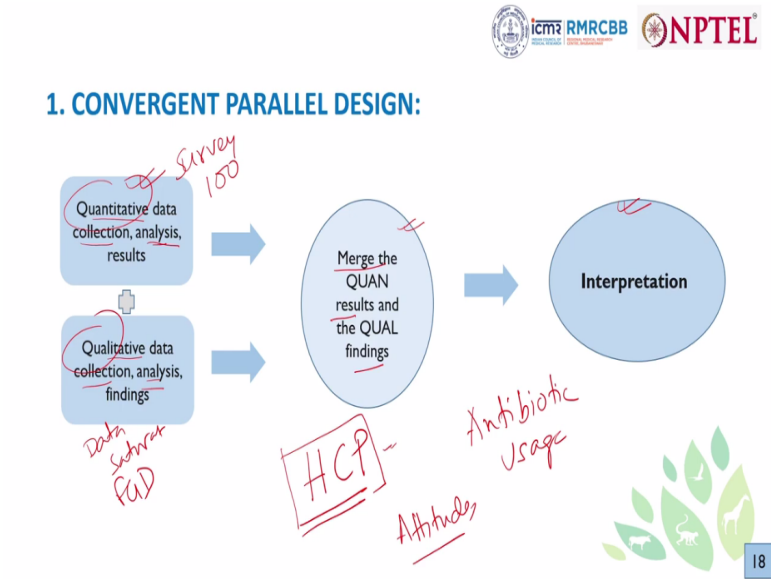

So, first type, Convergent parallel design. So, as the name suggests it is going to converge. So we have qualitative data, we collect it, we analyze it. We have quantitative data, we collect it, we analyze it So, what we are doing here is we are prioritizing each of the methods, quantitative and qualitative equally. They are going independently, we are conducting both this independently and

we are also merging the results and even before the results obviously we are going to analyze them also independently.

And then finally we mix the results and overall during the interpretation time we mix the results during the final interpretation. We merge the quantitative results and the qualitative findings and then we mix the results during the overall interpretation time. Two separate terms they are going concurrently, parellely we merge the results and finally during the interpretation time we merge the results.

And we try to interpret the final findings or results. So, take an example let us see suppose there are formal and informal health care providers. We want to understand their attitude towards antibiotic usage. What are their attitudes? We want to find out their attitudes towards antibiotic usage. So, as a researcher we will parallely we will do a quantitative survey. So, we will do a survey among all the healthcare providers.

We will try to find out; so we will analyze the survey maybe we will be taking 100 healthcare physicians will be based on a questionnaire we will be trying to find out quantitatively what do they have the attitude towards antibiotic usage and among those hundred people only we will be doing a qualitative data collection till we are attaining data saturation. So, these two are going parallely trying to understand the attitude towards antibiotic usage.

Now we will be doing the analysis also separately. Focus group discussion here and here a survey going on. So, we will be doing the analysis also separately and then finally we will be trying to find out in what way the physicians' attitudes you know after checking their results and finally we will be interpreting in what way do the attitudes converge and diverge. So, why do we do this?

Here we are trying to because each of them gives a partial view. So, to have a complete understanding by collecting both the quantitative and qualitative data we are trying to find out what are the attitudes. So, each of them gives us a partial view so it is like half plus half gives a

full one. So, circumstances or studies regarding this you usually go for convergent parallel design. It is giving us a partial view by going only by doing one type of study design.

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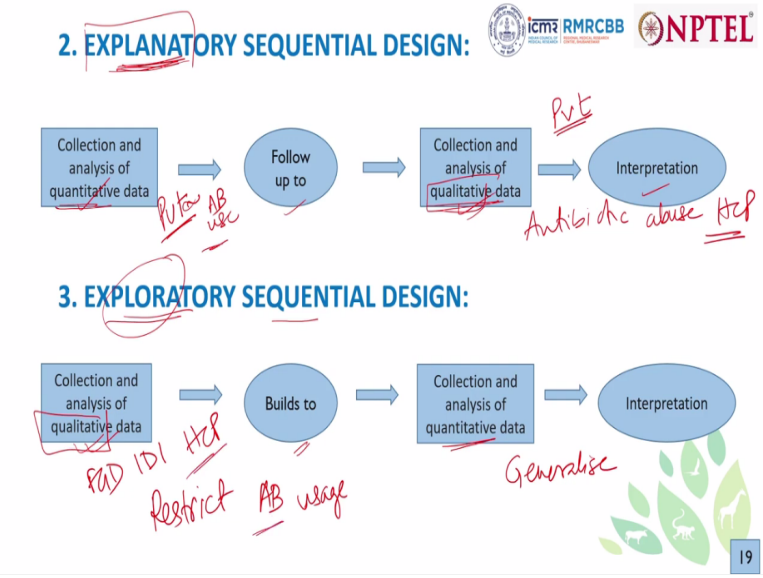

Coming to the next type. Now the next two types are sequential designs. The first one was parallely each of the strands we are going parallel. In this one each of them are going sequentially. So, the first one is explanatory sequential design. So, the key word here is explain. So, we will be collecting and analyzing quantitative data. We will follow them up with qualitative data and finally we will be interpreting it.

So, here the qualitative results are actually trying to explain the initial quantitative results that we have got. From quantitative data we are getting some results, but we need explanation for that. That is why I told the key term here is explanation. We need explanation for that and for that we are doing a qualitative study and so finally we will be interpreting the final mixed and method study based on the interpretation.

So, let us continue with the previous example. We want to find out what are the significant predictors for antibiotic abuse among the healthcare providers that we were discussing previously. So, what are the significant predictors for this abuse? So, maybe while doing a quantitative study surprisingly we found that maybe private practice has got something association with antibiotic use.

It has got some association with antibiotic usage. So, to explain this we need to do a qualitative study and we may not do among the same individuals that we got, we will be doing only among the people who are practicing private you know healthcare providers among in the private practice we will be trying to understand why they are excessively using antibiotics.

So, why we are doing this kind of studies because it gives us in detail the participants voice, the participants perspectives to tell us what are the mechanisms for such a trend, why this significant association happened? To understand the mechanism we went through a qualitative study design after doing a quantitative research. Next comes is Exploratory sequential design.

Again here is a sequence so first you will be going with since it is an exploratory study so first we will be going with qualitative data, you explore it, you build it up to finally do a quantitative study design and then the final interpretation. So, here we build from the qualitative results to do a second quantitative study design to generalize what we found in the qualitative findings, qualitative research.

Continuing from the previous example, suppose we want to restrict antibiotic usage. So, we do a qualitative study, FGDs or some IDI among the healthcare physicians and listen to the different stories that they are telling that how they attempted to restrict the usage of antibiotics. So, we got those results, we identified some context, we identified some strategies and then those strategies obviously will be some variables.

We make it into some variables make us study instrument and then we conduct a survey to find out to assess what is the overall prevalence of those strategies of those variables among all the healthcare physicians who are using antibiotic usage excessively. So, what we did here is we got qualitative data, we found the results, we found the stories, we found the stories of how they have tried to restrict themselves.

We found some strategies that they have used to restrict themselves and we checked if those strategies how prevalent are those strategies in the general population. So, that is exploratory. We

started with exploratory and then we checked it among all the healthcare physicians this is the third type of study design.

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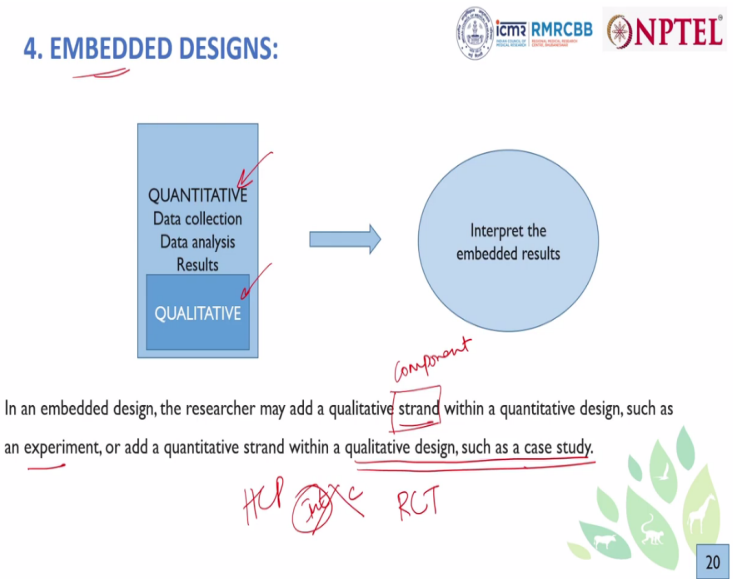

Coming to the fourth type. Embedded. As the name suggests so it is embedded within the other type of study design. So, if we are doing; so here the term strand means any component of a study design. So, any component of a study, it may be the research question, it may be collecting of data, it may be analyzing data, it can be interpreting the results. So, these are all different components so these are called a strand.

So, suppose we have a quantitative design like an experiment or RCT let us give an example. So, in that RCT if you add a qualitative strand like if you do a FGD inside an RCT, then we usually say it is an embedded design or we may add suppose we are doing a qualitative research, a case study is going on and inside that we add a quantitative strand. So, that is also an embedded design.

So, continuing from the previous example, healthcare physician. Suppose we found out a strategy in the previous and that strategy is quite prevalent in many of the communities. So, we want to check if the strategy actually works or not. So, we are doing an RCT intervention, now we have put the strategy to restrict antibiotic usage among the healthcare physician. So, one arm will be the intervention arm where we have put the strategy.

And the other arm will be the controller. So, while doing this RCT, in the intervention arm, when we are putting the strategy that we discussed we may conduct a FGD among healthcare providers and we may take their views, we may explore their views on the new strategy and find out if they are comfortable with the new strategy or not or what are their views on the delivery of the intervention.

So, this is a qualitative component that we have added in a quantitative study design. So, this is a 4 type of study design under mixed method.

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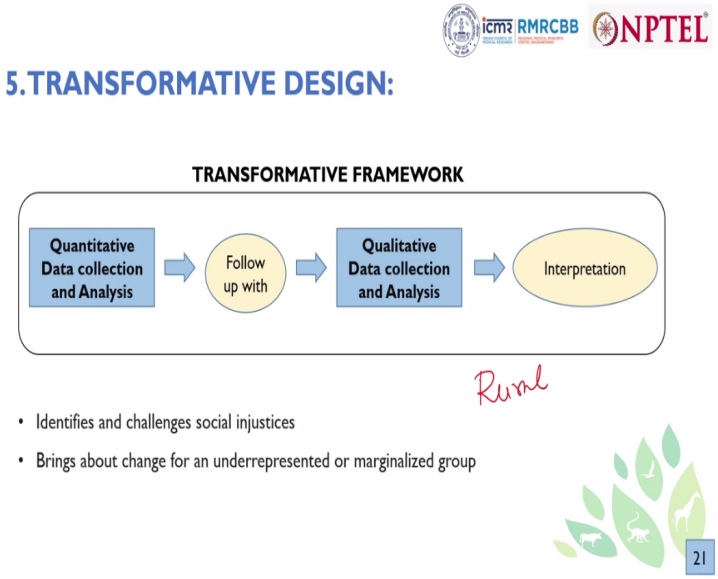

The fifth one is transformative design. So, if a researcher shapes the study within a transformative theoretical framework it may not be quantitative followed by qualitative or it may be qualitative followed by quantitative. The sequence does not matter, but there has to be a sequence. So, for that kind of a transformative framework, we call it a transformative design.

So, it is usually done to lift the voices of participants against the challenges of social injustice or to bring about a change for a marginalized group. Many of the studies have been done in South Africa for focusing on both the magnitude, that is the breadth that we discussed previously and the depth of the issues like for the magnitude of social injustice. So, using quantitative approach

and also to try to understand the participants perspectives using the qualitative approach that is a depth.

So, let us give an example in one of the studies that I was going through what they had done was to check the social injustice of water accessibility they found the magnitude of water access is more among the urban community compared to rural community. So, rural people had less access of water and so that they have found quantitatively and then they followed it up with a qualitative study component to lift the voices of the people in the rural community.

To understand their perspective or to live the voices of the participants regarding the basic you know right for basic service access that is water here. So that people get to know what is their view, what are the problems they are facing and what is their right regarding basic water access. So, here we have both the quantitative and qualitative study design.

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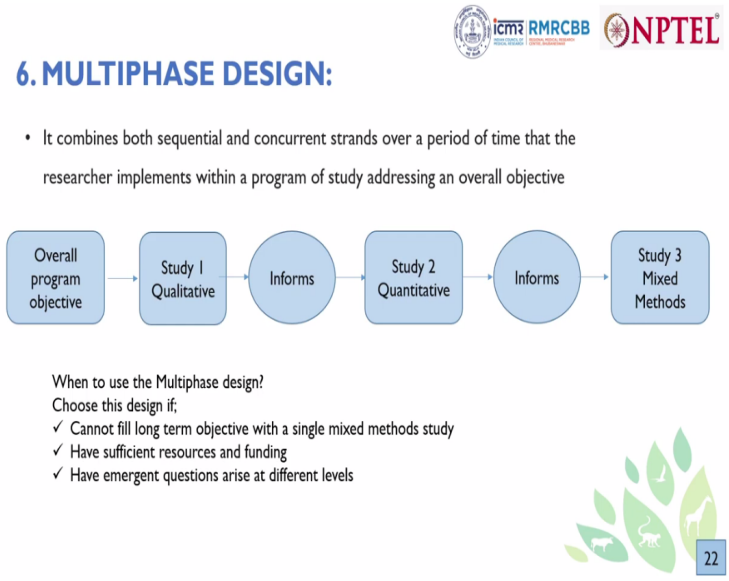

Finally, we have this multiphase design it combines both sequential and concurrent strands over a period of time. This multiphase design is usually done when we have sufficient resources, funding and many times even a single mixed method is not enough. We need to do two mixed methods study designs at a different levels of program you know at the primary level at the policy level.

So, this is usually approach done when we want to do a program evolution. So, that kind of approach for that we need multiphase design. First we will do a qualitative component, try to find out where are the lacking, where are the problems then based on that we may need to do quantitative study on again we may need to do a qualitative study among the different levels of health system.

And then finally do a mixed method style design to find out where are the problems and how to solve it in a program evaluation. So, coming to the summary for the second session; what is a mixed method research we had discussed this let us see the definition one more that we should have both the breadth and depth of understanding that is we should have the quantitative part and the qualitative part in this study.

So, we should be able to collect and analyze both qualitative and quantitative data giving priority to one or both at the same time and they can be going sequentially or parallelly or embedding one within the other so that is what is mixed method research. When to conduct it? We discussed that usually when we have both qualitative and quantitative data and together they are stronger.

When one type of research is not enough and we need a different perspective also and it is really well suited for multi interdisciplinary research like One health and finally what are the different types of mixed method under it?

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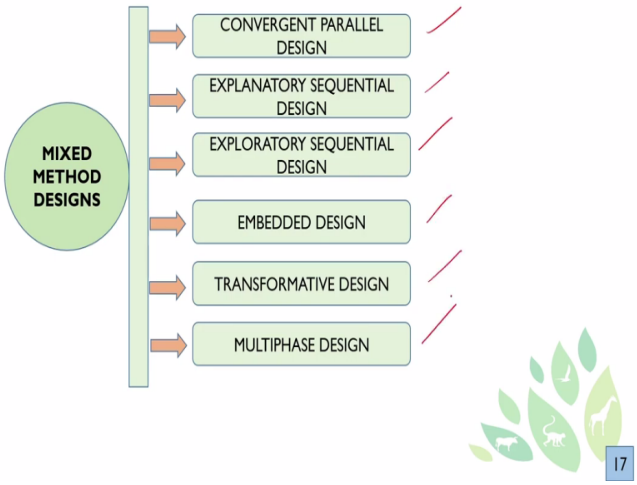

So, we have convergent parallel, we have explanatory and exploratory sequential design, we have embedded design, we have transformative design and finally multiphase design. This is the summary for the second phase. Thank you.