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Dr. Hamza Aduraidi

Rawan Almujaibel

Laila Zakariya









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Doctor

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This course covers an introduction to biostatistics, its purposes, concerns, fields of studies found in this topic and philosophies of quantitative research and biostatics.

To begin with, what is biostatistics?

The word itself is divided into two parts:

1- (**Bio-**) which comes from biology, because it is concerned with the statistics of living things such as humans, animals, etc...

2- (-statistics) is a branch of science, and is really the art and science of prediction.

<u>Prediction</u> is when human beings use their knowledge of certain small group of individuals to predict the characteristics of the larger group of individuals.

NOTE: Some people think that statistics is the same as math, but that is not true. They're different.

From the slide:

- It can be defined as the application of the mathematical tools used in statistics to the fields of biological sciences and medicine.
- It is a growing field with applications in many areas of biology including epidemiology, medical sciences, health sciences, educational research and environmental sciences.

The purpose of the <u>small group</u> of individuals (also called our <u>sample</u>), that we study and collect data from, is not only to understand the characteristics of the samples' members. But also to build up conclusions and to make predictions about the bigger population from the knowledge which we acquired from the small group (our sample).

And that takes us to the essence and the purpose of scientific research.

From the slide:

Concerns of biostatistics:

- Biostatistics is concerned with collection, organization, summarization, and analysis of data.
- We seek to draw inferences about a body of data when only a part of the data is observed.

Purposes of statistics:

- To describe and summarize information thereby reducing it to smaller, more meaningful sets of data.
- To make predictions or to generalize about occurrences based on observations.
- To identify associations, relationships or differences between the sets of observations.

Why do healthcare professionals need to do researches?

To begin with, research is the process of building knowledge, and we are in an endless need to increase our knowledge. Also, it is an attempt by scientists to understand the universe, to produce and bridge gaps in our knowledge.

So we need to do researches to increase our knowledge and understanding of the human body, human behavior, and their interaction with the environment. And we also need to understand as many phenomena surrounding us as possible, and by doing so we will have a better understanding of the universe. As a result of this, we will be able to better solve our problems, better deal with our challenges, and more importantly to better treat our diseases and illnesses by finding treatments and solutions in healthcare sets.

How can we better understand things by doing a research?

• Things start from an interesting or provoking thought that came up to a healthcare professionals mind. It could be from their own experiences or their own observations in a form of question, such as if there is a relationship between two variables or not.

(For example: A dermatologist is wondering if there is a relationship between using sunscreen and developing skin cancer later in life in adult women.)

- Then if there is no answer to his question in recent papers (researches), he will try to get an answer via conducting a study (research).
- By having a hypothesis; Hypothesis is an assumption, for example he hypothesized that women using sunscreen have lower chances of developing skin cancers. This is just a hypothesis; it isn't tested or proved. And can come from different sources of knowledge, theory and information. Now, here comes the importance of biostatistics in proving a hypothesis, where he could collect data from a small sample and give a conclusion regarding the bigger population by using the knowledge that he collected from the smaller sample.

- We have different types of variables such as dependent and independent. In our hypothesis; skin cancer is dependent variable (because it depends on the use of sunscreen to develop) and the use of sunscreen is the independent variable (because it affects and is not affected by anything).
- Afterward, he will recruit two suitable samples from the population (adult women); his first sample is going to be women who had used sunscreen, and the second will be women who haven't used sunscreen.
 NOTE: a sample member (each individual) is called a subject.
- Next, he collects data from both samples (**collection**). But the information that he collected is still meaningless, and it should be organized.
- He organizes them with the help of biostatistics. Biostatistics has two steps the first one is called descriptive statistics (description of the characteristics of the data), is to describe huge sums of data into more organized, summarized and understandable pieces of information, in the form of tables and numbers using mean, median, standard deviation, percentages and proportions. So, the data becomes more describable in the least amount of words and numbers possible.

Back to our example: after organization, it will be like this (I had 1000 women, 35% of them have used sunscreen regularly and 10% of them developed skin cancer).

Now this format is much more meaningful and easy to understand.

 The second step is called inferential statistics, which is more important; <u>inference</u> means to have a conclusion of something. In this step we'll do some calculations on the results of the descriptive statistics to build up our inference. We can run some calculations such as the T-test, one-way ANOVA, regression, etc... So we will end up with a number, such as a T value (in case of a T-test) along with another value called the P value. This P value is the key of answering research questions because it tells if there's an association between two variables or not, and that is called hypothesis testing (knowing if our guess is correct or not).

(The idea will be much clearer in the coming lectures because we will take them one at a time so don't worry).

• Then, **analyzing** comes next, which means comparison; we compare groups of people in terms of their sample statistics and after this we draw inferences to better understand the population. This way there's no need to give an observation to each individual alone to make conclusions about the whole population.

<u>To sum up</u>

In every research there is a first step of **collecting** data, then a second step of **entering** this data to an appropriate software (will be discussed later), then data will be **cleaned**, organized and summarized (managed) so it's easier to deal with, and then it is presented as tables, graphs or specific numbers that are ready to be **analyzed**, and finally the results are taken and compared to other groups in order to come up with inference regarding the population, which is the most important step in any Scientific research.

(What was discussed above is called quantitative research and we will focus on this type of research in our course. There is another type of research which is the qualitative research; it is conducted by selecting a really small sample and then asking the participants open-ended questions and seeking for their emotions and their own experiences).

<u>NOTE</u>: At the end of the lecture, Dr. was asking questions about the dependent and independent variable, be sure to go back to them (questions start in the "31 min" from section 2 record in the website).

Best of luck...