



# Some Applications Of Biostatistics To Nutrition And Anthropology

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## ABSTRACT

Biostatistics is a very potent tool in life, medical, health science and clinical researches. It is a branch of applied statistics. Biostatistics not only covers the health, medicine, and nutrition but also covers the agriculture, genetics, biology, biochemistry, demography, epidemiology, anthropology and many others. Biostatistics helps to evaluate many life and death issues in medicine. The aim of this article is to educate medical and health practitioners about some useful measures and applications of biostatistics to nutrition and anthropology.

**Keywords:** Biostatistics, Nutrition and Anthropology

## INTRODUCTION

There are many fields where statistical methodology and procedures can be applied. One of such fields is life science. Wayne (2014) defined biostatistics as the application of statistical methodologies and procedures to life sciences. It is a very important technique used in most research works in medical and health sciences. Biostatistics has applications not only in medical and health sciences, biology, agriculture, biochemistry, demography and genetics but also in disciplines like nutrition and anthropology. Biostatistics helps the researcher or investigator to develop the appropriate research design, collect data, analyze data, interpret and present results. The usefulness of biostatistics cannot be overstated. Application of statistical methods and procedures to nutrition and anthropology are scattered all over research literature.

### Vital Statistics

Vital events simply mean those events in our communities pertaining to life. These events include but are not limited to birth and death, marriages and divorces, illness etc. the branch of biostatistics that studies vital events is called vital statistics. In other words, vital statistics is the application of statistical methodology and procedures to vital events (Erik *et al*, 2019). It can also cover areas like demography of a population, nutrition and very many aspects of health.

### Sources of Vital Event Data

Sources of vital event data may be secondary or primary. Generally, vital event data can be sourced from population census, surveys, databases and registries.

**Methods of Statistics**

The methods of statistics broadly used in vital statistics include;

1. Rates

Rate is a probabilistic measure for the likelihood of occurrence of an event of interest (Meyners, et al, 2015). It is expressed mathematically as

$$Rate = \left(\frac{f}{n_1}\right) n_2$$

Where

*f is the frequency with which the event of interest occurred during some specified time period*  
*n<sub>1</sub> the number of persons exposed or at risk of the event of interest during the same time period*  
*n<sub>2</sub> numbers such as 100, 1000, 10,000, ... ..*

There are two types of rates namely; Specific Rate (SR) and Crude Rate (CR)

**Specific Rate**

Specific rate is the measure for a specific group of the population such as gender, age, residential area, marital status etc. it is denoted by SR and expressed mathematically as

$$SR = \left(\frac{N}{M}\right) \times 1000$$

Where

N is the number of events which occurred among specific group of the population of a given area during a given time

And

M is the mid-year population of the specific group of population in the same area during a given year

**Crude Rate**

Kasim, Khaled (2012) defined Crude Rate (CR) measures the proportion between total events and the population in an area over a period of time.

**2. Ratios**

Broadly speaking, a ratio is a measure that compare two quantities by division. However, in biostatistics a ratio is applied in a more specific sense. That is, the numerator and the denominator are two mutually exclusive quantities. It thus implies that the numerator is not a component of the denominator. There are two types of ratios commonly used in biostatistics

**a) Sex Ratio**

Sex ratio can be defined as the ratio of the number of females to the number of males per thousand (Hardy & Ian; 2002). Mathematically

$$Sex\ Ratio = \frac{number\ of\ female}{number\ male} \times 1000$$

**b) Foetal Death Ratio**

Foetal Death Ratio is the ratio of the number of foetal deaths in a year to the number of live births in a year. Mathematically

$$Foetal\ Death\ Ratio = \frac{number\ of\ foetal\ death\ in\ a\ year}{number\ of\ live\ birth\ in\ a\ year}$$

In addition to these, other examples of ratios are “Person-Hospital Ratio”. “Patients -Doctors Ratio”, or Patience- Hospital bed Ratio”.

**3. Proportions**

Proportion can be seen statistically as the ratio of the number of successful outcomes of an event to the number of total outcomes of the event. It is defined mathematically as

$$proportion = \frac{\alpha}{\alpha + \beta}$$

Where

*α is the frequency with which an event has occurred during a specified time*  
*α + β represent total number of exposed subjects during the time*

Whenever  $\alpha$  and  $\beta$  are integers, the measurer of proportion is called relative frequency. In a very large population proportion can be seen as the probability or likelihood of the occurrence of a certain event of interest.

#### 4. Measures of Fertility

Fertility can be defined at the state of being fertile. Being fertile is the ability to bear or reproduce your kind. The study of the rate of child bearing in a place is of great importance to health decision makers (Jafaru, 2020) This knowledge will help health planners provide adequate health facilities and services. There are many measures of fertility but we have considered the following;

##### I. Crude Birth Rate (CBR)

This is the most commonly used measure of fertility. This is the ratio of the number of live births which occurred in a specific geographical location per year to the mid-year population of the area in the same year. Mid-year population must be known to be able to measure CBR. Mathematical

$$CBR = \frac{\gamma}{\delta} \times 1000$$

Where

$\gamma$  represent the number of live births which occurred in a specific geographical location per year  
 $\delta$  represent the mid – year population of the area in the same year

##### II. Fertility Rate (FR)

Fertility rates are measures that take into consideration woman in the reproductive age and are a better measure of fertility in a population. below are some fertility rates commonly measured;

##### General Fertility Rate (GFR)

This is the ratio of the total number of live births in a year to the total number of women within the age bracket of 15-49years per thousand. Mathematically

$$GFR = \frac{\text{total number of live births in a year}}{\text{total number of women within the age bracket of 15 – 49.}} \times 1000$$

##### General Marital Fertility Rate (GMFR)

This is the ratio of the total number of live births in a year to the total number of married women within the age bracket of 15-49years per thousand. Mathematically

$$GMFR = \frac{\text{total number of live births in a year}}{\text{total number of women within the age bracket of 15 – 49.}} \times 1000$$

##### Age Specific Fertility Rate (ASFR)

Age Specific Fertility Rate measure GMFR for specific age brackets. Age groups likely uses are 15-19yrs, 20-24yrs, 25-29yrs, 30-34yrs, 40-44yrs and 45-49yrs. Mathematically ASFR is defined as

$$ASFR = \frac{\text{total number of live births in a year}}{\text{total number of women of specific age .}} \times 1000$$

##### Total Fertility Rate (TFR)

Assume  $\varepsilon_i$  represents the number of births associated with women of ith age and  $\varphi_j$  represents the number of women of ith age in a given population and in a specific time period, then TFR is defined mathematically as

$$TFR = \sum_{I=15}^{49} \frac{\varepsilon_I}{\varphi_I} \times 1000$$

**Sex Ratio (SR)**

Sex ratio is the ratio of the number of females to the number male per thousand. It is a common fertility measure. Is the defined mathematically as

$$SR = \frac{\text{Number of female}}{\text{number of male}} \times 1000$$

Literature have shown that sex ratio at birth is a better fertility measure than SR. it is measure mathematically as

$$\text{Sex Ratio at Birth} = \frac{\text{Number of female live birth}}{\text{number of male live birth}} \times 1000$$

**Mortality**

Mortality can simply be defined as the number of deaths caused by a particular disease of interest (Mahmud, 2020). It can be measured as a rate or as an actual count. Most commonly it is represented as a rate per 1000 individuals. It is also called death rate. There many measures of mortality rates.

**Mortality Rate**

Mortality rate, or death rate can simply be defined as a measure of the number of deaths in a given population scaled to the size of that population, per unit of time. Mortality rate is typically expressed in units of deaths per 1,000 individuals per year; thus, a mortality rate of 9.5 (out of 1,000) in a population of 1,000 would mean 9.5 deaths per year in that entire population, or 0.95% out of the total. There are many measures of mortality rate but we have considered the commonly measures below;

**Crude Death Rate (CDR)**

This is the ratio of the total number of deaths which occurred in a specific geographical location in a given time period to the mid-year population of the area during same year. CDR is defined mathematically as

$$CDR = \frac{\text{total number of deaths which occurred in a specific geographical location in a given time period}}{\text{the mid - year population of the area during same year.}} \times 1000$$

**Age or Sex Specific Death Rate**

There is a variation in death rate with respect to age and sex. Literature have shown that death rate is higher for infants and woman of child-bearing age. Age Specific Death Rate (ASDR) or Sex Specific Death Rate (SSDR) are very useful mortality measure. It is defined mathematically as

**Age Specific Death Rate**

$$ASDR = \frac{\text{total number of deaths which occurred in a specific age group in a geographical location in a given time period}}{\text{the mid - year population of the same age group of the area during same year.}} \times 1000$$

And

$$SSDR = \frac{\text{total number of deaths which occurred in a specific age group in a geographical location in a given time period}}{\text{the mid - year population of the same age group of the area during same year.}} \times 1000$$

**Infant Mortality Rate (IMR)**

This is one of the most commonly used mortality measures. it is a very important measure to people in maternity and child-health services. it can be a very good index to measure the success of many procedures and intervention in child-health services. It is the ratio of the number of deaths under one year of age in a year to the number of live births per thousand (Okorie *et al*; 2023). It is defined mathematically as

$$IMR = \frac{\text{number of deaths under one year of age in a year}}{\text{number of live births.}} \times 1000$$

**Neonatal Mortality Rate (NMR)**

This is a special type of IMR. It is the ratio of the total number of deaths up to 28 days of life to the total number of live births. It is defined mathematically as

$$NMR = \frac{\text{Total number of deaths up to 28 days of life}}{\text{Total number of live births}} \times 1000$$

**Post-Neonatal Mortality Rate (PNMR)**

This is a special type of IMR. It is the ratio of the total number of deaths after 28 days of life to the total number of live births. It is defined mathematically as

$$PNMR = \frac{\text{Total number of deaths after 28 days of life}}{\text{Total number of live births}} \times 1000$$

Most PNMR are caused by environmental and nutritional

**Morbidity**

Morbidity is the state of being symptomatic or unhealthy for a disease or condition (ref). It is usually measured using prevalence or incidence. Prevalence describes the proportion of the population with a given symptom while incidence measure the frequency at which individuals within a specific population develop a given symptom.

**Measures of Morbidity**

There are two basic measures of morbidity;

**Incident Rate**

Incidence is the rate of new cases or events over a specified period for the population at risk for the event (ref). In epidemiology, incidence is commonly the newly identified cases of a disease or condition per population at risk over a specified timeframe. Mathematically incident rate is defined as

$$incidence\ rate = \frac{\text{total number of new cases of an event of interest in a year}}{\text{mid - year population}} \times k$$

Where is dependent on the magnitude of the numerator

**Prevalence Rate**

Prevalence is defined simply as the proportion of the population with a disease of interest at a specific point in time (point prevalence) or during a period of time (period prevalence) (ref). Incidences increase Prevalence and prevalence decreases when a patient is either cured or dies. it is mathematically defined as

$$prevalence\ Rate = \frac{\text{total number of cases at a point in time}}{\text{total populaton at that point in time}} \times k$$

**Case Fatality Rate**

Case fatality rate can simply be defined as the proportion of people who die from a disease of interest among all individuals diagnosed with the disease over a certain time period(ref). Case fatality rate typically is used as a measure of disease severity and is often used for prognosis (predicting disease course or outcome), where comparatively high rates are indicative of relatively poor outcomes. It also can be used to evaluate the effect of new treatments, with measures decreasing as treatments improve. Case fatality rates are not constant; they can vary between populations and over time, depending on the interplay between the causative agent of disease, the host, and the environment as well as availability of treatments and quality of patient care. It is defined mathematically as

$$Case\ Fatality\ Rate = \frac{\text{total number of death due to the disease of interest}}{\text{total number of cases due to the disease of interest}} \times k$$

### **Descriptive statistics**

Descriptive statistics is a branch of statistics that summarizes the sample data without attempting to infer. Descriptive measures are used to describe the data at hand. There are many descriptive measures commonly used in biostatistics; Mean, Median and Mode Variance and Standard Deviation. Descriptive measures are very important in nutrition and anthropology researches.

### **CONCLUSION**

Without adequate knowledge of the application of biostatistics to medical and health science research, it is almost impossible for a researcher to analyze data and infer on a population. So, learning the basic techniques and procedures of biostatistics and its applications in medical and health science research cannot be overemphasized.

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