Introduction to Biostatistics

Lesson 1: Basics

Definition

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Biostatistics

- (a portmanteau word made from biology and statistics)
- The application of statistics to a wide range of topics in biology.
- Physiology and Anatomy
- A (Variables) Height and B (variables) = weight
- Pharmacology
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Observation Study

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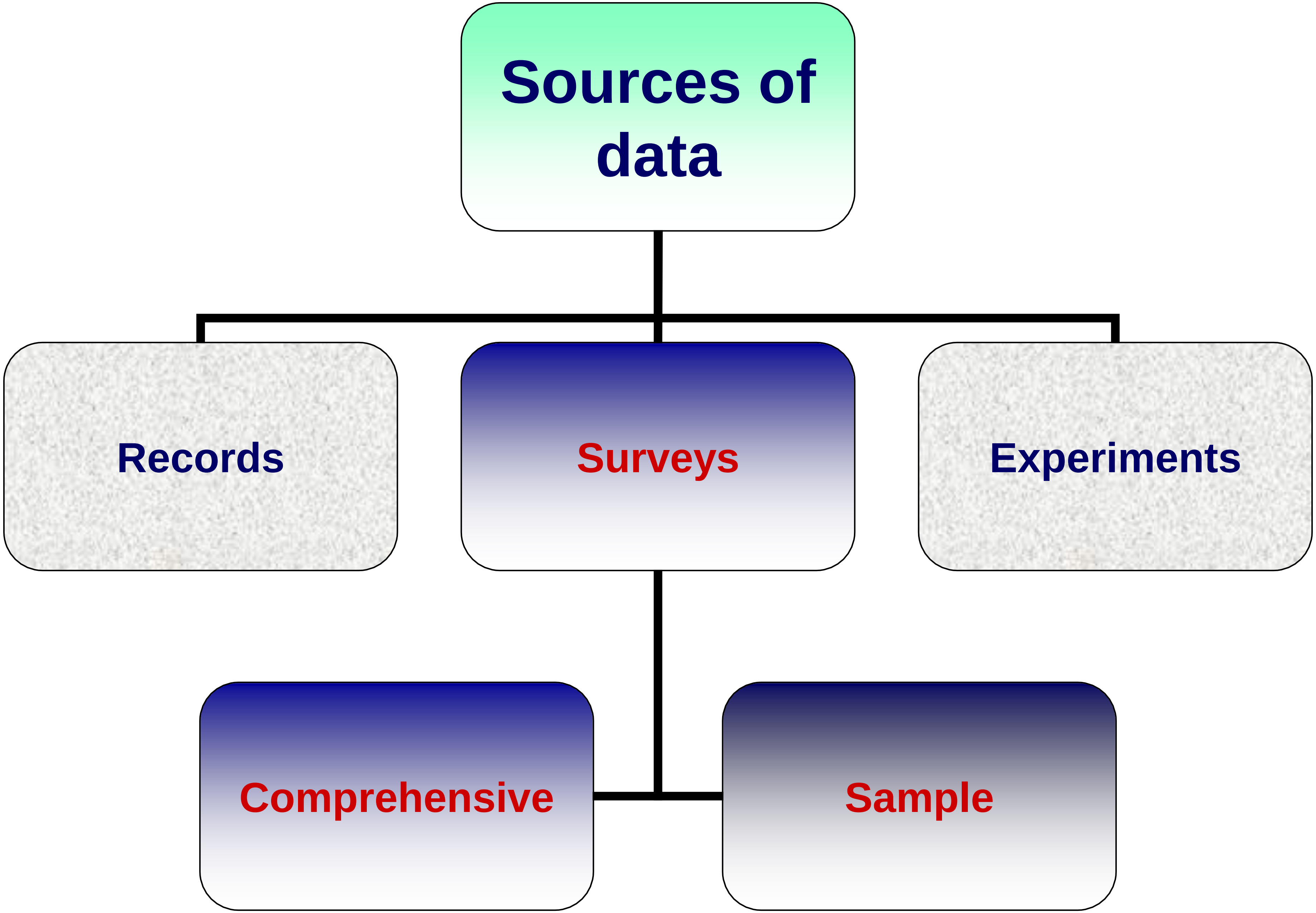
Role of statisticians

- ☜ To guide the design of an experiment or survey prior to data collection
- 💻 To analyze data using proper statistical procedures and techniques
- ✉ To present and interpret the results to researchers and other decision makers



Sources of data

Records

Surveys

Experiments

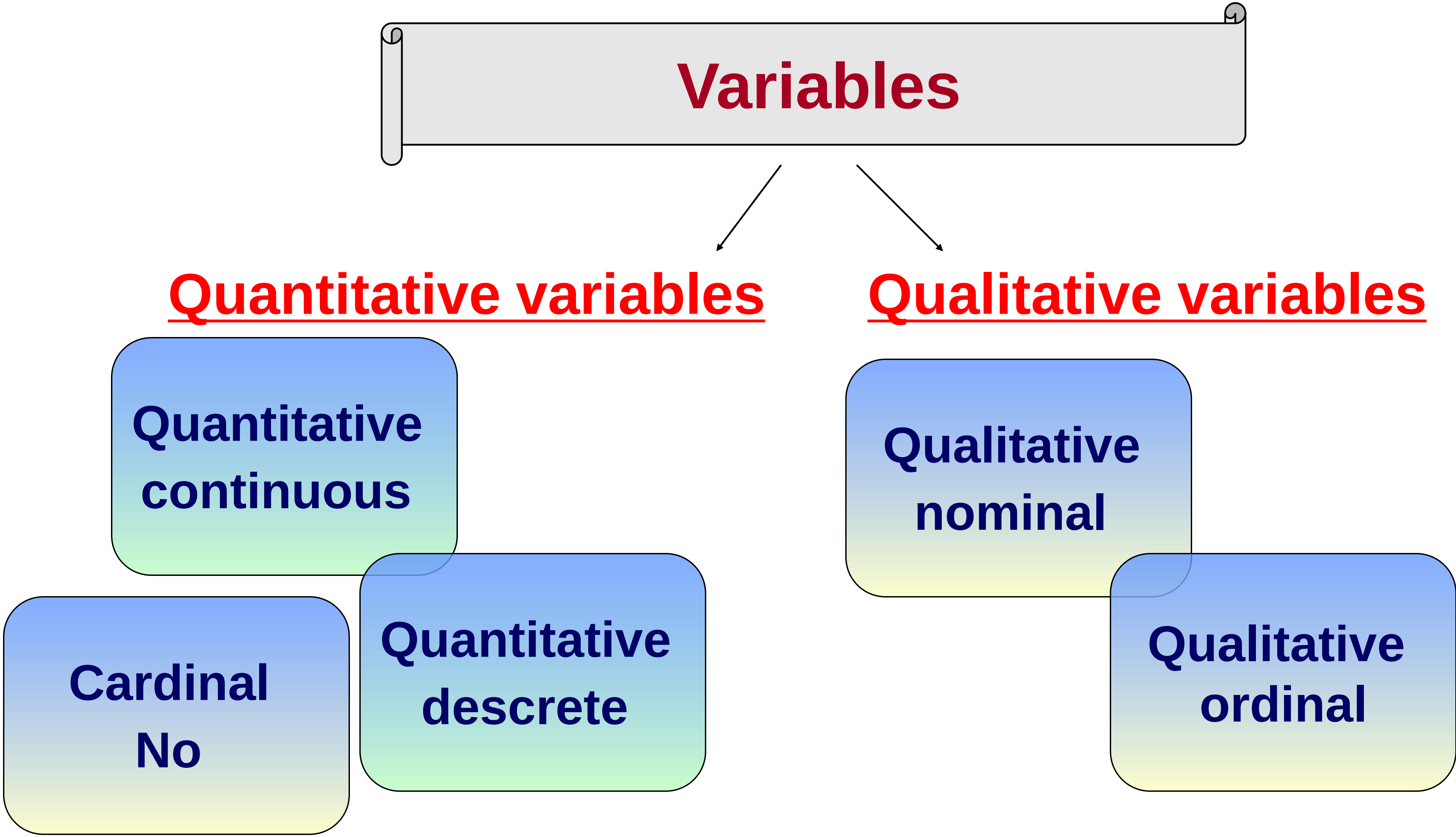
Comprehensive

Sample

Types of data

Constant

Variables



Variables

Quantitative variables

Qualitative variables

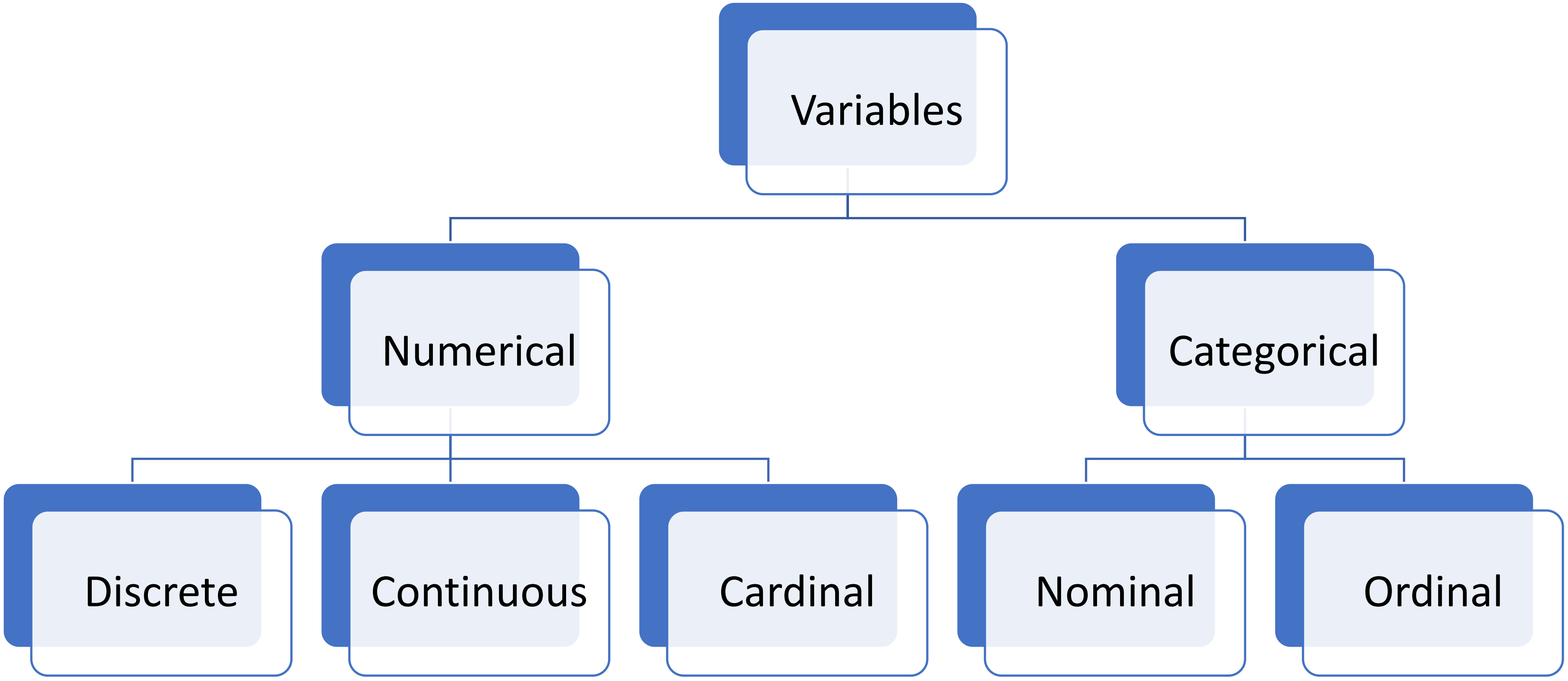
Quantitative continuous

Quantitative descrete

Cardinal No

Qualitative nominal

Qualitative ordinal


Variables
Numerical
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Methods of presentation of data

1. Numerical presentation
2. Graphical presentation
3. Mathematical presentation

1- Numerical presentation

Tabular presentation (simple – complex)

Simple frequency distribution Table (S.F.D.T.)

Title

Name of variable (Units of variable)	Frequency	%
- - Categories -		
Total		

Table (I): Distribution of 50 patients at the surgical department of Alexandria hospital in May 2008 according to their ABO blood groups

Blood group	**Frequency**	**%**
A	12	24
B	18	36
AB	5	10
O	15	30
Total	50	100

Table (II): Distribution of 50 patients at the surgical department of Alexandria hospital in May 2008 according to their age

Age (years)	Frequency	%
20-<30	12	24
30-	18	36
40-	5	10
50+	15	30
Total	50	100

<u>Complex frequency distribution Table</u>

Table (III): Distribution of 20 lung cancer patients at the chest department of Alexandria hospital and 40 controls in May 2008 according to smoking

Smoking	Lung cancer				Total	
	Cases		Control			
	No.	%	No.	%	No.	%
Smoker	15	75%	8	20%	23	38.33
Non smoker	5	25%	32	80%	37	61.67
Total	20	100	40	100	60	100

Complex frequency distribution Table

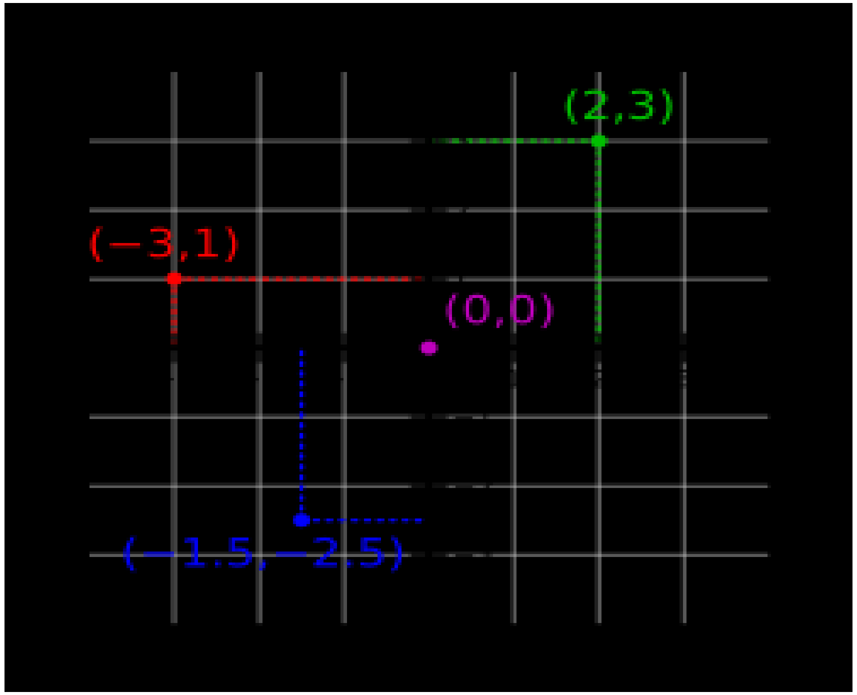
Table (IV): Distribution of 60 patients at the chest department of Alexandria hospital in May 2008 according to smoking & lung cancer

Smoking	Lung cancer				Total	
	positive		negative			
	No.	%	No.	%	No.	%
Smoker	15	65.2	8	34.8	23	100
Non smoker	5	13.5	32	86.5	37	100
Total	20	33.3	40	66.7	60	100

2- Graphical presentation

❶ ***Graphs drawn using Cartesian coordinates***

- Line graph
- Frequency polygon
- Frequency curve
- Histogram
- Bar graph
- Scatter plot

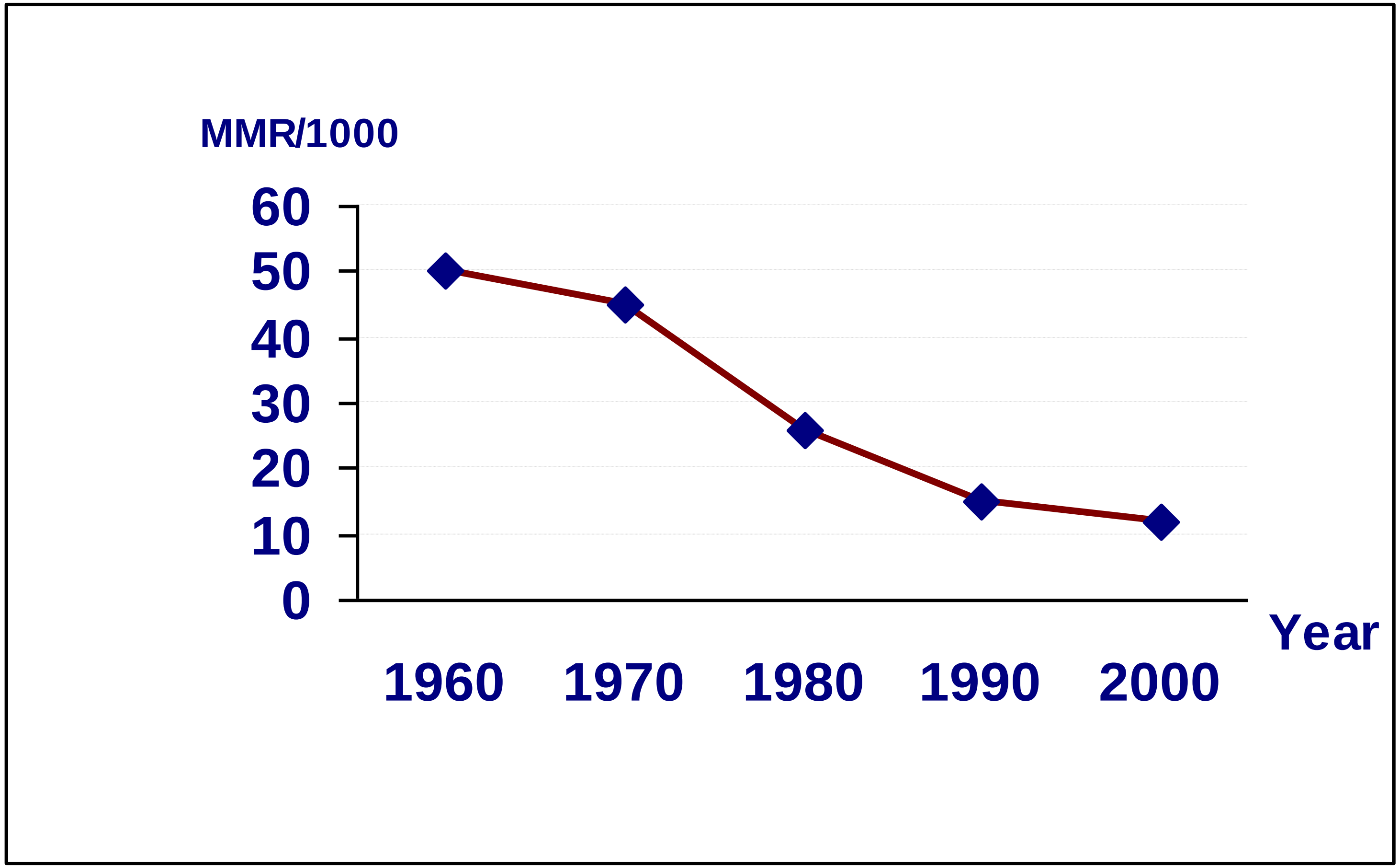


❷ ***Pie chart***

rules

❸ ***Statistical maps***

Line Graph



Year	MMR
1960	50
1970	45
1980	26
1990	15
2000	12

Maternal mortality rate of (country), 1960-2000

Frequency polygon

Age (years)	**Sex**		**Mid-point of interval**
	Males	**Females**	
20 -	3 (12%)	2 (10%)	(20+30) / 2 = 25
30 -	9 (36%)	6 (30%)	(30+40) / 2 = 35
40-	7 (8%)	5 (25%)	(40+50) / 2 = 45
50 -	4 (16%)	3 (15%)	(50+60) / 2 = 55
60 - 70	2 (8%)	4 (20%)	(60+70) / 2 = 65
Total	25(100%)	20(100%)	

Frequency polygon

Age	Sex		M-P
	M	F	
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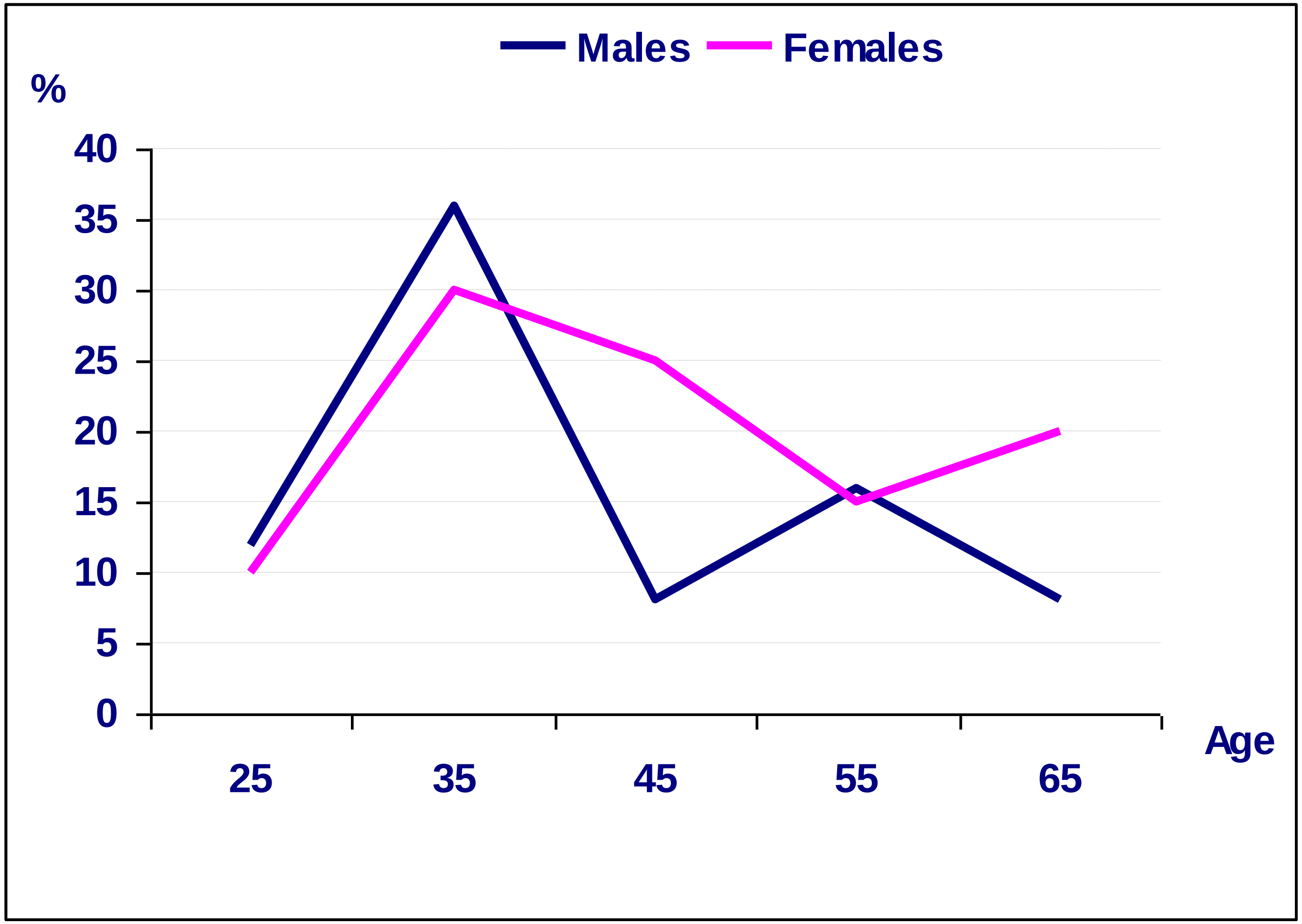
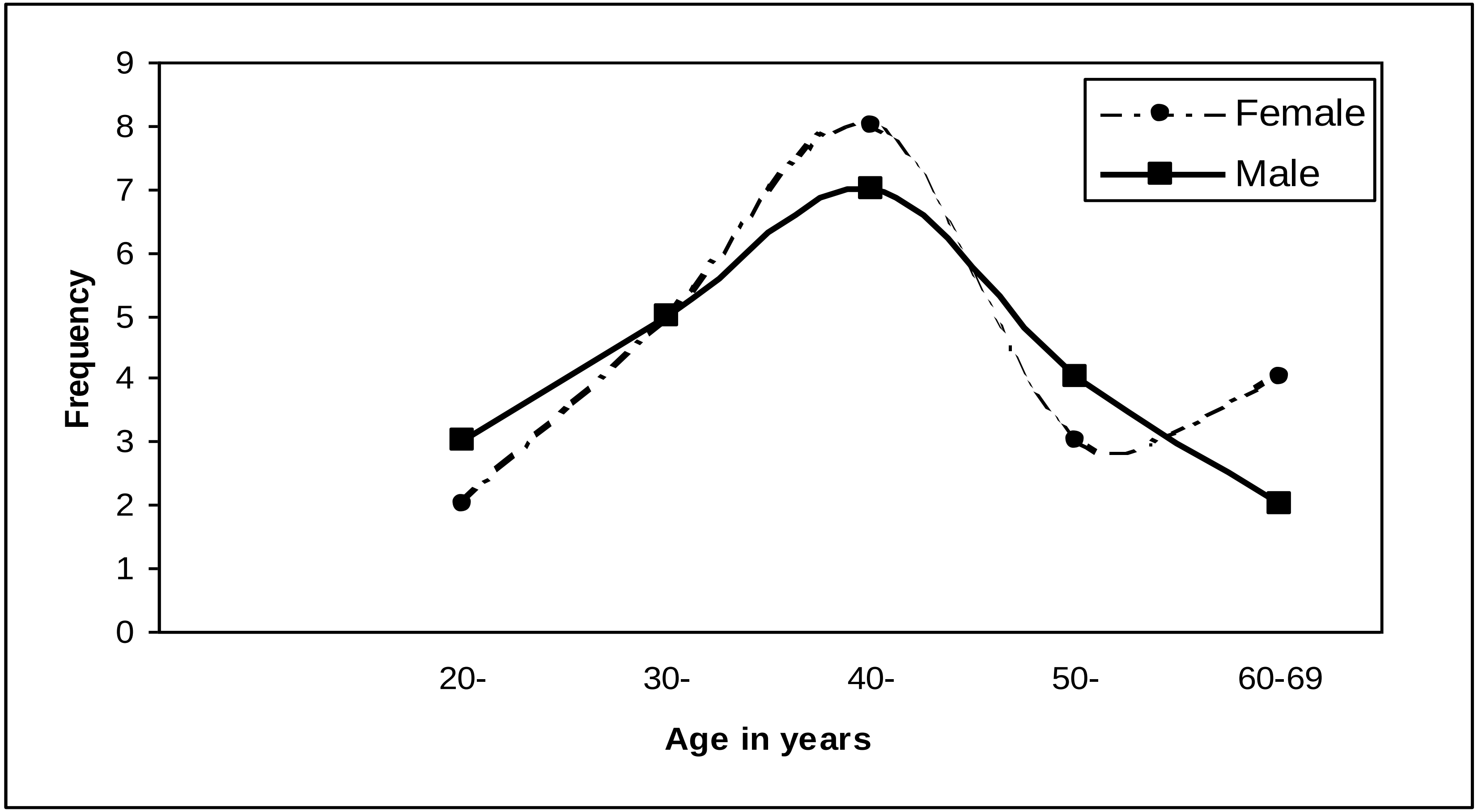


Distribution of 45 patients at (place) , in (time) by age and sex

Frequency curve



Histogram

Distribution of a group of cholera patients by age

Age (years)	Frequency	%
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30-	5	23.8
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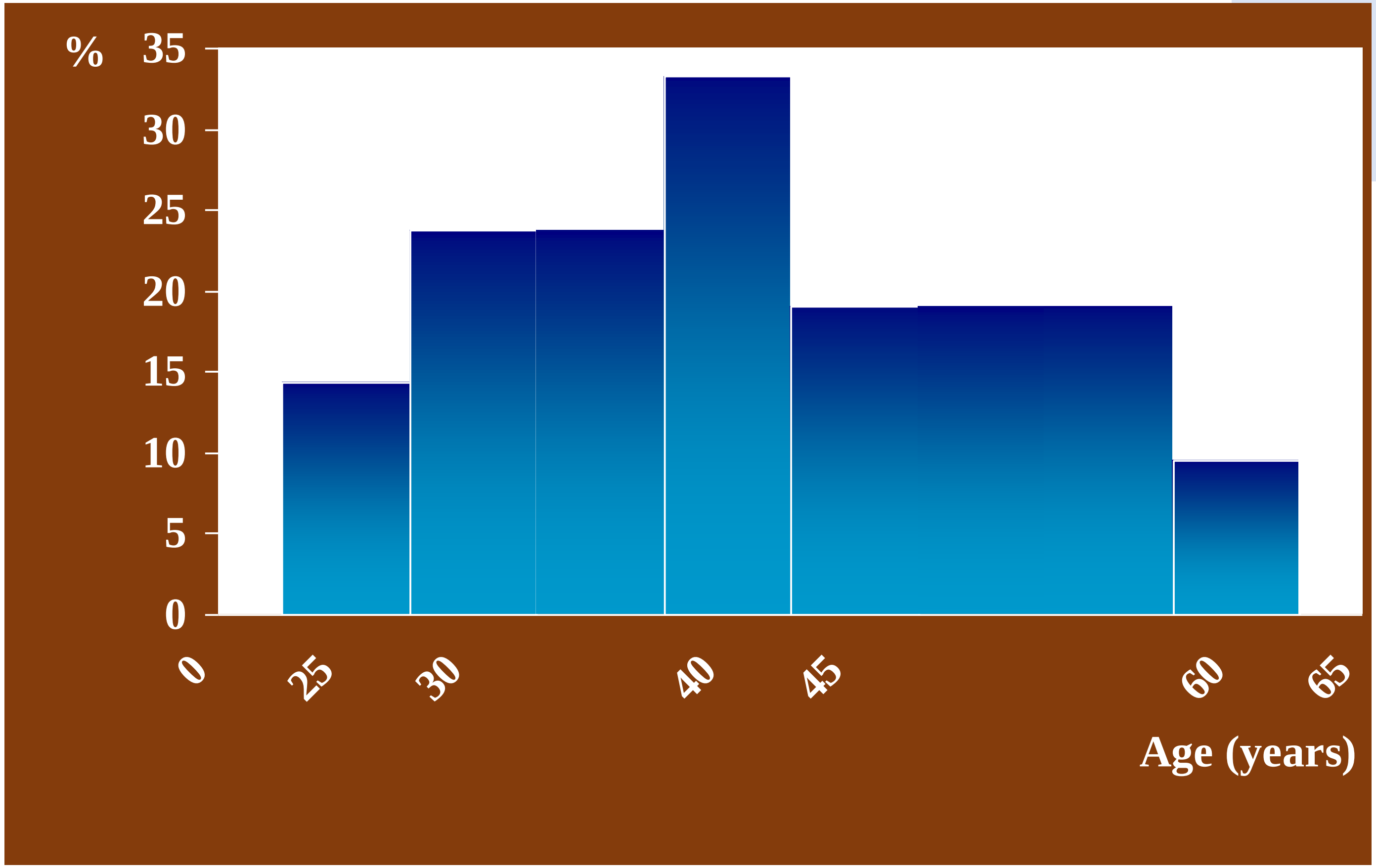
Total	21	100



Distribution of 100 cholera patients at (place) , in (time) by age

Blood Group	Frequency	%
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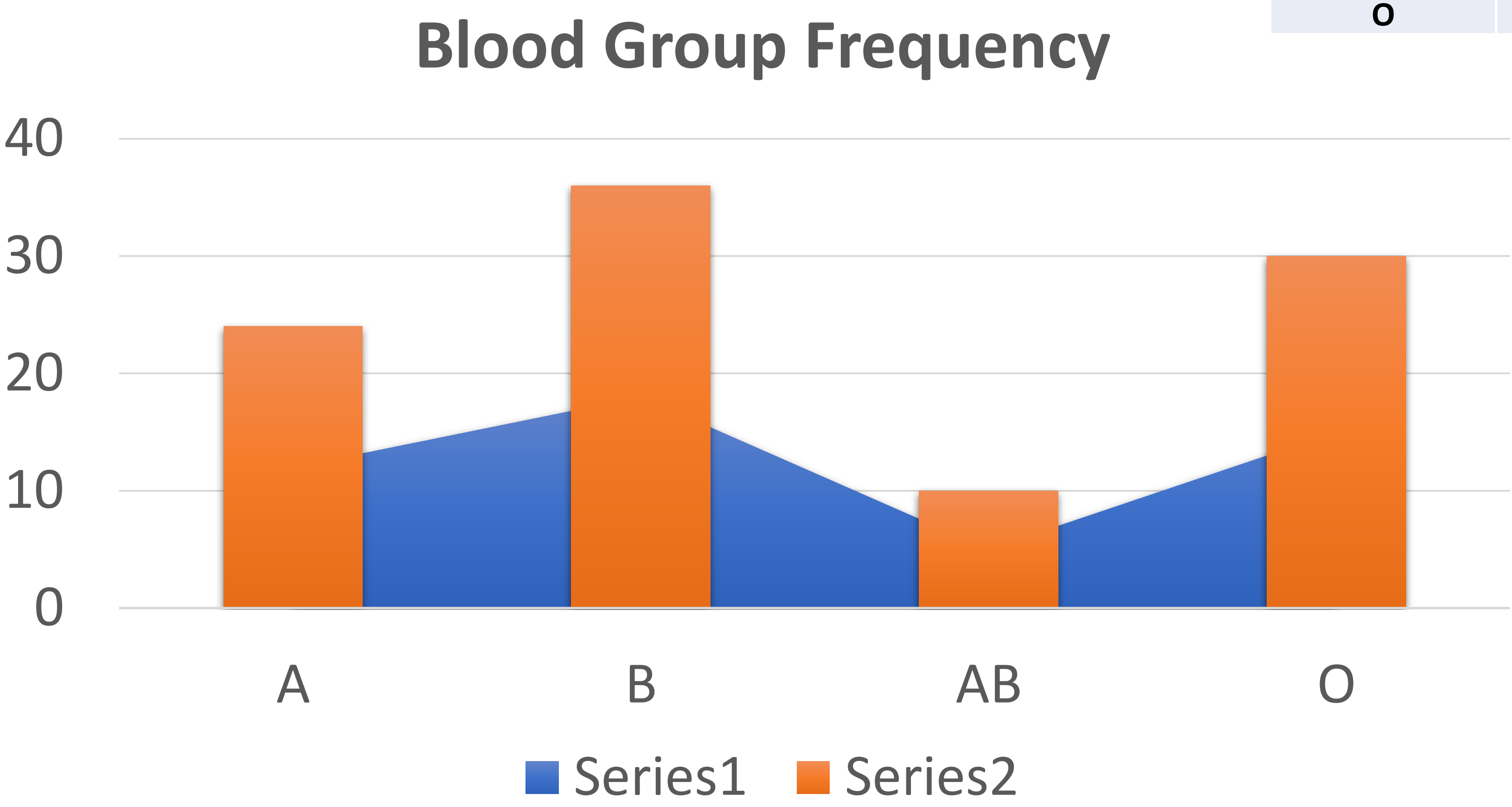
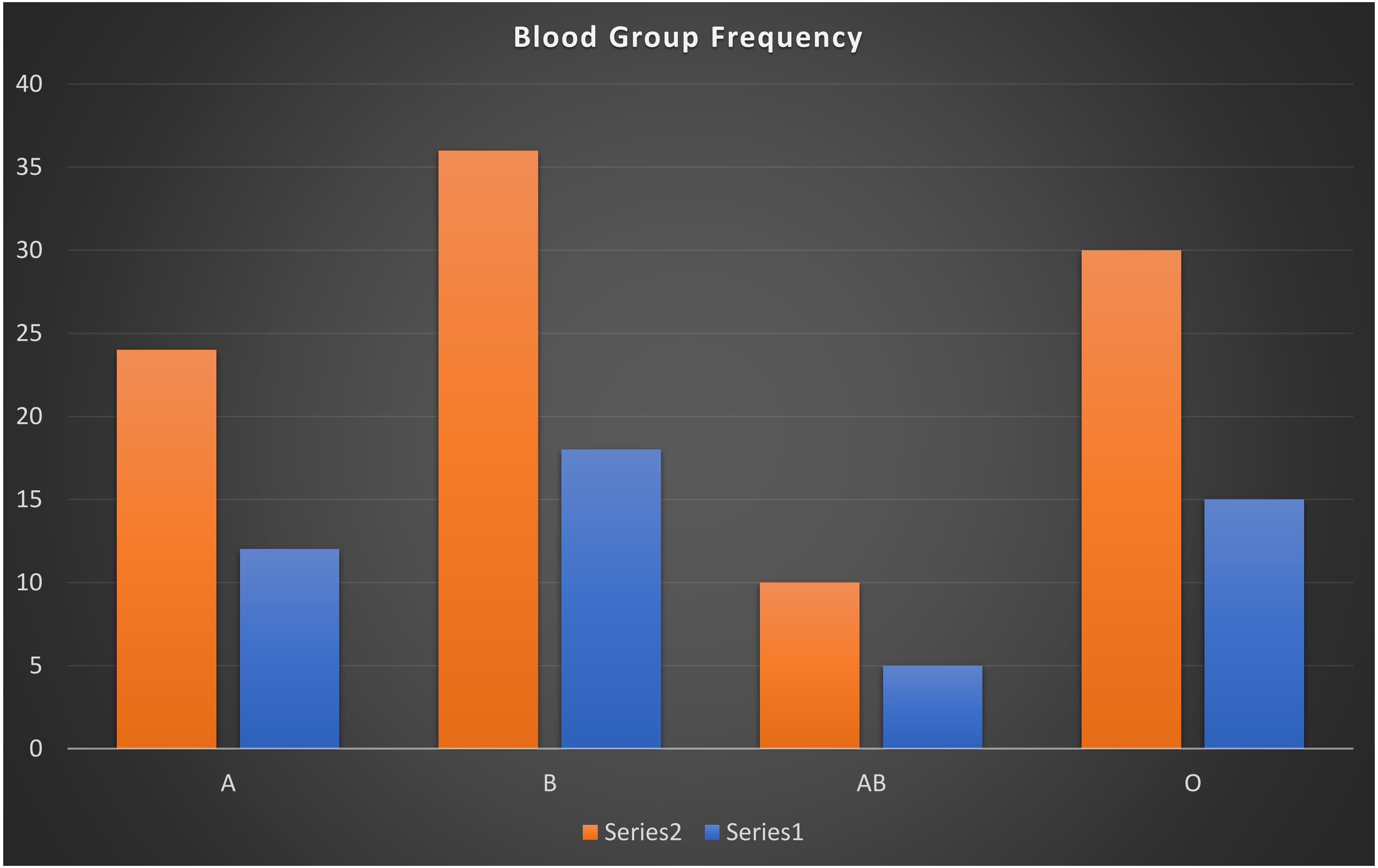


Combo: Stacked Area-Cluster Colum

Bar chart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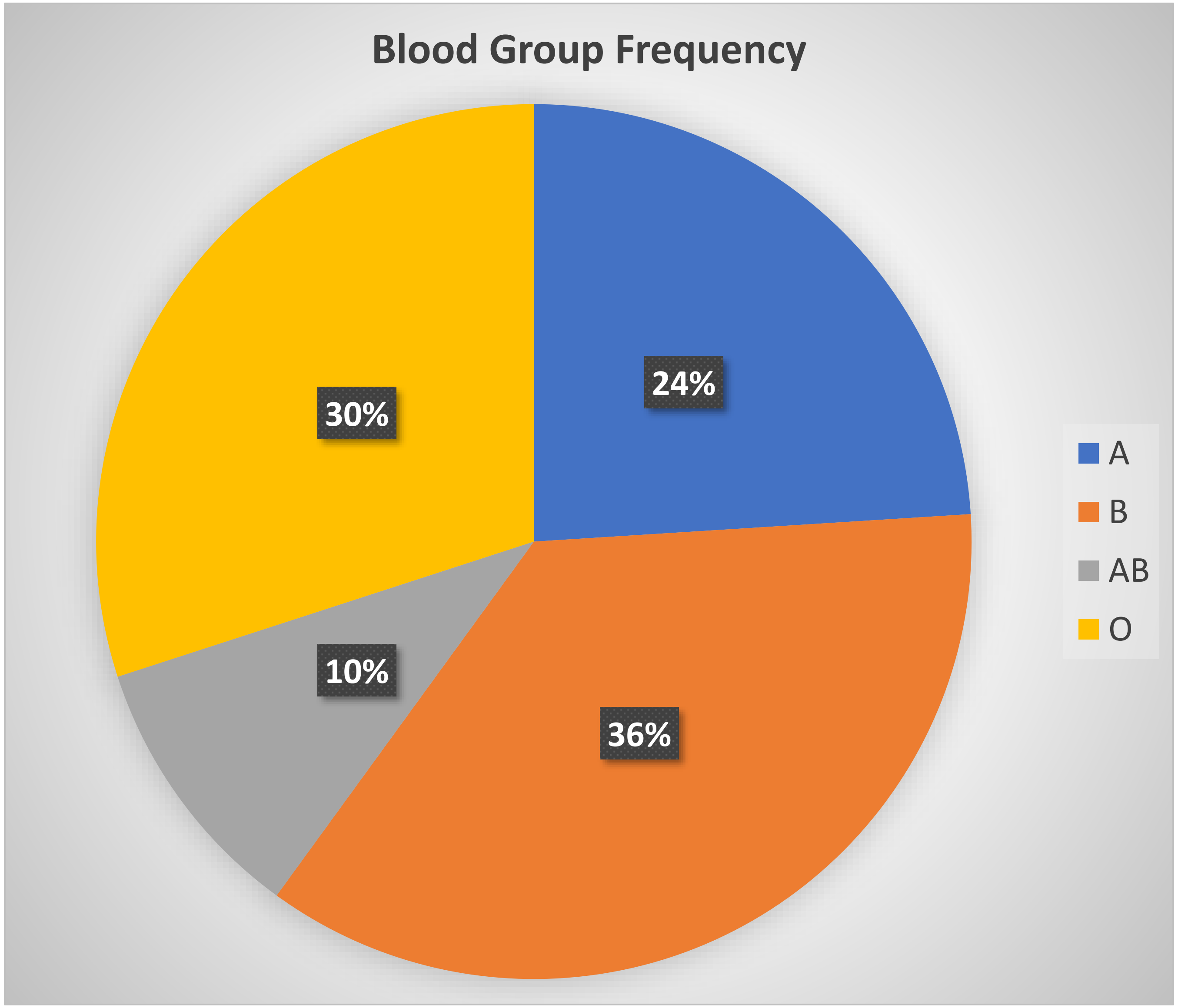
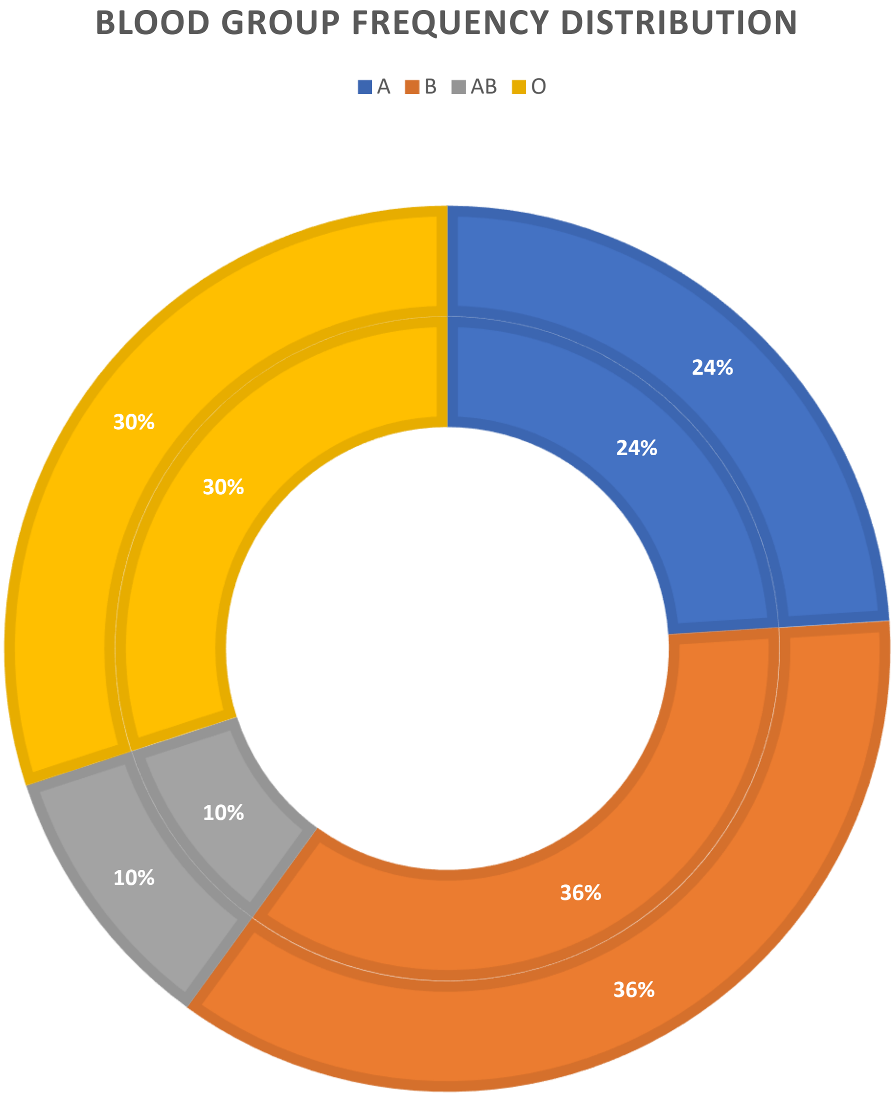


Doughnut chart



How to determine the appropriate statistical test?

1. Specify the biological question you are asking.
2. Put the question in the form of a biological null hypothesis and alternate hypothesis.
3. Put the question in the form of a statistical null hypothesis and alternate hypothesis.
4. Determine which variables are relevant to the question.
5. Determine what kind of variable each one is.
6. Design an experiment that controls or randomizes the confounding variables.
7. Based on the number of variables, the kinds of variables, the expected fit to the parametric assumptions, and the hypothesis to be tested, choose the best statistical test to use.
8. If possible, do a power analysis to determine a good sample size for the experiment.
9. Do the experiment.
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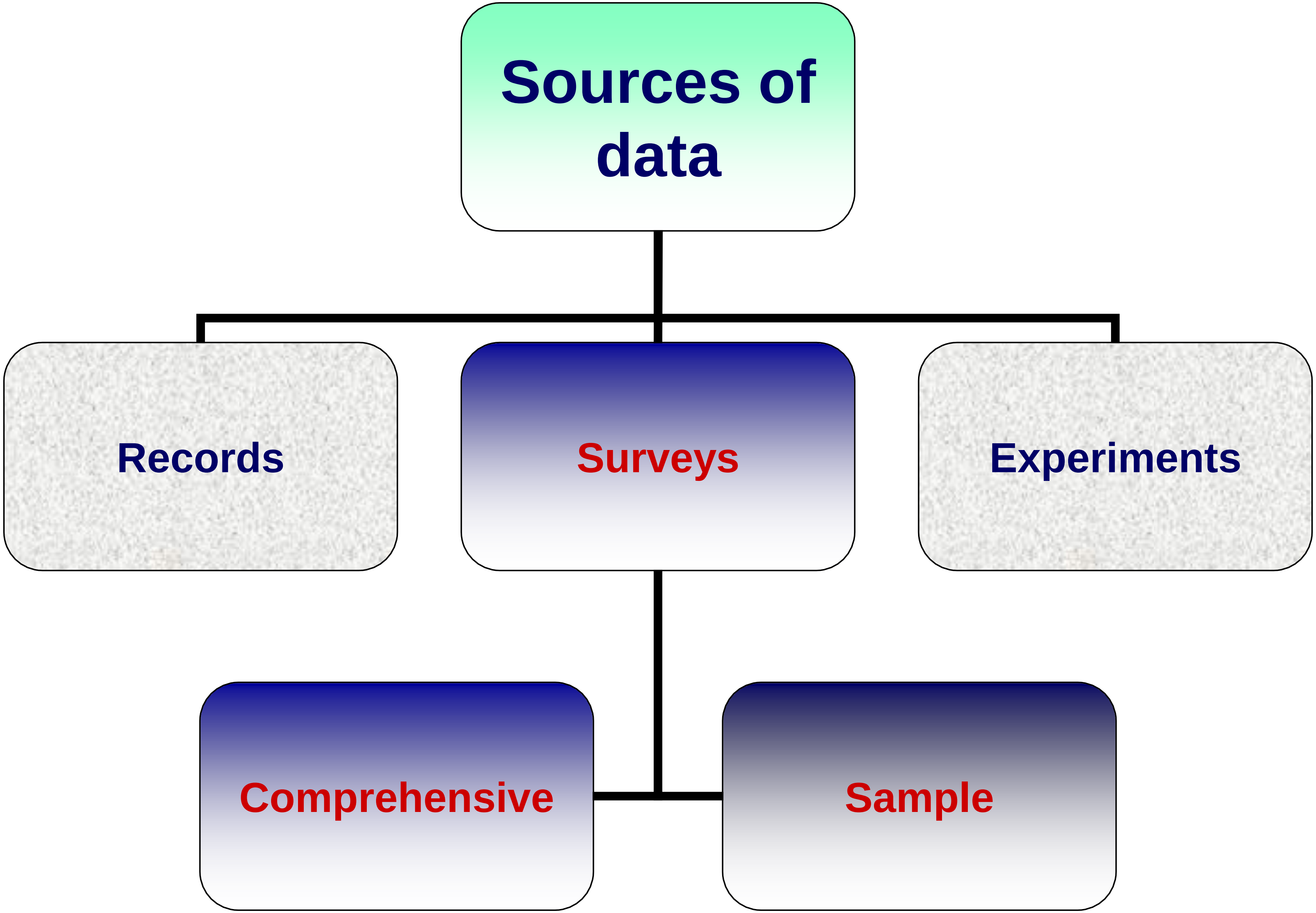

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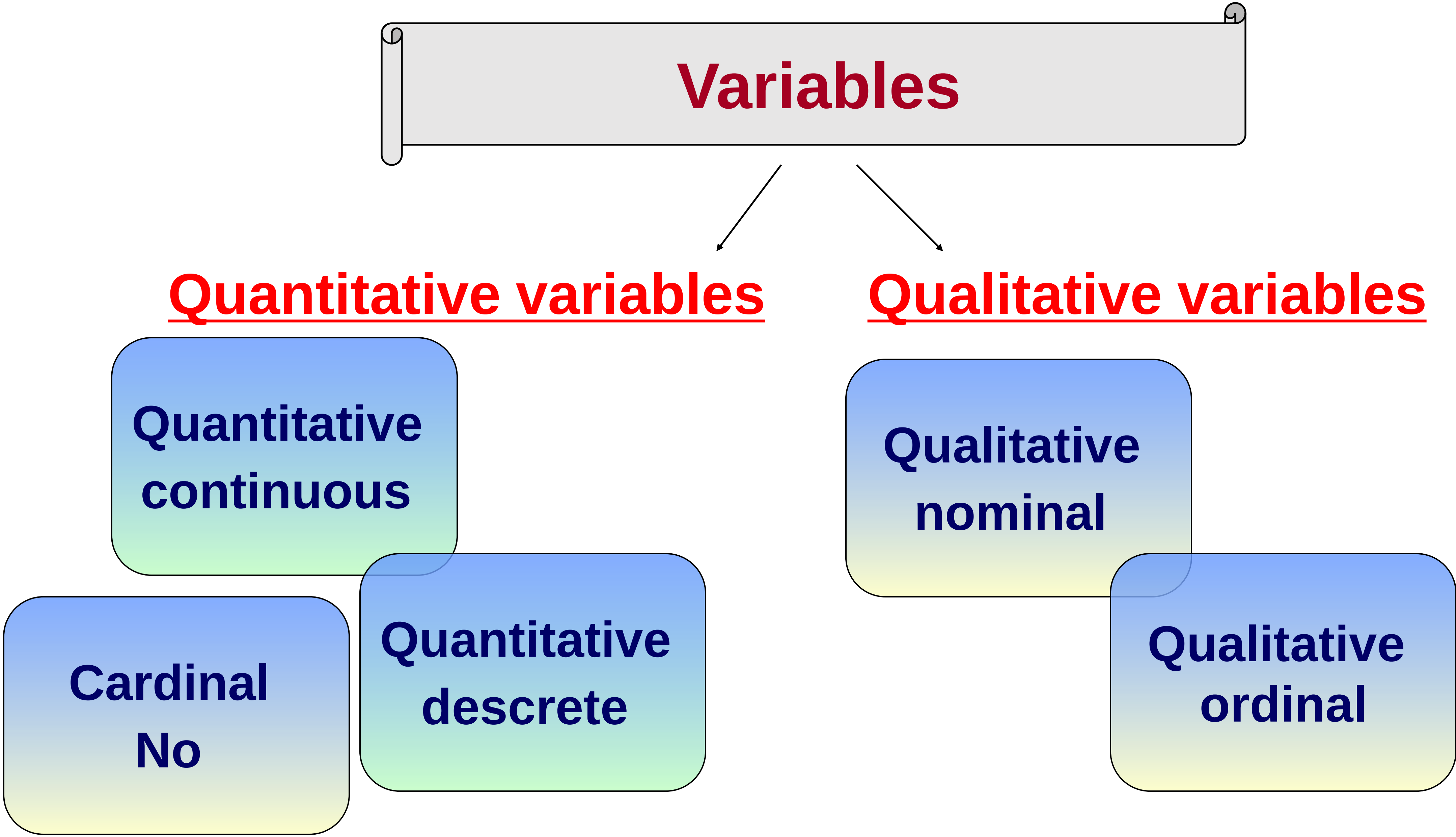

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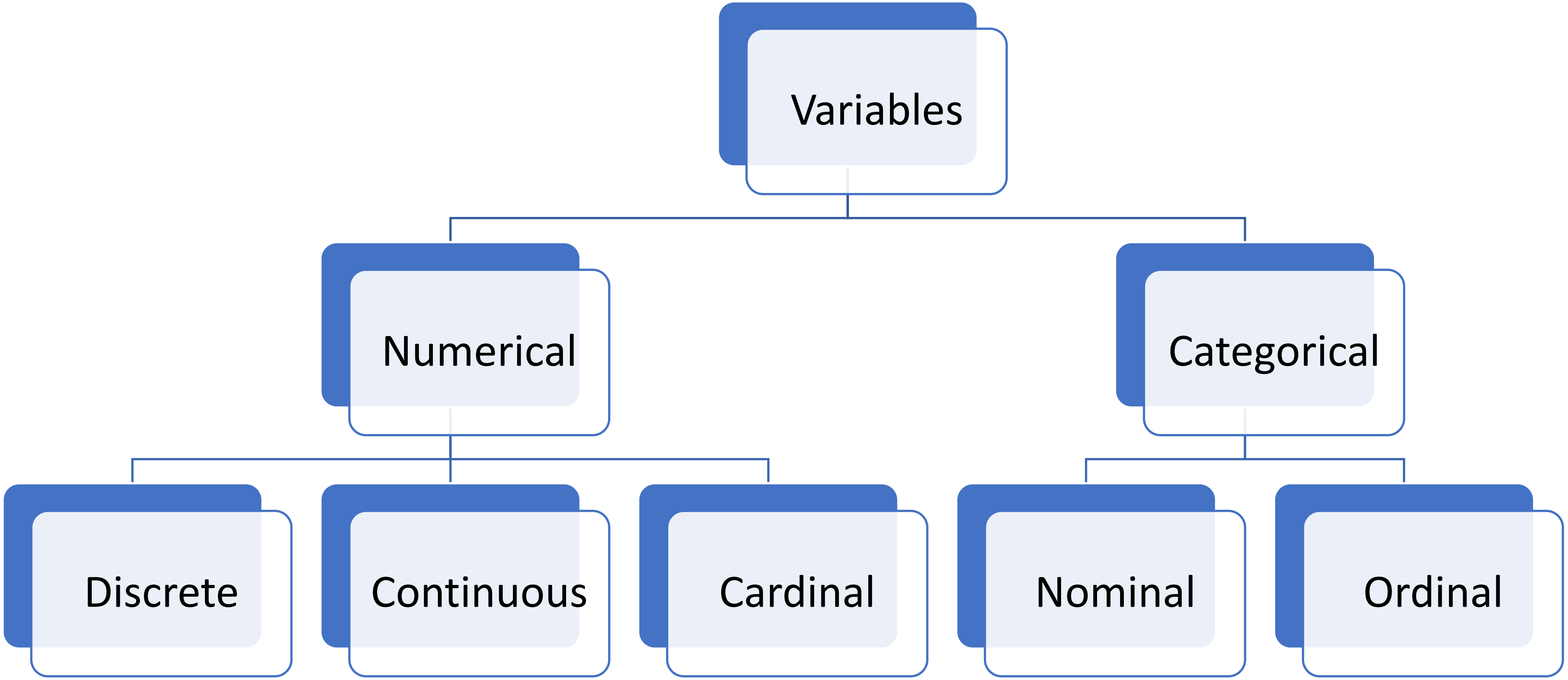

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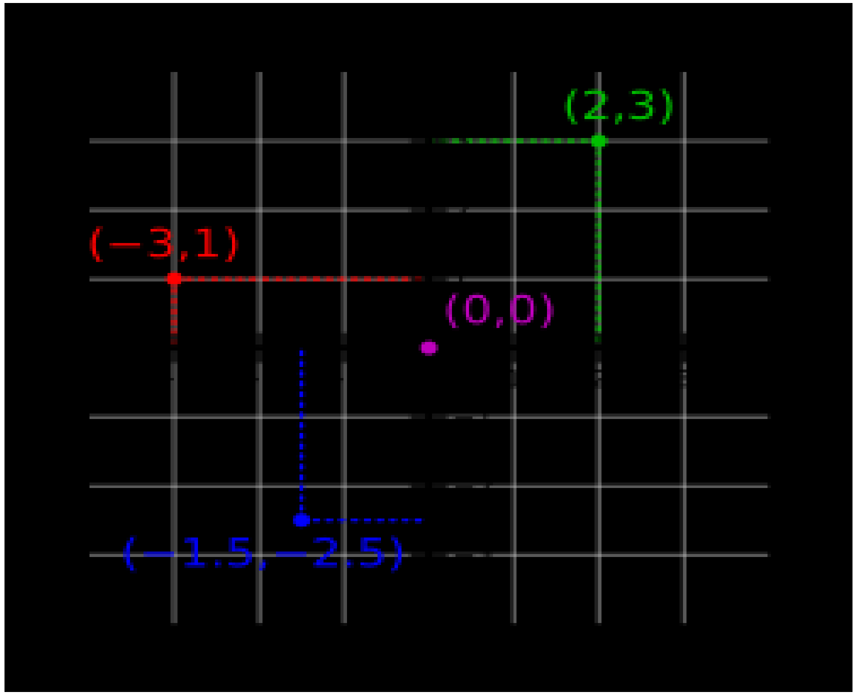

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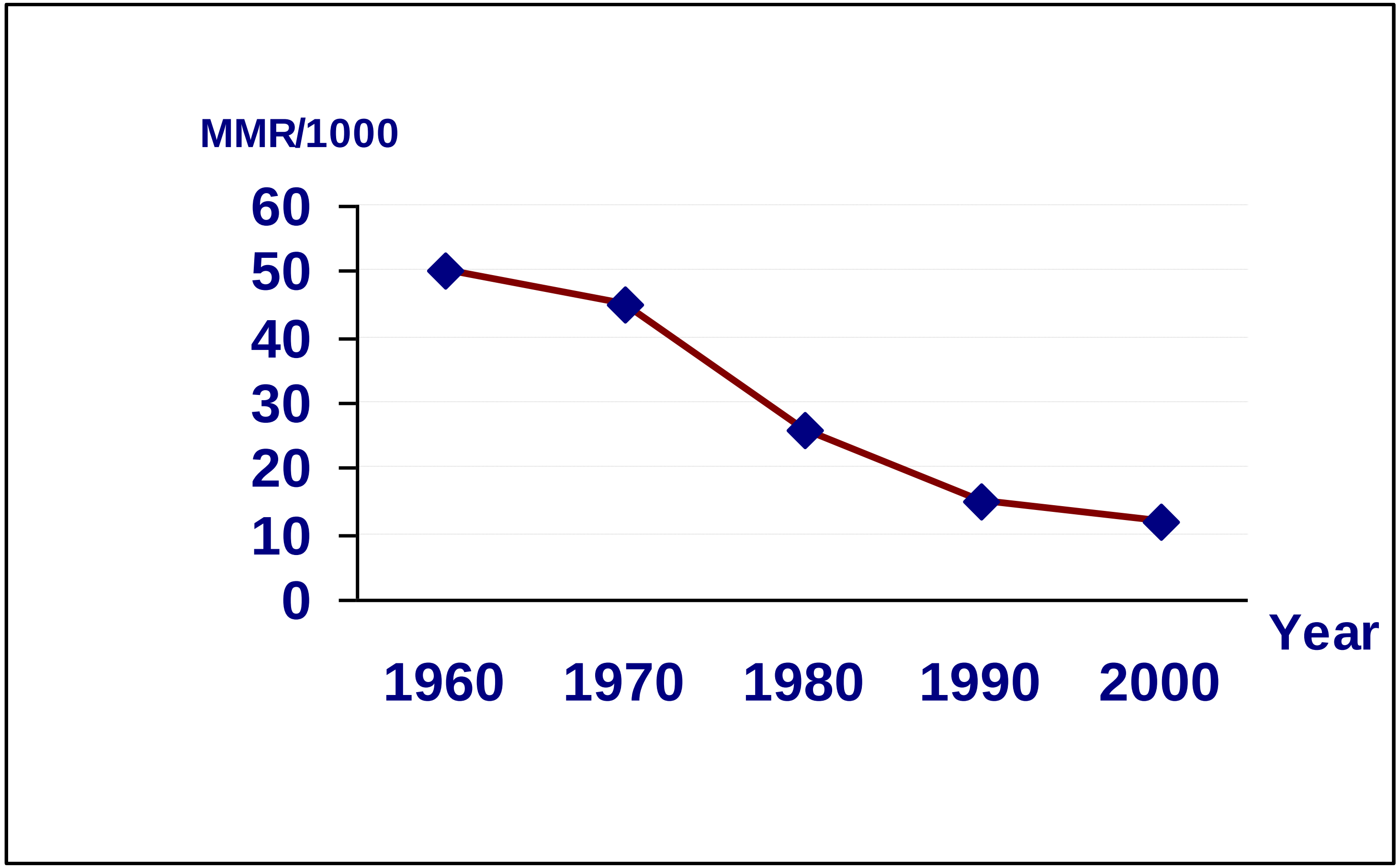

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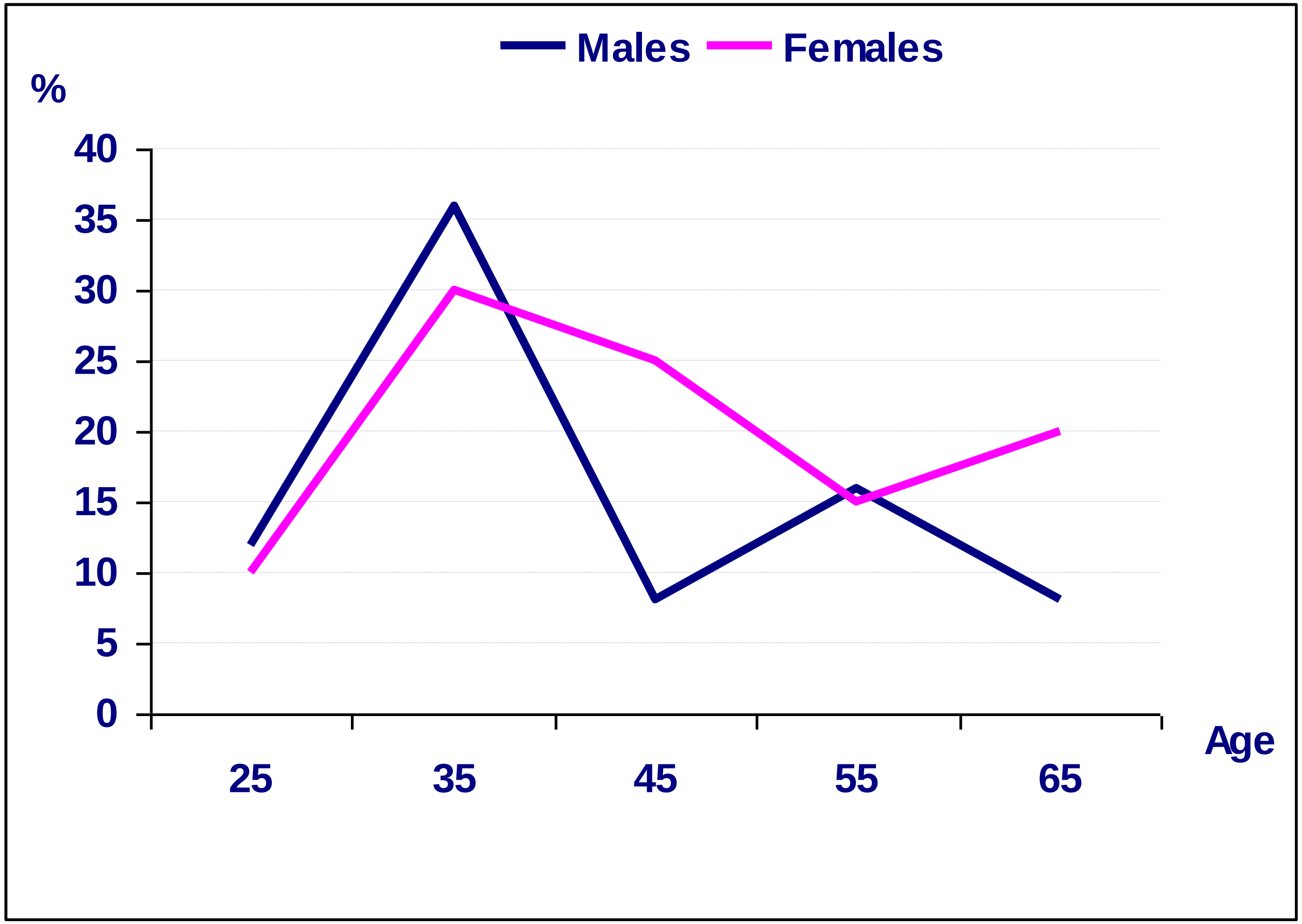

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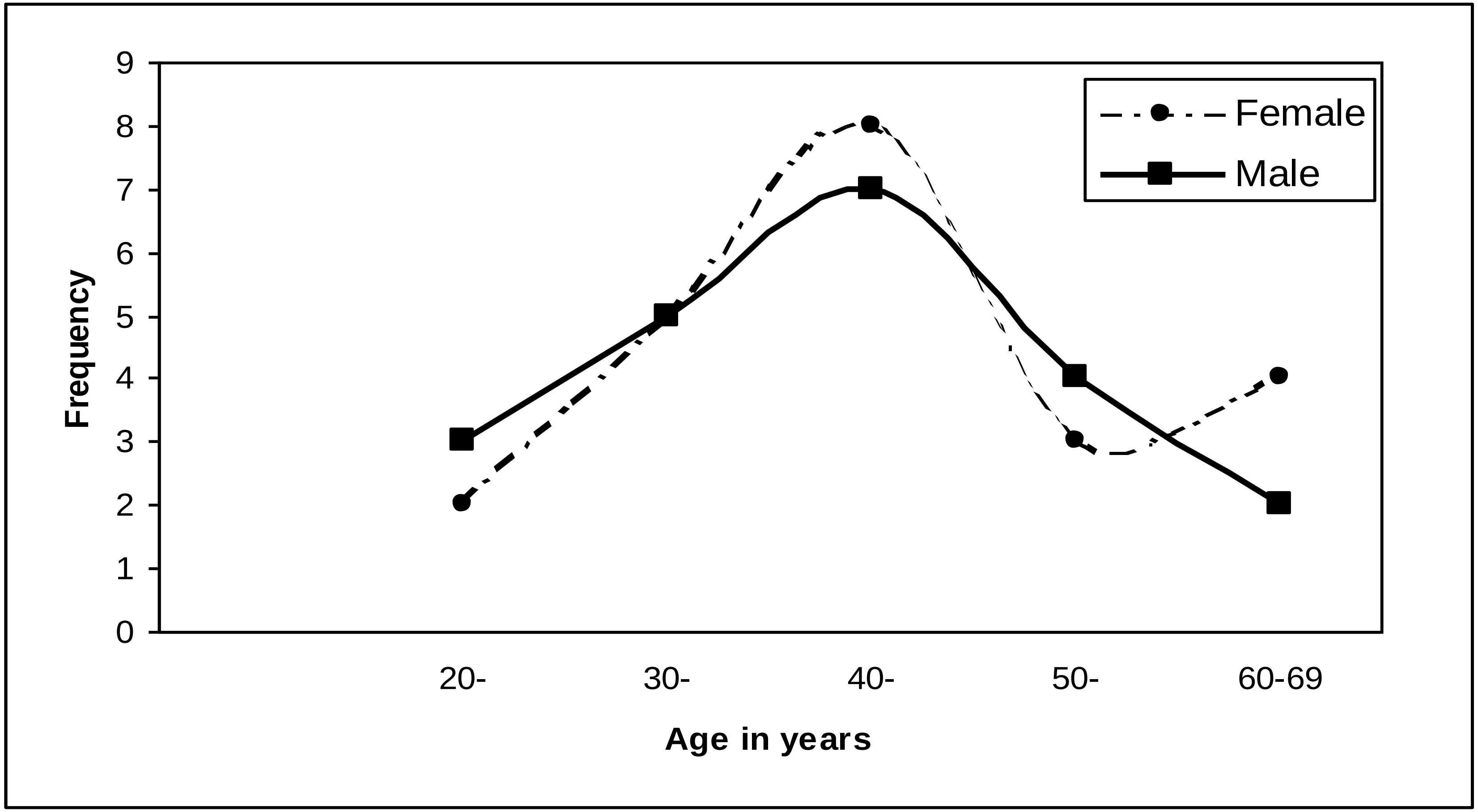

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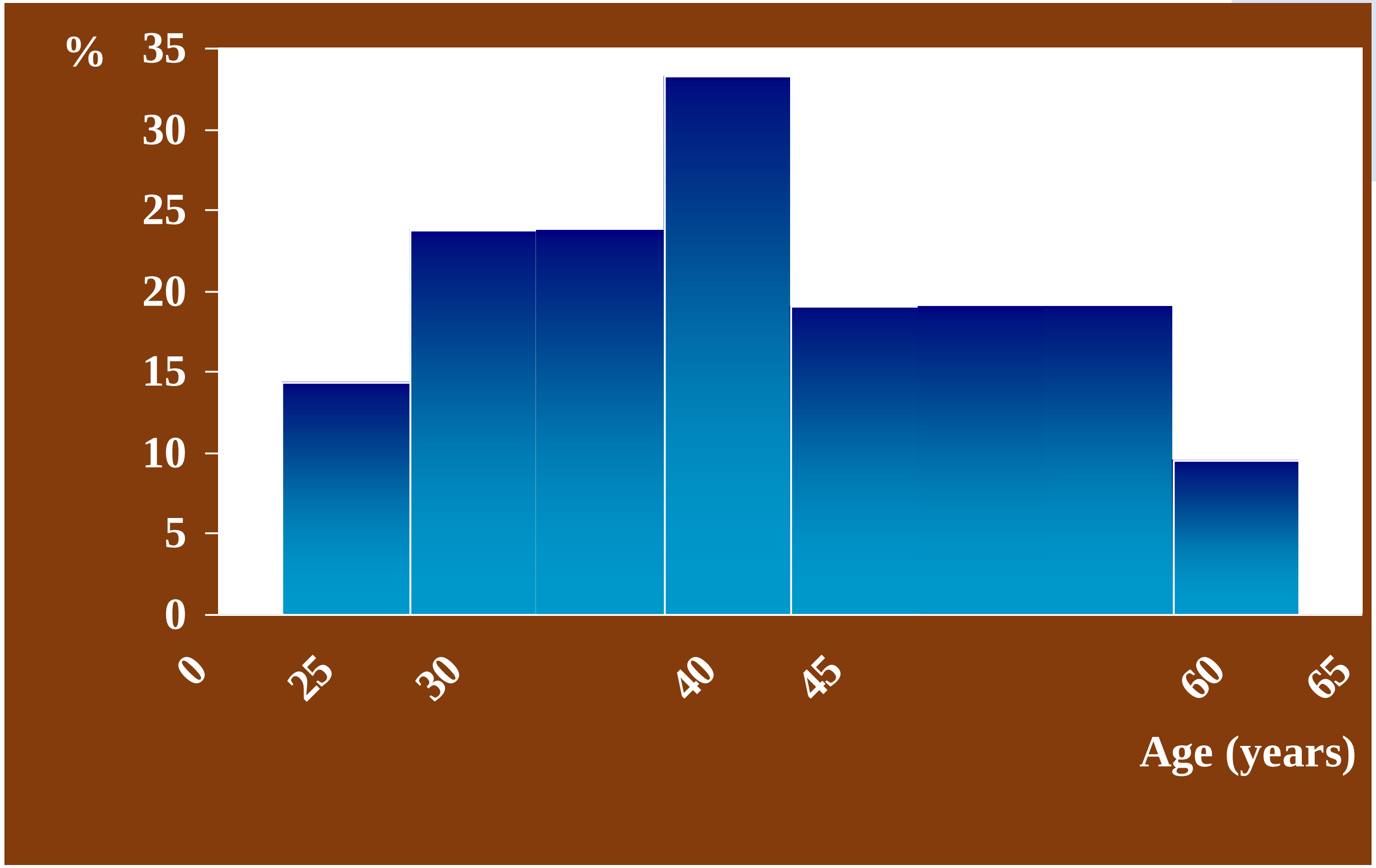

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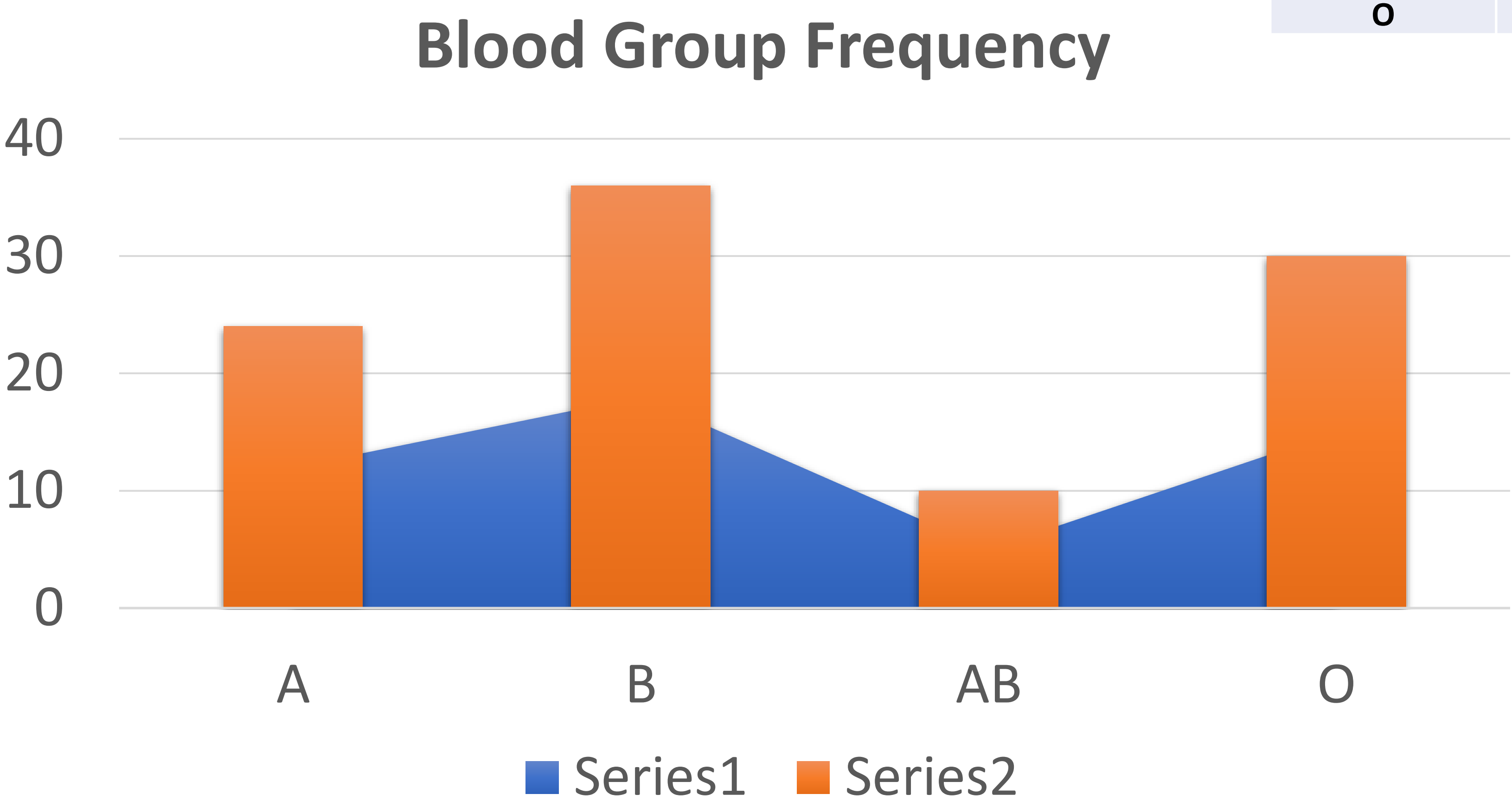

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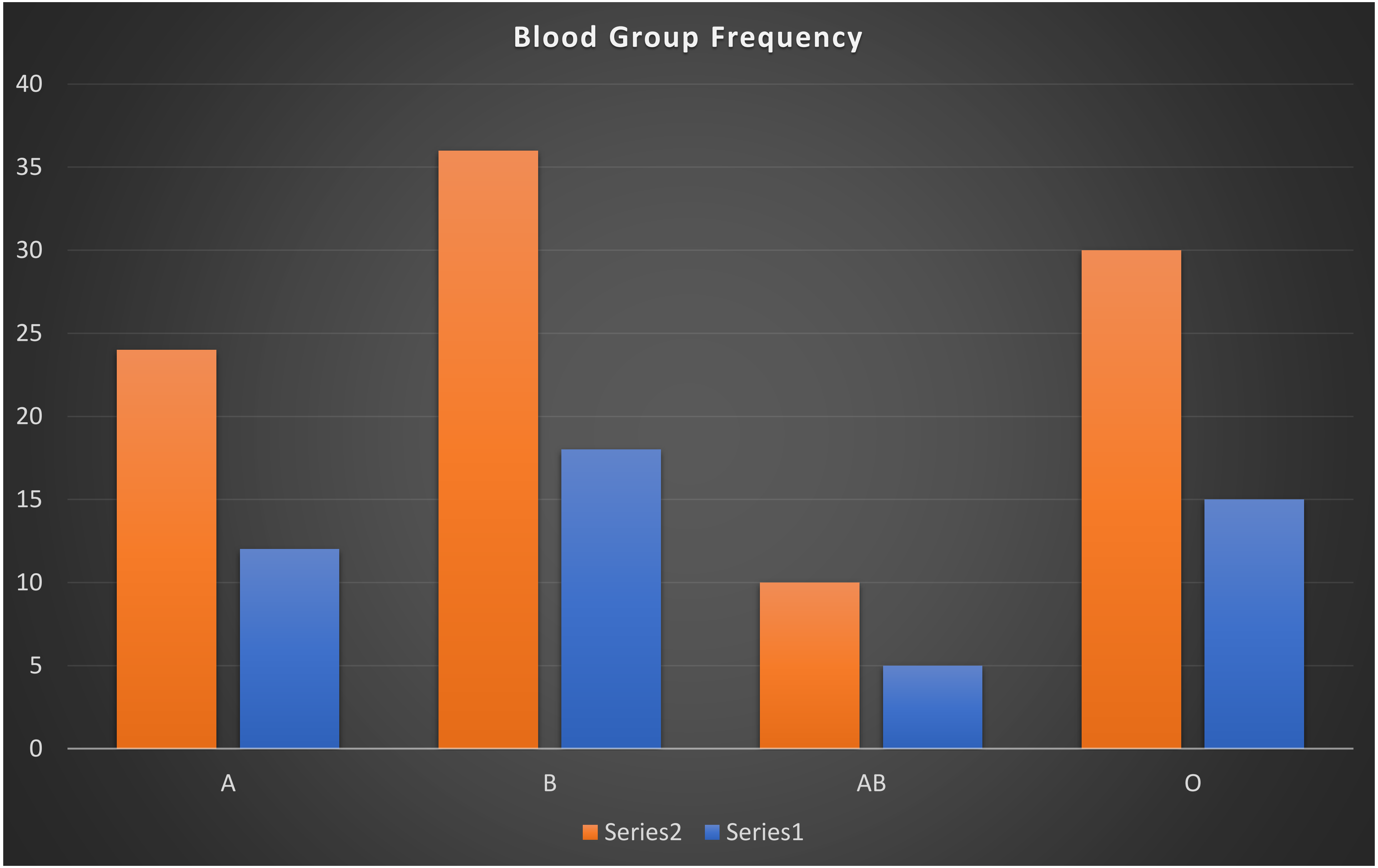
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Series2
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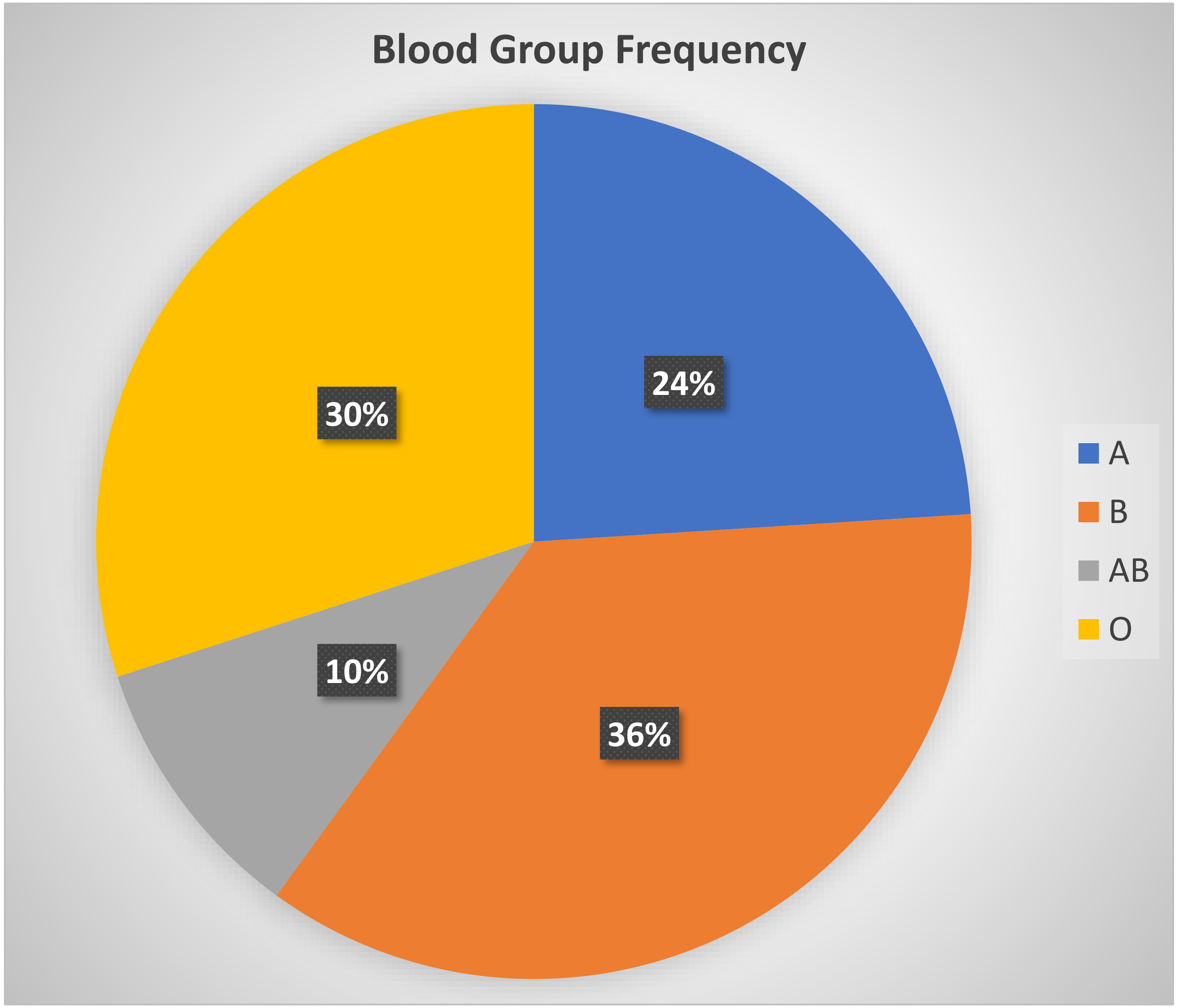
Pie Chart



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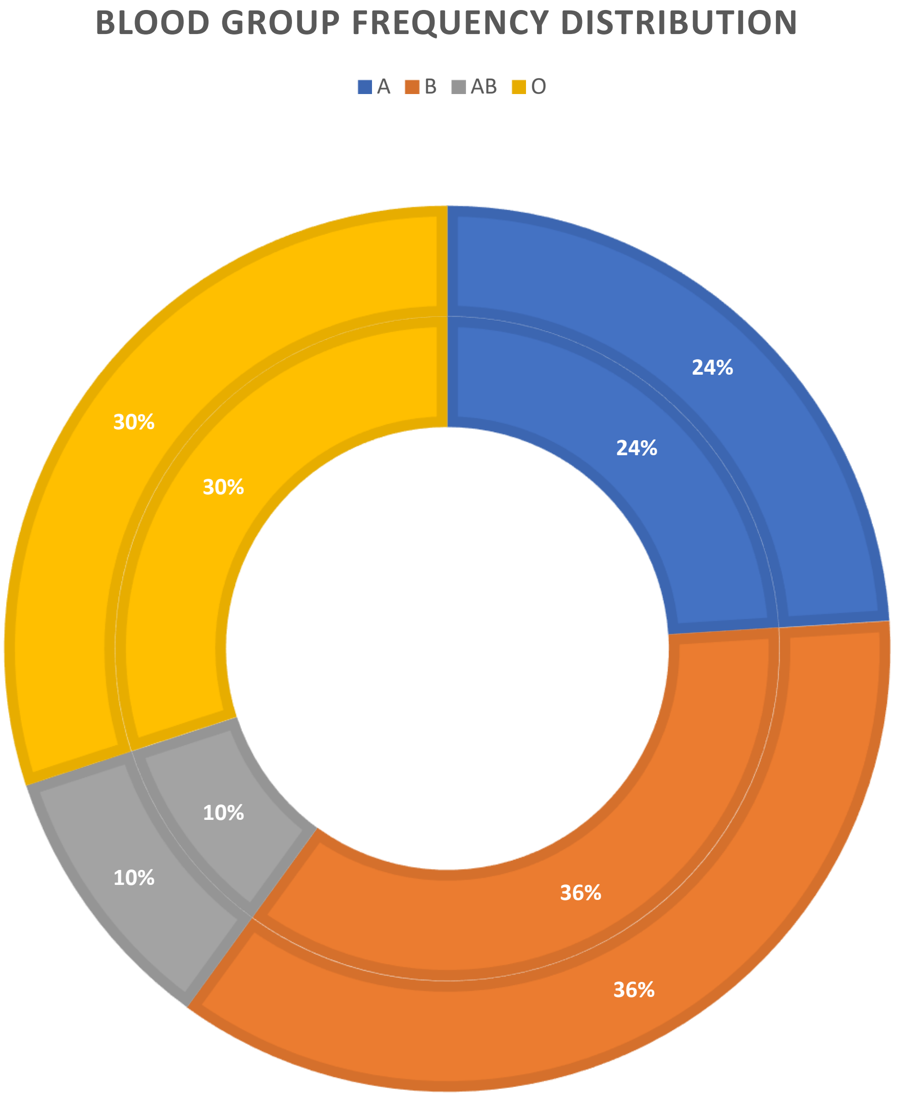

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