Application of Mathematics and Statistics –
Case Study of Government Hospital,
Eluru, West Godavari Dist.

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ABSTRACT

In the Modern World of Computers and Information Technology, the importance of Statistics is very well recognized by all the disciplines. Statistics has originated as a Science of State hood and found applications in the fields of Agriculture Sciences, Social Sciences, Commerce, Biological Sciences, Applied Sciences, Mathematical Sciences, Medicine, Industry, Planning, and Education etc. It is evident that statistics plays a key role in Mathematics considering it a branch of Applied Mathematics. However, Statistics is a universal subject dealing with Research studies in all areas with the application of Applied Statistical tools and suitable method in analysis and interpretation of data which will help the academicians, scholars and administrators to get appropriate and exact estimated results without manipulations. We can find Statistical Techniques in Integration, Differentiation, and Algebra and we can find those in statistics as well. In present education system Mathematics is based on applying Statistical methods which helps in innovating New Research Mathematical Theories Scientist in these fields felt that the possibility of getting accurate results. Using Averages, Dispersions, and Estimation allows you to come up with conclusions that are closer to the accurate answer than just taking a wild guess. In this study the authors felt that research on Health Sciences is the need of the hour and selected the theme of Inpatients and provision of beds in Government Hospital and few registered, licensed Private hospitals, Eluru, West Godavari Dist. Andhra Pradesh.

Key Words: Information Technology, Disciplines, State hood, Universal Subject, Manipulations

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Introduction

Applied Statistics is concerned with scientific methods for collecting, organizing, summarizing, presenting and analyzing data as well as deriving valid conclusions and making reasonable decisions on the basis of this analysis. Statistics is concerned with the systematic collection of numerical data and its interpretation. The word 'statistic' is used to refer to Numerical facts, such as the number of people living in particular area and the study of ways of collecting, analyzing and interpreting the facts.

Statistics is defined differently by different authors over a period of time. In the olden days statistics was confined to only state affairs but in modern days it embraces almost every sphere of human activity. Therefore a number of old definitions, which was confined to narrow field of enquiry, were replaced by more definitions, which are much more comprehensive and exhaustive. Secondly, statistics has been defined in two different ways –Statistical data and statistical methods. Statistics are the classified facts representing the conditions of people in a state. In particular they are the facts, which can be stated in numbers or in tables of numbers or in any tabular or classified arrangement. Statistics are measurements, enumerations or estimates of natural phenomenon usually systematically arranged, analyzed and presented as to exhibit important interrelationships among them.

Importance of Statistics in hospital data:

❖ Quantitative research guides health care decision makers with statistics—numerical data collected from measurements or observation that describe the characteristics of specifics summarize the utility, efficiency and costs of medical goods and services, increasingly, health care organization employ statistical analysis to measure their performance outcomes. Hospital and other large provider services organization implement data-driven, continuous quality improvement programs to maximize efficiency.

❖ Researchers employ scientific methods to gather data on human population samples. The health care industry benefits from knowing consumer market characteristics such as age, sex, race, income and disabilities. These "demographic" statistics can predict the types of services that people are using and the level of care that is affordable to them. Health

administrators reference statistics on service utilization to apply for grant funding and to justify budget expenditures to their governing boards.

❖ Health statistics and data are important because they measure a wide range of health indicators for a community. A community can be the entire States, a region, or city. Health data provide comparisons for clinical studies, can be used to assess costs of health care, can help identify needed prevention targets for such programs as Healthy People, and are important for program planning and evaluation by finding a baseline against which to measure in the evaluation phase.

Objectives:

At the conclusion of this chapter we should be able to:

1. Have a clear idea about Hospital statistics

2. State the importance of health care statistics

3. List the type of statistical information collected in hospitals on a monthly in annual basis

4. State the formulae used for the calculation of rates and percentages used in the collection of statistical data

5. Calculate rates and percentages used in the collection of statistical data in hospitals

6. Describe the process of statistical collections in presentation of data

7. Prepare appropriate statistical reports.

Statement of the Research Study:

Hospital data:

Hospital data is one of richest and most valuable sources of health-related information. These data present an invaluable to study a most number of inpatient in health conditions in a complete manner as possible. Beginning in 2016 and 2017, reporting hospital statistical data became mandatory for licensed hospitals. The goal of statistics in hospital project work is to collect, compiles, and disseminate patient level data as well as to analyze and interpret that data. In accordance with this goal, this report aims to establish major current trends in hospital- level care and to pinpoint impending public health issues. Most importantly, our goal is to make our findings available to public health officials, health care providers, policy makers, and the general public health in easily understandable and readily available way. Finally, we hope that this report will establish a base for

future longitudinal studies of trends in major diseases and the cost of their treatment. This report summarizes the 2016 and2017 hospital inpatient data for patients treated in hospitals. Presented are summary statistics and rates of inpatient hospital inpatient stratified by patients' demographic characteristics, payer groups, clinical diagnoses, medical procedures. For the data management and analytical purposes the "Clinical Grouper" is widely used by federal and state organizations and its use allows us to aggregate and evaluate clinical conditions and medical procedures in a more comprehensive way.

Methodology

1. Collection of Data:

Collection of data is the first step in a statistical investigation .The person who conducts the enquiry is known as 'investigator'. The person who helps the investigator in collecting the information is called 'enumerators'. The persons from whom the information is collected are known as 'respondents'. The primary task in any statistical enquiry is to determine its aim and objectives. Once these objectives have been determined, the next task is to collect the data. The data to be used can be of two types.

Types of Data:

There are two types (sources) for the collection of data:

(**1**) Primary Data.

(**2**) Secondary Data

Primary Data:

Primary data are the first hand information which is collected, compiled and published by organizations for some purpose. They are the most original data in character and have not undergone any sort of statistical treatment. The data collection is based on pilot survey. Here researcher directly interviewed the concerned authorities.

Secondary Data:

The secondary data are the second hand information**,** which is already collected by an organization for some purpose and are available for the present study. Secondary data are not pure in character and have undergone some treatment at least once. Is the data collected by some other person or organization for their own use but the investigator also gets it for his use, According to M.M. Blair, "Secondary data are those already in existence for some other purpose than the answering of the question in hand?"

Difference between Primary and Secondary Data:

The difference between primary and secondary data is only a change of hand. Primary data are the first hand information which is directly collected form one source. They are the most original in character and have not undergone any sort of statistical treatment, while secondary data are obtained from other sources or agencies. They are not pure in character and have undergone some treatment at least once.

A) Methods of Data Collection:

The word 'Population' has a different meaning in Statistics than in ordinary usage. Ordinarily, the word population is used to mean the number of the people living in an area, a region or a country. In Statistics the word 'Population' or 'Universe' refers to the number of observations connected with the enquiry.

When the entire population is taken into account for study, it is known as Census Method. When a small group is taken into account as representative of the whole, it is known as Sample Method.

1. Census method.

2. Sample method.

1. Census Method:

Census method means the complete enumeration of the population. In the world, every country conducts the population census at a regular interval of time. In our country the population census is conducted every 10 years.

2. Sample Method:

In the sampling technique instead of every unit of the universe only a part of it is studied and the conclusions are dawn on the basis for the entire universe. This technique was first used by A.L. Bowleys in 1912 to study the extent of the poverty of laborers'. In 1934, the Indian Government also adopted this method.

Census Vs Sample:

After studying the Census method and Sampling method, one has to make a choice between the two. So, when the population is small and precise information is needed, the Census method will be most appropriate; whereas, when the population is very large or the field of investigation is very wide and quick results are needed with minimum cost, sampling method is the most appropriate.

2. Presentation of Data:

The data collected should be presented in a suitable, concise form for further analysis. The collected data may be presented in the form of tabular or diagrammatic or graphic form. This refers to the organization if data into tables, graphs or charts, so that logical and statistical conclusions can be derived from the collected measurements. Data may be presented in 3 methods:

 a) Textual.

 b) Tabular

 c) Graphical or digraphs

a) Textual presentation:

➤ The data gathered are presented in paragraph from.

➤ The data are written and read.

➤ It is a combination of texts and figures,

b) Tabular presentation:

➤ Method of presenting data using the statistical tables.

➤ A systematic organization of data in columns and rows.

c) Graphical presentation:

Kinds of Graphs or digraphs:

1. Bar graphs-used to show relationship/comparisons between groups.

2. Pie or circle graph-shows presentation effectively.

3. Line graph-most useful in displaying data that changes continuously over time.

4. Pictograph-or pictogram. It uses small identical or figures of objects called isotopes in making comparison. Each picture represents a definite quantity.

3. Analysis of Data:

The data presented should be carefully analyzed for making inference from the presented data such as measures of central tendencies, dispersion, correlation, regression etc. Data analysis, also known as analysis of data or data analytics, is a process of inspecting, cleansing, transforming and modeling data with the goal of discovering useful information, suggesting conclusions and supporting decision-making. Data analysis has multiple facets and approaches, encompassing diverse techniques under a variety of names, in different business, science and

social science domains.

Analysis in present study refers to breaking a whole into its separate components for individual examination .data analysis is a process for obtaining raw data and converting it into information useful for decision-making by users. Data is collected and analyzed to answer questions, test hypotheses.

The findings in this report are based on inpatient discharge data from reporting hospitals in Eluru during 2016 and 2017.Rates were calculated using the April 2010 population estimates of India. The unit of analysis is a hospital inpatient discharge, a term that denotes inpatient settings of hospital-level care and this term is used interchangeably with the term hospitalization throughout this report. It is also important to note that some patients might have multiple hospital admissions and discharges within years. In addition, while all inpatient hospital discharges occurred within 2016 and 2017, some admissions might have started before the beginning of the calendar year. The major findings are presented here as brief descriptions, tables, graphs and figures. The occupancy rates are as follows in the year 2010 to 2017.
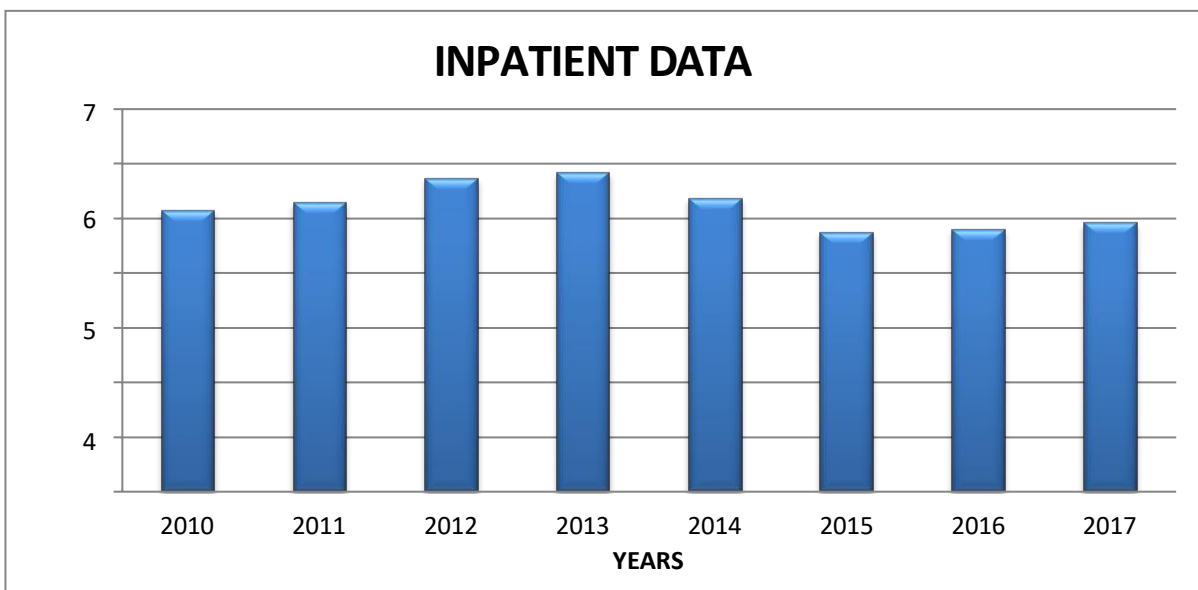
Highest inpatient occupancy rate was observed in the year 2013 is 5.95% and the   lowest inpatient occupancy rate was observed in the year 2015 is 4.62%.

The purpose of the statistics project is to answer a particular research question by collecting, analyzing, organizing and interpreting relevant information. The data in such project should be presented in a certain form and according to the defined instructions. The end goal of such paper is to provide an understandable and exhaustive conclusion by using statistical

methodology.

Statistics are numerical statement of facts in any department of enquiry placed in relation to each other. Statistics may be defined as the science of collection, presentation, analysis and interpretation of numerical data from the logical analysis. It is clear that of statistics is the most scientific and realistic one. Statistical investigation methods are used to study the concrete mass phenomena and diversify according to statistical research stages: data collection, data processing and analysis. All of the operation processes and methods of statistical investigation constitute the methodology of statistics. To capture the exact trends of mass phenomena in the socio-economic area and to estimate their evolution, statistical activity follows a rigorous program with concrete actions named statistical investigation which includes all operations of collecting, systematization, classifying, processing, storage, analysis and interpretation of statistical data. The methodology for statistical data in four ways:

➢ Collection of data

➢ Presentation of data

➢ Analysis of data

➢ Interpretation of data

Statistical investigation is part of an information gathering and learning process which is undertaken to seek meaning from and to learn more about observed phenomena as well as to inform decisions a actions. The ultimate goal of statistical investigation is to learn more about a real world situation and to expand the body of contextual knowledge.

4. Interpretation of Data:

The final step is drawing conclusion from the data collected. A valid conclusion must be drawn on the basis of analysis. A high degree of skill and experience is necessary for the interpretation. Interpretation is the process of making sense of numerical data that has been collected, analyzed and presented.

Interpretation refers to the task of drawing inferences from the collected facts after an analytical or experimental study. It is a search for broader meaning of research finding. Interpretation is the device through which the factors that seem to explain what has been observed by researcher in the course of the study can be better understood and it also provides a theoretical conception which can serve as a guide for further researchers. Interpretation is required for hypothesis results. Data analysis and interpretation is the process of assigning

meaning to the collected information and determining the conclusions, significance and implications of the findings.

Data interpretation refers to the process of critiquing and determining the significance of important information, such as survey results, experimental findings, observations or narrative reports. Interpreting data is an important critical thinking skill that helps you comprehend text books, graphs and tables.

Study Area:

Statistics Related To Hospital System:

Hospital system is a project on methodology. Its central objective is to develop a methodology for the improved comparability of hospital inpatient and day case and month activity data across and to produce a pilot common data set based on that methodology. Hospital collection data about inpatient on a monthly basis they use statistics to monitor of patients treated daily, weekly, monthly or with in some other specified time period.

Rate, Ratio and proportions are commonly used to describe hospital populations. Hospital-based rates are used for variety of purposes. Firstly, they describe the general characteristics of the patient treated at the facility. Hospital administrators use the data to monitor the volume of patients treated monthly, weekly or with in some other specified time frame. The statistics give health care decision-makers the information they need to plan facilities and to monitor inpatient and outpatient revenue streams. With the knowledge of how clinical data are collected and analyzed.

These statistics gives the health care decision-makers the information need to plan facilities and to monitor inpatient renewal stream. A number of patients are admitted for trivial ailments. Such cases will not even be considered for admission in any civil hospital. Since these admission numbers also are included in the total number of patients admitted, they dilute the percentage in all statistical analysis. Therefore, it will not be proper to compare our statistics with the statistics of international or national civil hospitals. It reveals a lot but what it hides is more interesting.

Terminology:

1. Admission:

The formal process whereby a person is accepted by a hospital for the purpose of hospital treatment as an inpatient if an inpatient is formally discharged from the hospital and then returns

for further treatment, the admission process is repeated and a second admission is recorded in the statistics.

Live births in the hospital are considered inpatient admissions, but are always recorded separately as newborn admissions whether or not they require, during their continuous stay in the hospital since birth, special medical care in the nursery or in another clinical service of the hospital (for example, neonatal intensive care unit). A newborn admission is deemed to occur at the time of birth in the hospital. Typically, a patient should be admitted as an inpatient if treatment and/or care are provided by hospital staff over a period of 24 hours.

2. Inpatient

A person who occupies a bed in a hospital for the purpose of hospital treatment where a patient is admitted on the expectation that he or she will remain overnight, but the patient dies or is discharged before the midnight census, the patient should still be regarded as an inpatient, whether or not a hospital bed is occupied or treatment is provided. For example, the patient may die in the operating room or the recovery room, or may be discharged because surgery cannot be performed for medical or administrative reasons.

Patients who are held for observation in the Emergency Department or other observation areas, pending a decision whether to admit or not to admit to an inpatient bed should NOT be regarded as inpatients. However, if a decision is taken to admit such a patient, the time of admission should be regarded as the arrival time at the Emergency Department or observation area. A hospital newborn inpatient is an infant born in the hospital at the beginning of the current inpatient admission.

These infants are may be classified as normal newborns, or as those requiring special care because of Prematurity, Congenital Malformations, etc., and are admitted to the Neonatal Intensive Care Unit . Well newborns staying in the regular nursery are listed separately from those in the neonatal intensive care unit. Some countries include the special care newborns with regular inpatients others group them with the well newborns. In both instances the special care newborns should be listed separately.

3. Length of Stay (Discharge Days)

The total number of patient days for an inpatient episode the duration of an inpatient's hospitalization is considered to be one day if he is admitted and discharged on the same day and also if he is admitted on one day and discharged the next day. The day of admission should be

counted but not the day of discharge.

4. Patient Day (Inpatient Service Day)

Unit of measure denoting the services received by one inpatient during treatment for 24-hours Period is considered as Inpatient Service Day.

5. Total Length of Stay (Total Discharge Days)

The number of days of care rendered to a group of inpatients from admission to discharge. The sum of the length of stay of any group of inpatients discharged during a specified period of time**.**

Collection of Statistical Data in a Hospital:

In this we are introduced to the collection of statistical data in hospitals, community health centers and primary health care areas. The various rates and percentages generally calculated in health facilities are discussed along with the formula for their computation and definitions relating to statistical collections.

The collection of meaningful statistics is an important function of a hospital or clinic. Health records are the secondary source of data used in compiling health care statistics. The health record department staff, therefore, may be responsible for the collection, analysis, interpretation and presentation of statistical data wherever possible. Today, computerized systems automatically collect and calculate many of the statistics that were once previously done manually. Statistical tools are only as accurate as the original sources from which they are taken. The health information management/health record professional should see that.

Health records and other source documents are complete and readily available to meet the requirements for the production of useful statistics. Health service statistics are used for:

➢ Comparison of present and past performance of the hospital.

➢ Guide for planning future development of the hospital.

➢ Appraisal of work performed by the medical, nursing and other staff.

➢ Research.

Before proceeding, we should become familiar with some definitions relating to terms used in statistical collections.

Analysis and Interpretation of Data:

The purpose of this analysis is to evaluate the distribution by inpatients data and the

frequency distribution in health care, we deal with vast quantities of clinical data .Since it is very difficult to look at data in raw form (or) ungrouped data, data are summarized into frequency distribution.

"Procedures for analyzing data, techniques for interpreting the results of such procedures, ways of planning the gathering of data to make its analysis easier, more precise or more accurate, and all the machinery and results of (mathematical) statistics which apply to analyzing data".

The purpose is also to assess the existence of direct correlations between the articulating click and lateral deviation. The number and percentage of data captured by data collection method was presented using statistics.

Inpatient Statistical Data Collection in the Year 2016:

 Table-1

Month	Male	Female	Total number of inpatient days
January	220	250	470
February	195	400	595
March	300	123	423
April	352	227	579
May	405	270	675
June	410	243	653
July	300	240	540
August	275	220	495
September	195	152	347
October	320	295	615
November	195	176	371
December	165	200	365

This report summarizes the 2016 hospital inpatient data for patients treated in hospitals. Presented are summary statistics and data of inpatient in hospital stratified by patients by. The hospital has average of 350 beds available for use each month occupied in a 2016 year. We list the main inpatients described above in table, and analyze inpatient rate in every month. There is no significant difference among number of inpatients male and female in the year 2016

Inpatient Statistical Data Collection in the Year 2017:

Table:2

Month	Male	Female	Total number of inpatient days
January	225	330	555
February	270	350	620
March	205	292	497
April	365	200	565
May	400	390	790
June	356	420	776
July	288	385	673
Augusts	320	254	574
September	281	205	486
October	333	350	683
November	260	265	525
December	195	235	430

This report summarizes the 2017 hospital inpatient data for patients treated in hospitals. Presented are summary statistics and data of inpatient in hospital stratified by patients' by. A hospital has average of 400 beds available for use each month occupied in a 2017 year.

We list the main inpatients described above in table, and analyze inpatient rate in every month. There is no significant difference among number of inpatients male and female between each month in 2017 year.

Frequency Distribution:

A frequency distribution shows the values that a variable can take and the number of observations associated with each value. A variable is a characteristic or property that may take on different values. Heights, Weight, Sex, are examples of variables.

By simple series data or ungrouped data, we mean data, recorded without any definite systematic arrangement. By frequency of a particular value of the variable or for a particular category (depending on the type of data) we mean how frequently, i.e., the number of times the value of the variable or the particular category occurs in a given data set. When the different values of the variable, arranged in order or the different categories are written together with the

corresponding frequencies, generally in the form of a table, then, that is called a frequency distribution. A frequency distribution is a statement of all possible values of the variable together with their respective frequencies.

The characters of the information, collected from a group of individuals are of two types.1.Grouped data 2.Ungrouped data

The most common procedure for organizing and simplifying a set of data is to place them in a frequency distribution.

A frequency distribution is a table that lists each data point and its frequency. Data is often described as ungrouped or grouped.

1. Ungrouped data is data given as individual data points.

2. Grouped data is data given in intervals

The first step in solving problems in public health and making evidence-based decisions is to collect accurate data and to describe, summarize, and present it in such a way that it can be used to address problems. Information consists of data elements or data points which represent the variables of interest. When dealing with public health problems the units of measurement are most often individual people, although if we were studying differences in medical practice across the hospital, the subjects, or units of measurement, might be hospitals.

A population consists of all subjects of interest, in contrast to *a* sample, which is a subset of the population of interest. It is generally not possible to gather information on all members of a population of interest. Instead, we select a sample from the population of interest, and generalizations about the population are based on the assumption that the sample is representative of the population from which it was drawn.

Objects of Classification:

The following are main objectives of classifying the data:

1. It condenses the mass of data in an easily assailable form.

 2. It eliminates unnecessary details.

3. It facilitates comparison and highlights the significant aspect of data.

4. It enables one to get a mental picture of the information and helps in drawing inferences.

5. It helps in the statistical treatment of the information collected.

 Variables in a Frequency Distribution:

A variable is a characteristic or property that may take on different values Height, weight,

gender are examples of variables. Procedures to summarize data and to perform subsequent analysis differ depending on the type of data (or variables) that are available. As a result, it is important to have a clear understanding of how variables are classified.

Variables can be classified into:

1. Quantitative variable
2. Qualitative variable

1. Quantitative variable:

Measure outcomes that are expressed numerically examples include Patient's age, length of stay, weight, height.

2. Qualitative variable:

Consists of outcomes that cannot be expressed numerically without modification/coding Examples include patient satisfaction (very satisfied, satisfied, natural, Dissatisfied, very dissatisfied), and evaluation of a department performance (poor, average, well).

Ratio, Proportion and Rate:

Qualitative nominal variables often have only two possible categories, such as alive or dead, or male or female. Variables having only two possible categories are called dichotomous. The frequency measures used with dichotomous variables are ratios, proportions and rates. The 3 measures are based on the same formula:

$$\text{Ratio, proportion, and Rate} = x/y \times 10^n$$

In this formula, x and y are the two quantities being compared, and x is divided by y. 10^n is read as "10 to the nth power." The size of 10^n may equal, for example, 1, 10, 100, or 1,000, depending on the value of n

$$10^0 = 1$$
$$10^1 = 10$$
$$10^2 = 10 \times 10 = 100$$
$$10^3 = 10 \times 10 \times 10 = 1{,}000.$$

Ratio:

In a ratio, the values of a variable, such as sex (x = female, y = male), may be expressed so that x and y are completely independent of each other, or x may be included in y. For example, the sex of patients discharged from a hospital could be compared in either of two

ways:

      1. Female/male (or) x/y

      2. Female/ (male+ female) (or) x/(x+y)

In the first option, x is completely independent of y, and the ratio represents the number of female discharges compared to the number of male discharges. In the second option, x is a proportion of the whole, x + y.

      The ratio represents the number of female discharges compared to the total number of discharges. Both expressions are considered ratios (the 2nd type is called proportion).

      For Example: How, then would you calculate the female-to-male ratio for a hospital that discharged 457 women and 395 men during the month of July? The procedure for calculating a ratio is outlined as follows:

1. Define x and y

   X=number of females discharges Y=number of

   male discharges

2. Identify x and y.

   X=457

   Y=395

3. Set up the ratio x/y

   457/395 (or) 1.16

   There were1.16 female discharges for every male discharges

Proportions:

      A proportion is a particular type of ratio. A proportion is a ratio in which x is a portion of the whole, x + y. In a proportion, the numerator is always included in the denominator.

      For example: In the pre mentioned example. The proportion of female discharges during July would be 457/ (457+395) =457/852=0.54 (i.e.) the proportion of discharges that were female is0.54.

Rates:

      Rates are a third type of frequency measure. In health care, rates are often used to measure an event over time and are sometimes used as performance improvement measures. The basic formula for a rate is

Occupancy rate = Total number of inpatient days for a given period x 100 / Available beds x Number of days in the period

In inpatient facilities, there are many commonly computed rates.

➢ By convention, inpatient hospital rates are calculated as the rate per 100 cases

$(10^n = 10^2 = 10 \times 10 = 100)$ and are expressed as a percentage.

Occupancy Rates in Health Facilities:

The occupancy rate is a calculation used to show the actual utilization of an inpatient health facility for a given time period. And other terms which are often used synonymously include "Percent Occupancy," "Percentage Of Occupancy," Or "Occupancy Ratio." In the Health Statistics, occupancy rates are routinely calculated for hospitals and nursing homes and aggregated at the facility, country and state level. This information is very useful for health planning purposes and is requested from the data frequently.

To calculate the average occupancy rate for a typical one-year reporting period. Two data item are needed. These include "Inpatient Days of Care" and "Bed Days Available." Definitions of these two items are as follows:

Inpatient Days of Care –

Sum of each daily inpatient census for the year to arrive at this total, you would simply add together each daily census for the 365 days in the year. Other synonymous terms include "Total Inpatient Service Days," "Occupied Bed Days," or "Census Patient Days Of Care."

Beds Days Available-

The maximum number of inpatient days of care that would have been provided if all beds were filled during the year. If 50 beds were available for use each day during the year, bed days available would be 50 x 365 = 18,250. If the number of beds fluctuated throughout the year, bed days available should reflect this and the calculation would be more complicated. This will be discussed in more detail in the following paragraphs. Other terms used for bed days available include "Potential Days," "Maximum Patient Days," or "Total Inpatient Bed Count Days."

To calculate occupancy rate, use inpatient days of care and bed days available in this formula:

(Inpatient Days of Care / Bed Days Available) x 100

i.e., Bed Days Available= Available beds X Number of days in a period.

The calculation of occupancy rates is not limited to the facility as a whole.

Occupancy rates are often calculated to determine the utilization of a specific inpatient unit such as obstetric, psychiatric, medical/surgical, etc.

The occupancy rate is a valuable statistical measurement and is usually calculated for a certain period of time (Month, Year etc.) as opposed to calculating for one particular day. Determining the occupancy for a longer time period reflects the degree to which hospital beds have been utilized even though the number of beds may have changed during the reporting period.

For the occupancy rate to be a true utilization indicator, bed days available must be calculated to correctly reflect changes in the number of beds available for use during the year. If "Bed Days Available" are calculated incorrectly (for instance, the number of beds in service at the end of the year are multiplied by the number of days in the year even though the number of beds in service was considerably lower for several months), the resulting occupancy rate will be much lower than actual. The following calculation show how the result could differ if bed days available are calculated correctly.

Results:

Calculations of Inpatient Data in the 2016 Year:

Inpatient statistical data routinely collected and calculated in hospitals on a monthly and annual basis include.

Percentage of occupancy of inpatient beds per month

The percentage of inpatient beds occupied over a given period.

Formula

Occupancy rate = Total number of inpatient days for a given period x 100 / Available beds x Number of days in the period

1.   A hospital with 350 available beds and 470 patient days in January. January has 31 days. The percentage of occupancy for the hospital in January was:

$$\frac{470 X 100}{350 X 31} = \frac{47,000}{10,850} = 4.33\%$$

2.   A hospital with 350 available beds and 595 patient days in February. February has 29 days. The percentage of occupancy for the hospital in February was:

$$\frac{595 X 100}{350 X 29} = \frac{59,500}{10,150} = 5.86\%$$

3. A hospital with 350 available beds and 423 patient days in March. March has 31 days. The percentage of occupancy for the hospital in March was:

$$\frac{423 X 100}{350 X 31} = \frac{42,300}{10,850} = 3.89\%$$

4 A hospital with 350 available beds and 579 patient days in April. April has 30 days. The percentage of occupancy for the hospital in April was:

$$\frac{579 \ X \ 100}{350 X \ 30} = \frac{57,900}{10,500} = 5.51\%$$

5 . A hospital with 350 available beds and 675 patient days in May. May has 31 days. The percentage of occupancy for the hospital in May was:

$$\frac{675 \ X \ 100}{350 \ X 31} = \frac{67,500}{10,850} = 6.22\%$$

6 A hospital with 350 available beds and 653 patient days in June. June has 30 days. The percentage of occupancy for the hospital in June was:

$$\frac{653 X 100}{350 X 30} = \frac{65,300}{10,500} = 6.21\%$$

7 A hospital with 350 available beds and 540 patient days in July. July has 31 days. The percentage of occupancy for the hospital in July was:

$$\frac{540 X 100}{350 X 31} = \frac{54,000}{10,850} = 4.97\%$$

8 A hospital with 350 available beds and 495 patient days in August. August has 31 days. The percentage of occupancy for the hospital in August was:

$$\frac{495 X 100}{350 X 31} = \frac{49,500}{10,850} = 4.56\%$$

9 A hospital with 350 available beds and 347 patient days in September. September has 30 days. The percentage of occupancy for the hospital in September was:

$$\frac{367 X 100}{350 X 30} = \frac{36,700}{10,500} = 3.49\%$$

10. A hospital with 350 available beds and 615 patient days in October. October has 31 days. The percentage of occupancy for the hospital in October was:

$$\frac{615 X 100}{350 X 31} = \frac{61,500}{10,850} = 5.66\%$$

11. A hospital with 350 available beds and 371patient days in November. November has 30 days. The percentage of occupancy for the hospital in November was:

$$\frac{371 X 100}{350 X 30} = \frac{37,100}{10,500} = 3.53\%$$

12. A hospital with 350 available beds and 365 patient days in December. December has 31 days. The percentage of occupancy for the hospital in December was:

$$\frac{365 X 100}{350 X 31} = \frac{36,500}{10,850} = 3.36\%$$

We list the main inpatients described above in table-1, and analyze inpatient occupancy rate in every month. The patients' general data, the inpatient of monthly visits, the monthly distribution of common acute inpatient, and the treatment situation and mortality of the acute and critical inpatients the hospital in 2016 year were analyzed, based on the clinical data collected, to figure out the data differences among different months.

Calculations of Inpatient Data in the 2017 Year:

Percentage of occupancy of inpatient beds per month

The percentage of inpatient beds occupied over a given period.

Formula

Occupancy rate = Total number of inpatient days for a given period x 100 / Available beds x Number of days in the period

1. A hospital with 400 available beds and 555 patient days in January. January has 31 days. The percentage of occupancy for the hospital in January was:

$$\frac{555 X 100}{400 X 31} = \frac{55,000}{12,400} = 4.47\%$$

2. A hospital with 400 available beds and 620 patient days in February. February has 28 days. The percentage of occupancy for the hospital in February was:

$$\frac{620 X 100}{400 X 28} = \frac{62,000}{11,200} = 5.53\%$$

3. A hospital with 400 available beds and 497 patient days in March. March has 31 days. The percentage of occupancy for the hospital in February was:

$$\frac{497 X 100}{400 X 31} = \frac{49,700}{12,400} = 4\%$$

4. A hospital with 400 available beds and 565 patient days in April. April has 30 days. The percentage of occupancy for the hospital in April was:

$$\frac{565 X 100}{400 X 30} = \frac{56,500}{12,000} = 4.70\%$$

5. A hospital with 400 available beds and 790 patient days in May. May has 31 days. The percentage of occupancy for the hospital in May was:

$$\frac{790 X 100}{400 X 31} = \frac{79,000}{12,400} = 6.37\%$$

6. A hospital with 400 available beds and 776 patient days in June. June has 30 days. The percentage of occupancy for the hospital in June was:

$$\frac{776 X 100}{400 X 30} = \frac{77,600}{12,000} = 6.46\%$$

7. A hospital with 400 available beds and 673 patient days in June. July has 31 days. The percentage of occupancy for the hospital in July was:

$$\frac{673 X 100}{400 X 31} = \frac{67,300}{12,400} = 5.42\%$$

8. A hospital with 400 available beds and 574 patient days in August. August has 31 days. The percentage of occupancy for the hospital in August was:

$$\frac{574 X 100}{400 X 31} = \frac{57,400}{12,400} = 4.62\%$$

9. A hospital with 400 available beds and 486 patient days in September. September has 30 days. The percentage of occupancy for the hospital in September was:

$$\frac{486 X 100}{400 X 30} = \frac{48,600}{12,000} = 4.05\%$$

10. A hospital with 400 available beds and 683 patient days in October. October has 31   days. The percentage of occupancy for the hospital in October was:

$$\frac{683 X 100}{400 X 31} = \frac{68,300}{12,400} = 5.50\%$$

11. A hospital with 400 available beds and525 patient days in November. November has 30 days. The percentage of occupancy for the hospital in November was:

$$\frac{525 X 100}{400 X 30} = \frac{52,500}{12,000} = 4.37\%$$

12. A hospital with 400 available beds and430 patient days in December. December has 31 days. The percentage of occupancy for the hospital in December was:

$$\frac{430 X 100}{400 X 31} = \frac{43,000}{12,400} = 3.46\%$$

We list the main inpatients described above in table-2, and analyze inpatient occupancy rate in every month. The patients' general data, the inpatient of monthly visits, the monthly distribution of common acute inpatient, and the treatment situation and mortality of the acute and critical inpatients the hospital in 2017 year were analyzed, based on the clinical data collected, to figure out the data differences among different months.

This study helped the authors how to collect, analyze, and interpret hospital inpatients data in a year. Discussions of commonly report hospital inpatient rates are as follows:

➢ We have discussed the techniques of classification and tabulation that help in summarizing the collected data and presenting them in a systematic manner. However, these forms of presentation do not always prove to be interesting to the common man. One of the most convincing and appealing ways in which statistical results may be presented is through diagrams and graphs. Just one diagram is enough to represent a given data more effectively than thousand words. A frequency table is a simple way to display the number of occurrences of a particular value or characteristic.

➢ The reports generated are also very important and are used as a tool of communication. All presentations should be simple and readable with important facts highlighted. Although most reports will be in tabular form, they would be easier to read if visual aids such as graphs, bar charts and pie diagrams were used to illustrate clearly what the figures indicate.

➢ .

**The Hospital Inpatient Statistical Data in the 2016 Year**

Month	Total number of inpatients	Percentages
January	470	4.33
February	595	5.86
March	423	3.89
April	579	5.51
May	675	6.22
June	653	6.21
July	540	4.97
August	495	4.56
September	347	3.30
October	615	5.66
November	375	3.53
December	365	3.36
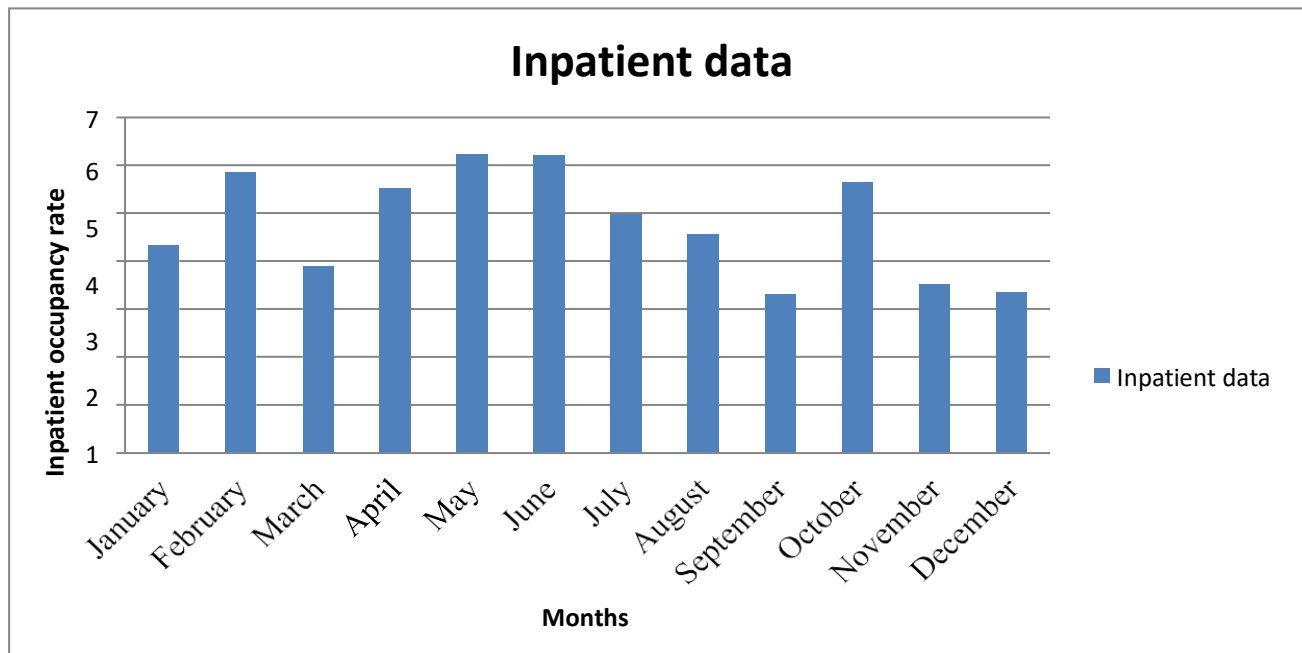
So by Observation, we can say that the highest occupancy rate was observed in the May month is 6.22% and the lowest occupancy rate was observed in September month is 3.30%.

The hospital inpatient statistical data in the 2017 year

Month	Total number of inpatients	Percentages
January	555	4.47
February	620	5.53
March	497	4
April	565	4.70
May	790	6.37
June	776	6.46
July	673	5.42
August	574	4.62
September	486	4.05
October	683	5.50
November	525	4.37
December	430	3.46
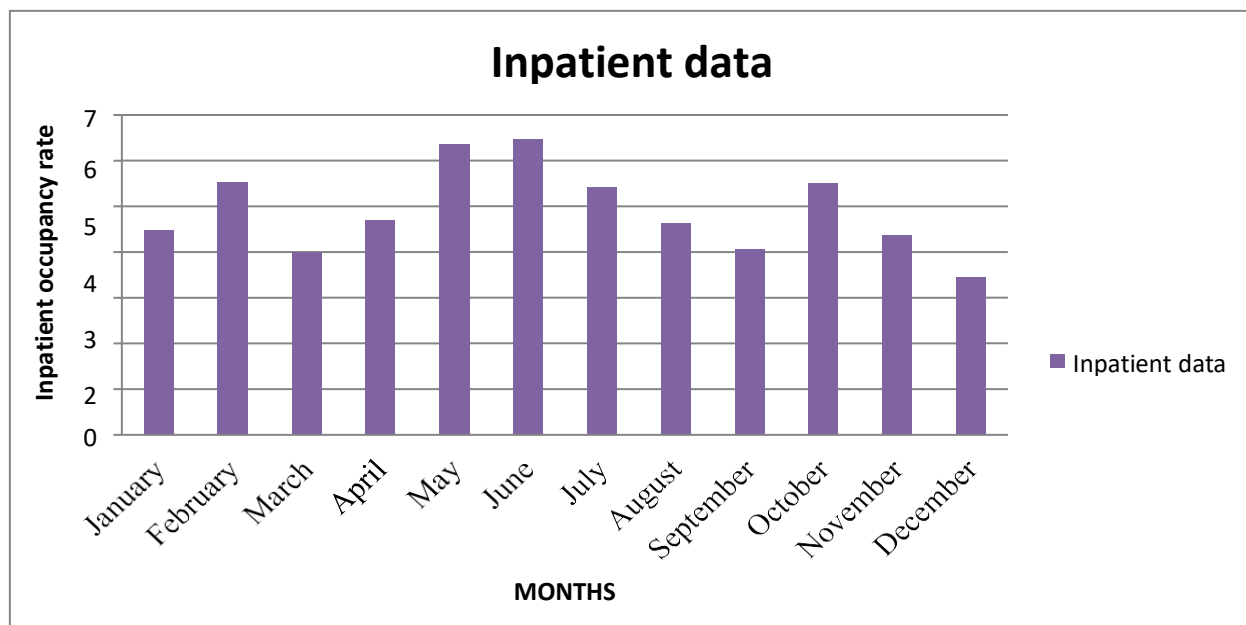
So by Observation, we can say that the highest occupancy rate was observed in the June month is 6.22% and the lowest occupancy rate was observed in December month is

3.46%.

Interpretation of the Hospital Data:

The Hospital system is to develop a methodology for the improved comparability of hospital inpatient data and month case activity. In 2016 year May has more number of inpatients are admitted and the above table-1 May has an occupancy rate is 6.22%.In 2017 year June has more number of inpatients are admitted and the above table-2 June month has 6.46% occupancy rate.

Hospital data project balance a range of competing priorities on a monthly basis including pressures to optimize bed utilization. The evidence generated through frequency distribution has quantized the probabilities of adverse events as a function of occupancy rate. Any effort to reduce inpatient occupancy is thus crucial from a patient safety perspective.

Inpatient Statistical Data in 2016 and 2017 Years
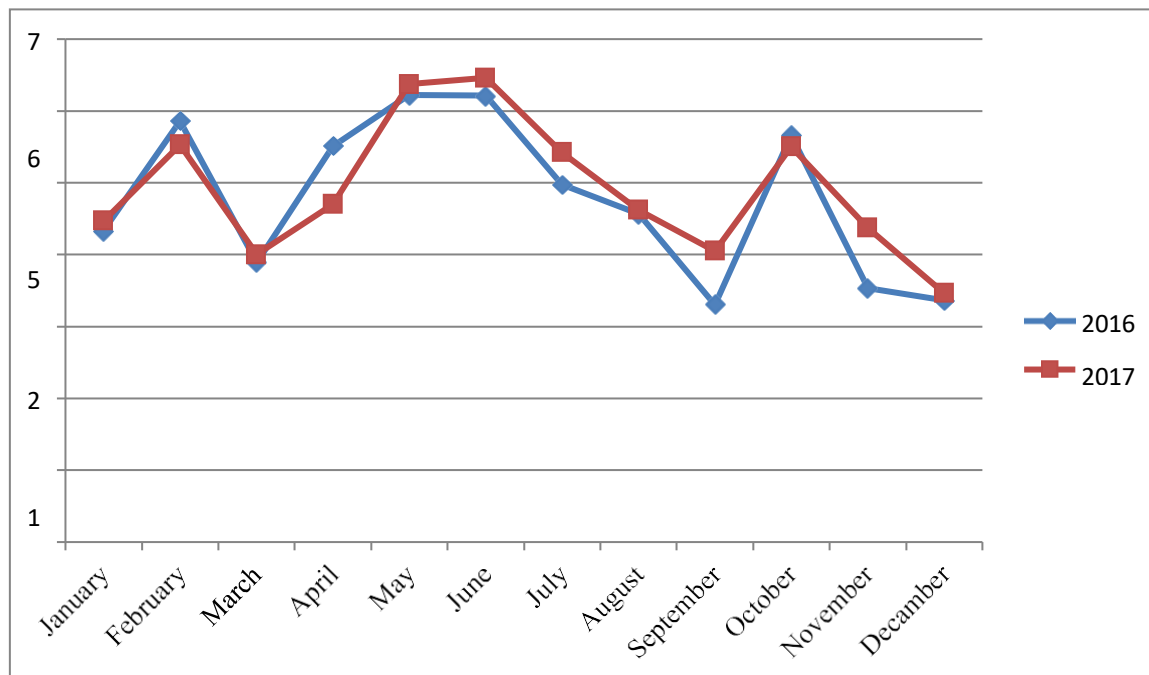
We list the main inpatients data described in above graph. In 2017, the inpatient data increase of 0.12 percent of the previous year, and analyze inpatient occupancy rate in every month. The patients' general data, the inpatient of monthly visits, the monthly

distribution of common acute inpatient, and the treatment situation and mortality of the acute and critical inpatients the hospital in 2016 and 2017 year analyzed, based on the clinical data collected, to figure out the data differences among different months.

Conclusion:

The entire project deals with the statistics and their application in hospital system. Health administration refers statistics on service utilization to apply for grant funding and to justify budget expenditures to their governing boards. Health statistics and data are important because they measure a wide range of health indicators for a community. In this project work we conclude that how the methodology of statistics to analyze the hospital inpatient data for day, month and annual basis. It is important information of a hospital statistics and it guide for planning future development of the hospital.

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