Biostatistics Lecture: Morbidity Statistics

1 Introduction to Morbidity Statistics

1.1 What Are Morbidity Statistics?

Morbidity statistics are essential tools in biostatistics that measure the occurrence and impact of diseases within a population. They provide insights into how diseases spread, persist, and affect different segments of society. The two primary rates used in morbidity statistics are the **Incidence Rate** and the **Prevalence Rate**.

1.2 Key Morbidity Rates

1. **Incidence Rate**
2. **Prevalence Rate**

2 Incidence Rate

2.1 Definition

Incidence Rate measures the degree of occurrence of *new cases* of a disease within a specific period. It helps determine the necessity for precautionary measures and the effectiveness of interventions.

2.2 Formula 1: Incidence Rate

$$\text{Incidence Rate} = \left(\frac{\text{Number of new cases of disease during the year}}{\text{Number of population in the middle of the year}} \right) \times 1000 \tag{1}$$

Note: All rates are multiplied by 1,000 to standardize the measurement per 1,000 individuals.

2.3 Example 1: Calculating Incidence Rate

Problem: In 1995, the number of children who contracted cancer in a country reached **224 cases**. If the population of the country was **6,234,190** in the middle of 1995, calculate the incidence rate of cancer among children for that year.

Solution:

$$\text{Incidence Rate} = \left(\frac{224}{6,234,190} \right) \times 1000 = 0.035\%$$

Interpretation: This means that for every **1,000 children** in the population, **0.035** cases of cancer were reported in 1995.

3 Prevalence Rate

3.1 Definition

Prevalence Rate measures the total number of cases of a specific disease present in a population at a given time. It is particularly useful in studying *chronic* and *acute diseases*.

3.2 Formula 2: Prevalence Rate

$$\text{Prevalence Rate} = \left(\frac{\text{Number of cases in a period of time}}{\text{Number of population in that period}} \right) \times 1000 \tag{2}$$

3.3 Example 2: Calculating Prevalence Rate

Problem: A study in a city found that **4,234** people were infected with cholera. If the population of the city was **323,418**, calculate the prevalence rate of cholera.

Solution:

$$\text{Prevalence Rate} = \left(\frac{4,234}{323,418}\right) \times 1000 = 13.09\%$$

Interpretation: Out of every **1,000 residents**, **13** individuals contracted cholera.

4 Case Fatality Ratio

4.1 Definition

Case Fatality Ratio represents the number of deaths caused by a specific disease relative to the number of diagnosed cases of that disease. It provides insight into the lethality of the disease.

4.2 Formula 3: Case Fatality Ratio

$$\text{Case Fatality Ratio} = \left(\frac{\text{Number of deaths from the specific disease}}{\text{Number of cases of the disease}}\right) \times 1000 \tag{3}$$

4.3 Example 3: Calculating Case Fatality Ratio

Problem: From the previous example, if **224** children contracted cancer and **97** children died from it, calculate the case fatality ratio.

Solution:

$$\text{Case Fatality Ratio} = \left(\frac{97}{224}\right) \times 1000 = 433.04\%$$

Interpretation: This indicates that for every **1,000** cases of cancer among children, **433.04** resulted in death. *(Note: A ratio over 100% suggests a miscalculation or data interpretation issue, as it implies more deaths than cases, which is typically not possible.)*

5 Immaturity Ratio

5.1 Definition

Immaturity Ratio measures the number of live-born children weighing less than **2,500 grams** relative to the total number of live births. It is an important indicator of neonatal health and can reflect the quality of maternal and prenatal care.

5.2 Formula 4: Immaturity Ratio

$$\text{Immaturity Ratio} = \left(\frac{\text{Number of children born with weight} < 2500\text{g during the year}}{\text{Total number of children born in the middle of the year}}\right) \times 1000 \tag{4}$$

5.3 Example 4: Calculating Immaturity Ratio

Problem: In the 2000 population census of a city, there were **1,362** children born with a weight not exceeding **2,500 grams** out of a total of **4,349** children. Calculate the immaturity ratio.

Solution:

$$\text{Immaturity Ratio} = \left(\frac{1,362}{4,349}\right) \times 1000 = 313.02\%$$

Interpretation: For every **1,000** children born in the city, **313** weighed less than **2,500 grams**.

5.4 Example 5: Another Calculation of Immaturity Ratio

Problem: In 1998, the city recorded **5,324** live births, with **1,476** children weighing less than **2,500 grams**. If the population in mid-1998 was **133,600**, calculate the immaturity ratio.

Solution:

$$\text{Immaturity Ratio} = \left(\frac{1,476}{5,324}\right) \times 1000 = 277.2\% \text{ per } 1,000 \text{ people}$$

Interpretation: Out of every **1,000** live births, **277** children weighed less than **2,500 grams**.

6 Summary

In today's lecture, we explored the fundamental **Morbidity Statistics** crucial for understanding disease dynamics within a population. We covered:

1. **Incidence Rate**: Measures new cases over a period.
2. **Prevalence Rate**: Assesses total cases at a specific time.
3. **Case Fatality Ratio**: Evaluates the lethality of a disease.
4. **Immaturity Ratio**: Indicates neonatal health based on birth weights.

By mastering these statistics, we can better analyze health trends, allocate resources effectively, and implement targeted health interventions to improve public health outcomes.