Trainer: Bondor Cosmina-Ioana, PhD, MsC

Descriptive statistics

Quantitative Variables

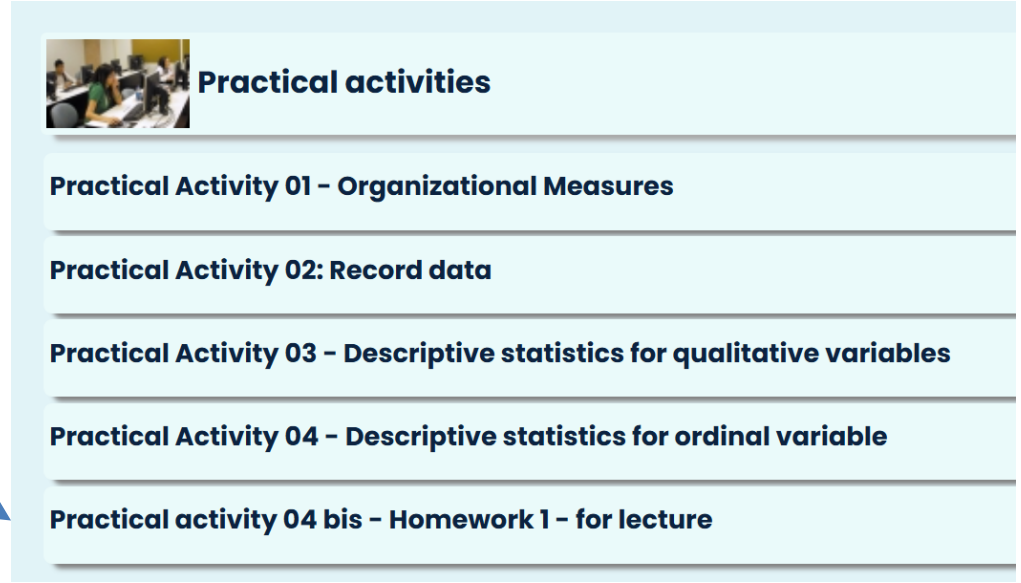
A ALWAYS

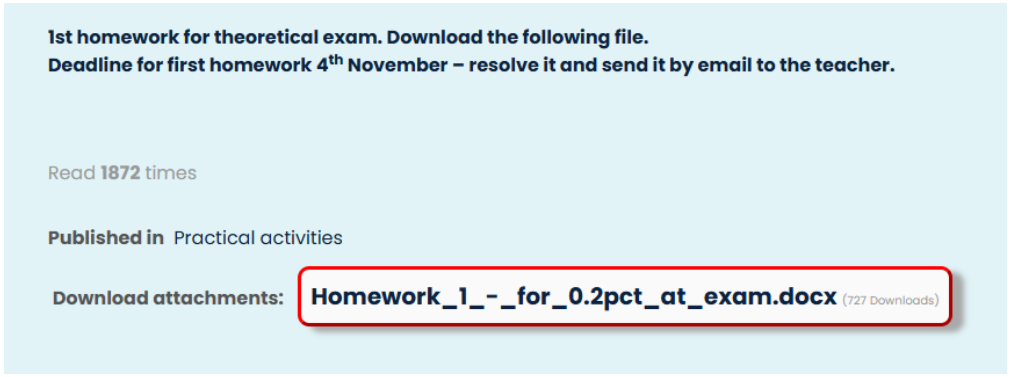
S SEEK

K KNOWLEDGE

Homework 1

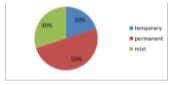
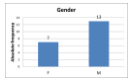
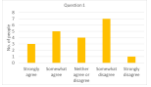
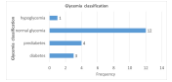
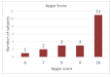
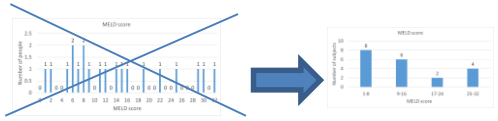
- Download the requested file
  - www.info.umfcluj.ro
- Print
- Resolve the exercises by hand
- Bring the homework to me
- Deadline 4th November 2025
  - if you made Homework 1 in time and obtain a mark higher or equal with 6 you will receive +0.2 for the exam mark





Summarizing Qualitative Variables

Organizing and presenting one qualitative variable

Variable type	Indicators	Charts
Qualitative		
• Nominal	Absolute and/or relative frequencies	Pie or Column or Bar  
• Dichotomial	Absolute and/or relative frequencies	Pie or Column or Bar  
• Ordinal		
– with text categories	Absolute and/or relative frequencies	Column or Bar  
– scores		
• with few categories ≤10	Absolute and/or relative frequencies minimum, maximum, median, quartiles, range, interquartile range, mode	Column or Bar 
• with many categories>10	Absolute and/or relative frequencies minimum, maximum, median, quartiles, range, interquartile range, mode	Column or Bar with the scores divided into intervals
	Absolute and/or relative frequencies after dividing the scores on intervals	

Summarizing Qualitative Variables

Organizing and presenting two qualitative variable

Two variables - both

- **dichotomial /**
- **nominal /**
- **ordinal** (with text as categories)

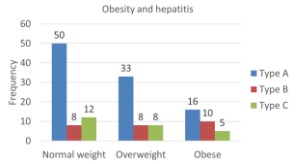
Statistics

contingency table

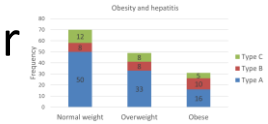
- joint absolute frequencies
- frequencies relative to
  - totals on rows
  - totals on lines
  - grand total

Chart

- Column/Bar



- Staked Column/Bar



- 100% Stacked Column/Bar

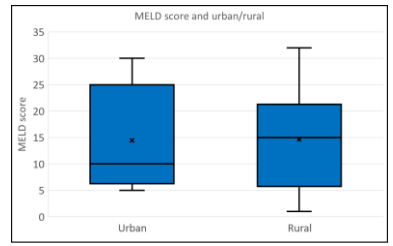
Two variables:

- **one**
  - **dichotomial /**
  - **nominal /**
  - **ordinal** (with text as categories)
- **one**
  - **ordinal** (with numbers as the categories) **-scores**

On each subgroup

- Range
- Median
- Quartile 0-4
- Interquartile range
- Mode

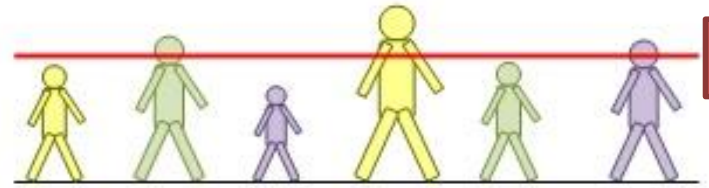
- Box-Whiskers Plot



Objectives

- Summarizing Quantitative (Numerical) Data (Continuous, Discrete)
  - Descriptive statistics
  - Charts

Measure of central tendency



Arithmetic mean $\overline{X}$ is the average of the observations.

Calculation: add the observations to obtain the sum and then divide by the number of observations.

The **formula** for the arithmetic mean: $\overline{X} = \frac{1}{n}\sum X$

Σ - to add, X represents the individual observations, n is the number of observations.

Example

- Ex. In 2011, 6 medical doctors earn in a month 2400, 2600, 2900, 2900, 3200, 3400 Euro.

$$\bar{X} = \frac{2400+2600+2900+2900+3200+3400}{6} = 2900 \text{ Euro}$$

The average income is 2900 Euro

Arithmetic mean is a measure of the middle

Median is a measure of the middle

Mean or median?

We can use **arithmetic mean** when data are **numerical without outliers**

Median can be use any time, but because the arithmetic mean is easy to understand ...

We use **median** only when the data are numerical with outliers or data are ordinal

Medical doctors' income in 2011

2400€ 2600 €

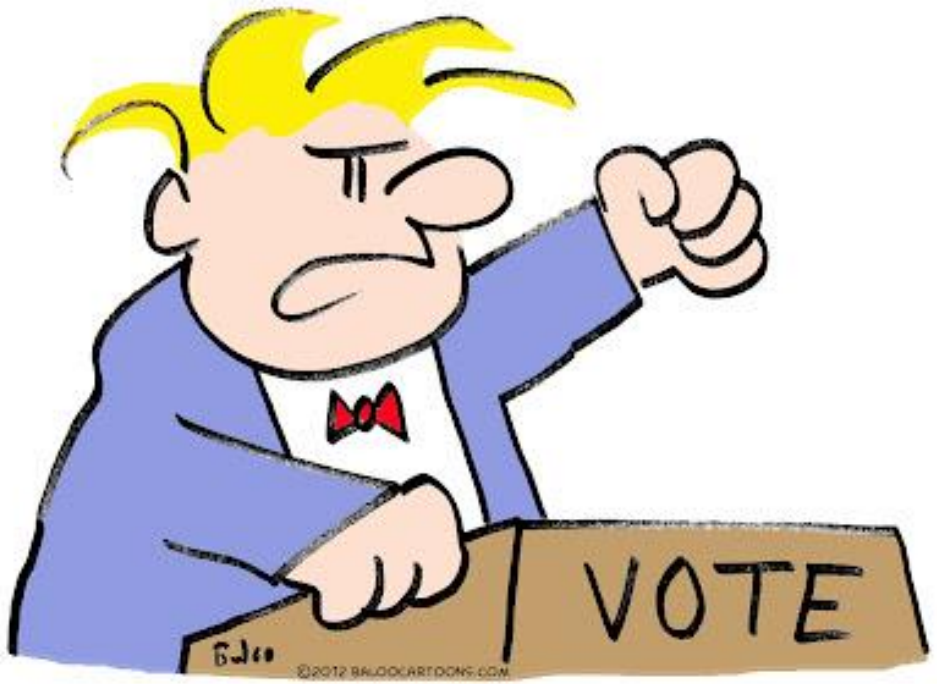
2900 € 2900 €

3200 € 3400 €

Arithmetic mean = 2900 €

Average income of medical doctors is 2900 €

Some political changes



"Desperate times call for
desperate politicians!"

After 12 months politician announce that:

Medical doctors' income near double in 12 months

2400€ 2600 €

2900 € 2900 €

3200 € 19000 €

Arithmetic mean = 5500 €

was 2900 €

- Conclusion: outliers **can** influence the mean

Outlier 19000 €

Median

2400€ 2600 € 3200 € 3400 €






2900 € 2900 €

Median = 2900 €

Medical doctors income after 12 months

2400€ 2600 € 3200 € 19000 €






2900 € 2900 €

Median = 2900 €

was 2900 €

- Conclusion: outliers **cannot** influence the median

Outlier or extreme case

19000 €

Mean is a measure of the middle?

We use **mean** if data are **numerical without outliers**

We use **median** if data are numerical with outliers or data are ordinal

Summarizing Numerical Data (Continuous, Discrete)

- Measure of central tendency
  - Arithmetic mean
  - Median
  - Mode
- Measure of spread
  - Variances
  - Standard Deviation
  - Coefficient of variation
  - Standard error
- Other measures
  - Skewness
  - Kurtosis
  - Quartile
  - Percentile
- Charts
  - Histograms
  - Box-plots

Objectives

- Measure of dispersion
- Examples

Series 1	Series 2	Series 3
1	1	1
1	44	8
2	45	11
3	46	14
5	48	28
6	48	30
6	49	37
7	50	48
93	50	52
94	51	62
94	52	70
95	52	72
97	54	84
98	55	91
98	55	92
100	100	100
Sum800	Sum800	Sum800

Measures of Spread

Why we need them when we want to describe data?

Number of observations in each set = 16

Average of each set = 50

Median of each set = 50

Series 1

1
1
2
3
5
6
6
7
93
94
94
95
97
98
98
100

The distribution

Frequency classes		
1-20	values between 1 to 20	
21-40		
41-60		
61-80		
81-100		
Total		

minimum = 1

maximum = 100

we divide the interval 1 - 100 in 5 equal subintervals

= 5 “classes” with the length of 20

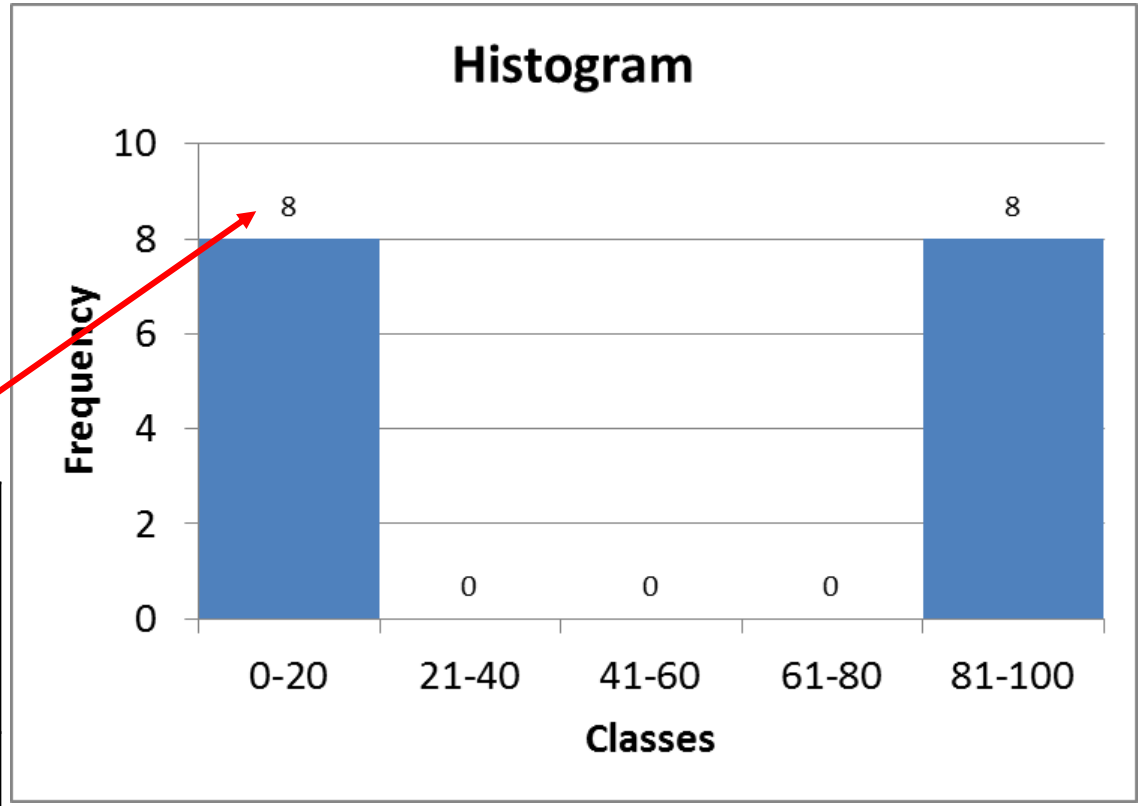
Series 1

1
1
2
3
5
6
6
7
93
94
94
95
97
98
98
100

The distribution

8 values between 0 to 20

Series 1 – Classes	Absolute Frequency	Relative Frequency %
0-20	8	50
21-40	0	0
41-60	0	0
61-80	0	0
81-100	8	50
Total	16	100



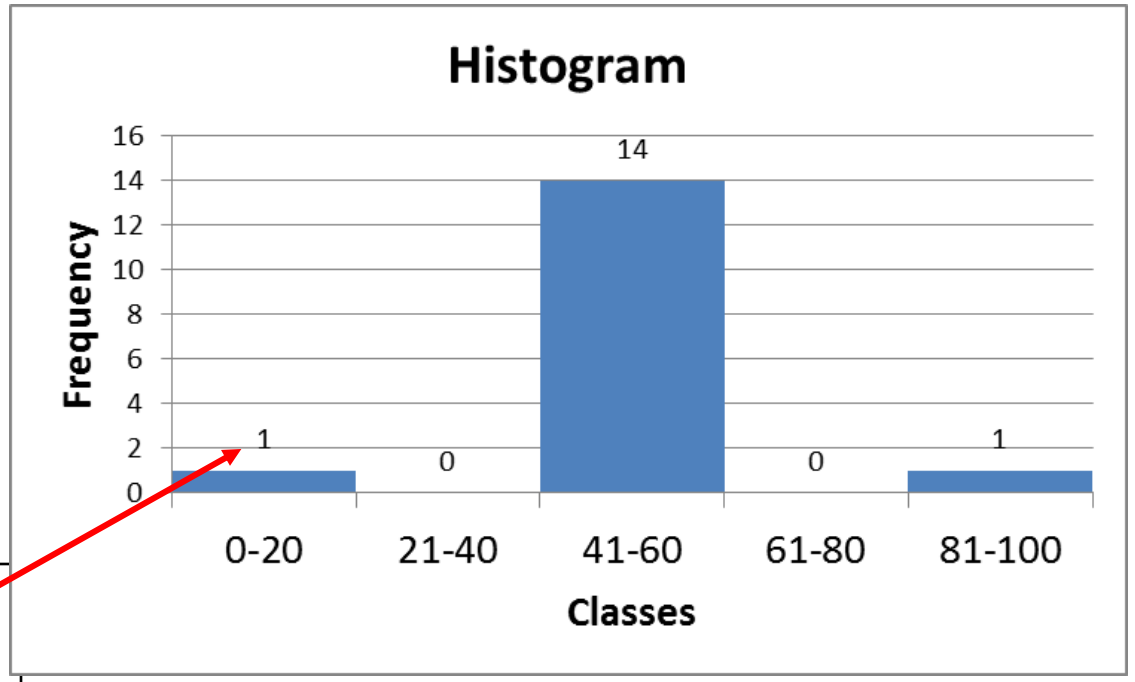
Series 1

Series 2

1
44
45
46
48
48
49
50
50
51
52
52
54
55
55
100

The distribution

1 value between 0 to 20



Series 2 – Classes	Absolute Frequency	Relative Frequency %
0-20	1	6.25
21-40	0	0
41-60	14	87.50
61-80	0	0
81-100	1	6.25
Total	16	100

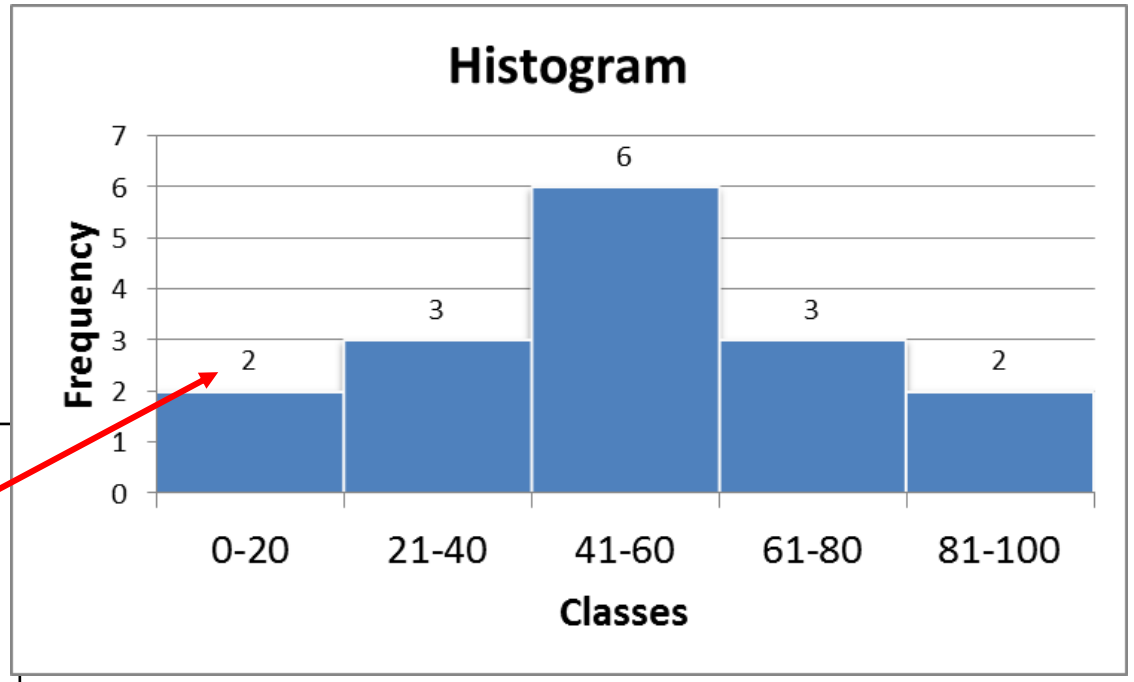
Series 2

Series 3

The distribution

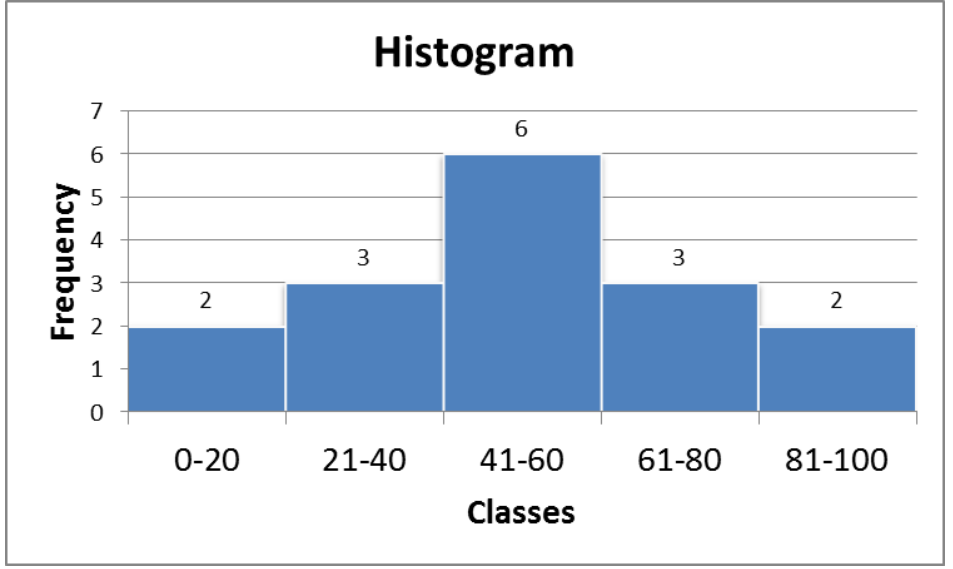
1
11 — 2 values between 0 to 20
24
29
36
41
45
49
51
55
59
64
71
76
88
100

Series 3 – Classes	Absolute Frequency	Relative Frequency %
0-20	2	12.50
21-40	3	18.75
41-60	6	37.50
61-80	3	18.75
81-100	2	12.50
Total	16	100



Series 3

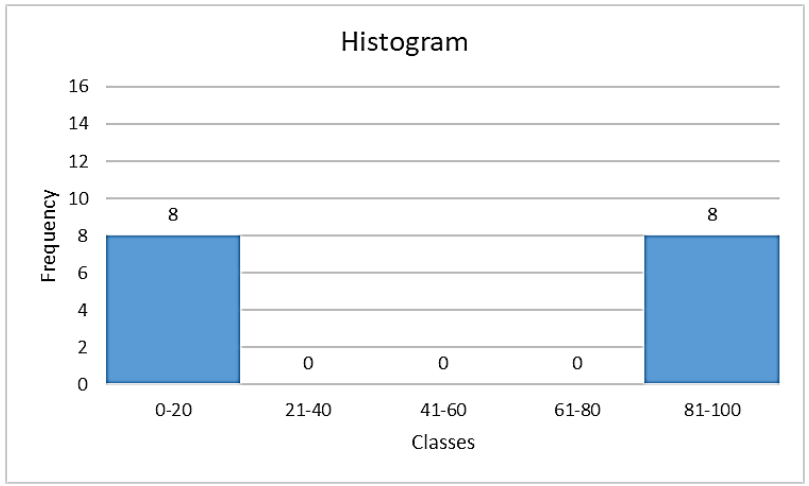
Histogram

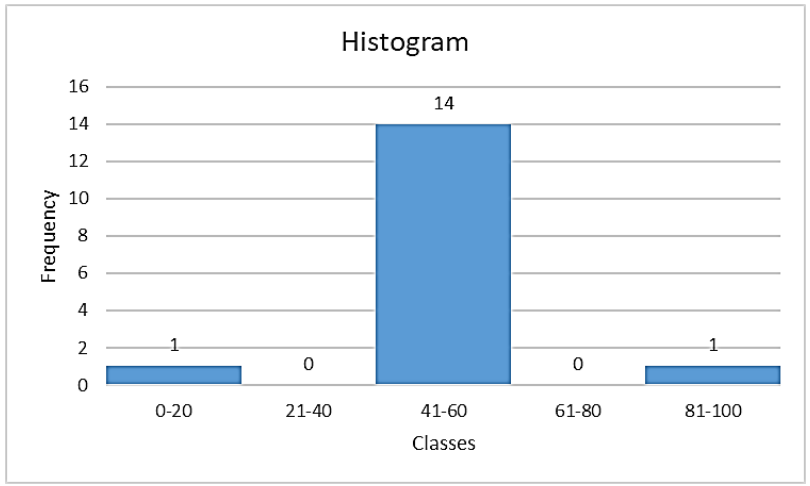


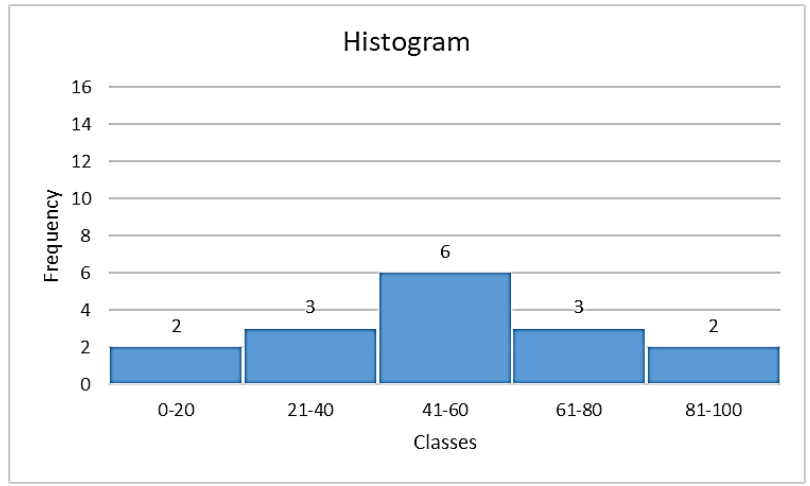
- a graphical representation
  - the distribution of quantitative **continuous** variables
  - bars
    - show the frequency of values within ranges (bins)
    - bar height = the number of values in that particular interval
  - must have
    - **equal** bars width = equal intervals (to compare the frequencies)
    - **no gap (space)** between the columns (intervals are adjacent and cover a continuous range of values)

Histogram

- useful to see the shape and the spread of data values







the same range on Oy
equal intervals on Ox

we can compare the distributions

Measures of Spread

The Standard Deviation – the average of the deviation (departure) from the mean

Formula for population (all observation):

$$\sigma = \sqrt{\frac{\sum (X - \bar{X})^2}{N}}$$

Σ *means "sum of,"*
X *= each value in the data set,*
$\bar{X}$ *= mean of all values in the data set,*
N *= number of values in the data set.*

Formula for subset of population (sample)

- The Standard Deviation of a sample (with correction for medical rseach)

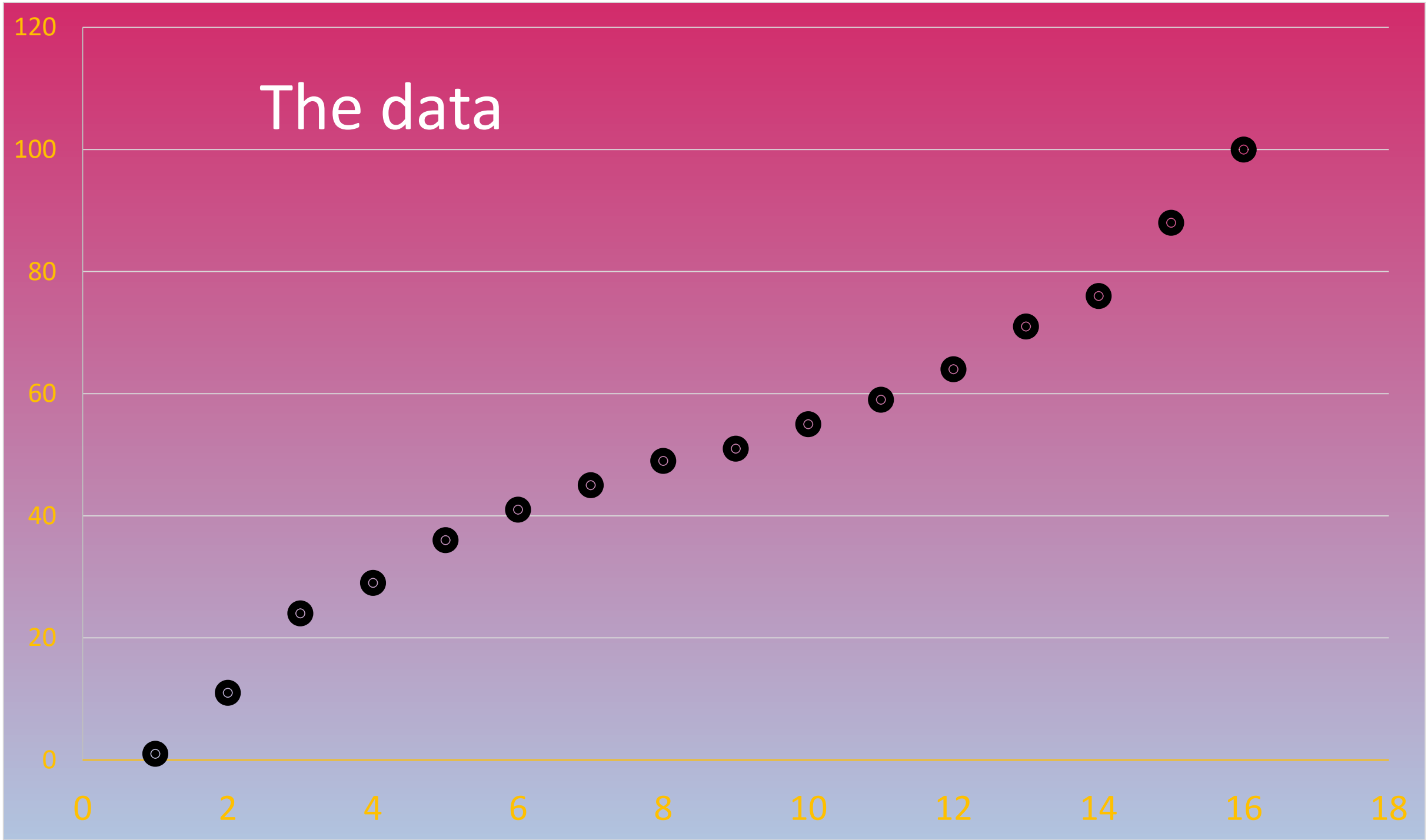
$$S = \sqrt{\frac{\sum(X-\bar{X})^2}{N-1}} = \sqrt{\frac{(x_1-\bar{x})^2+(x_2-\bar{x})^2+\ldots+(x_N-\bar{x})^2}{N-1}}$$

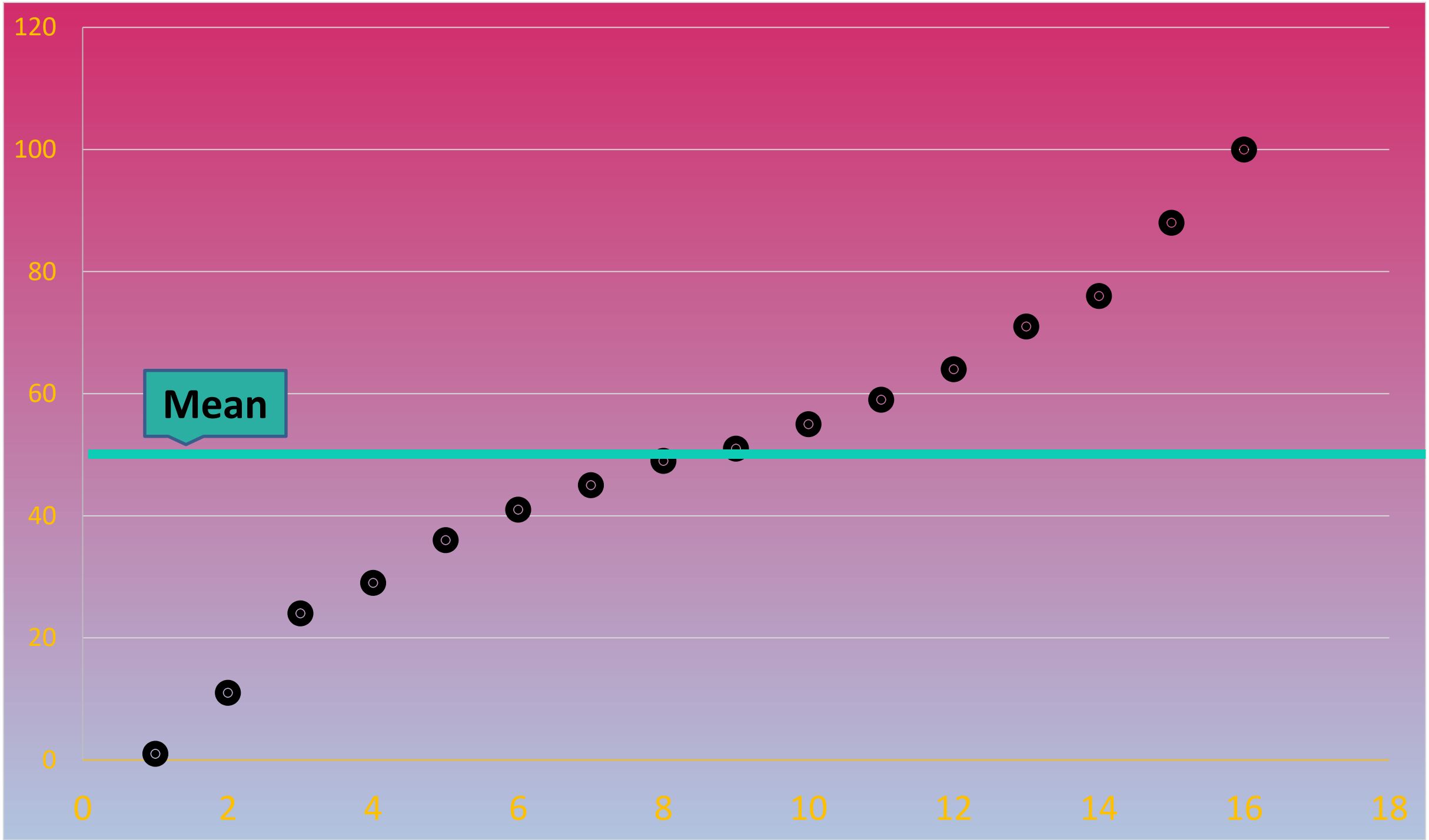
Where

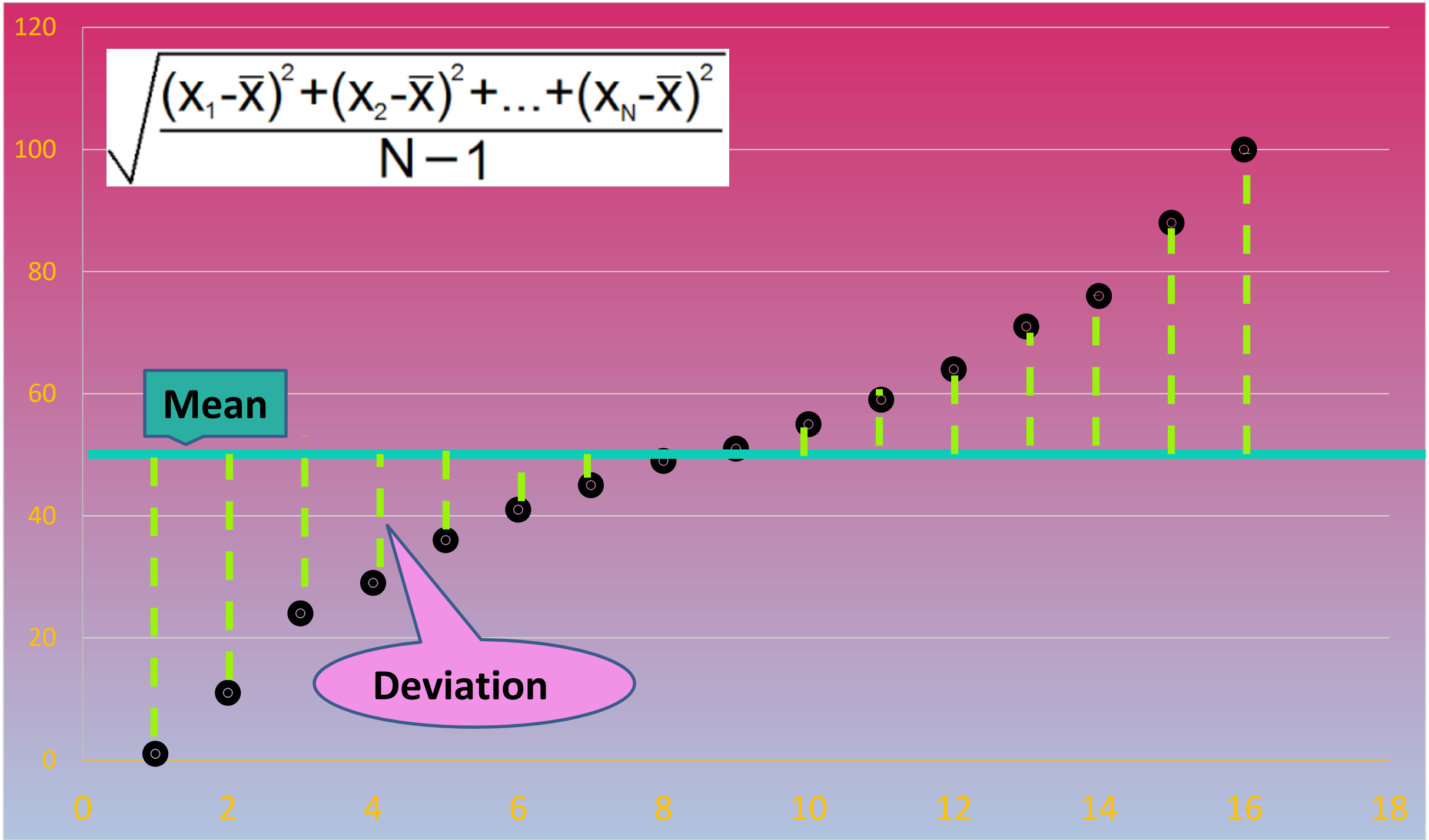
N - total number of observation

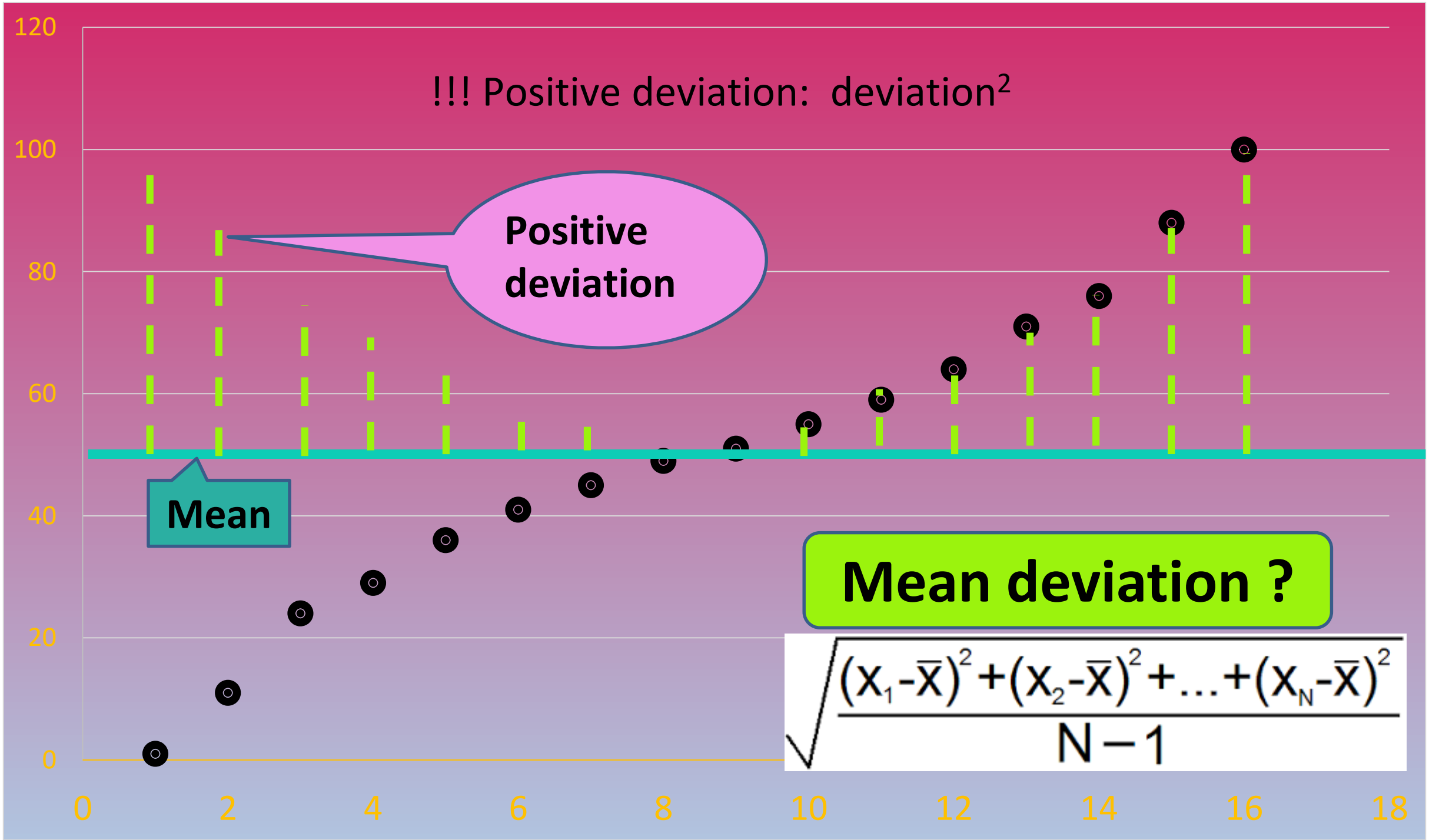
$\bar{X}$ - arithmetic mean

$X_1, \ldots X_N$ - observation


The data
120
100
80
60
40
20
0
0
2
4
6
8
10
12
14
16
18


120
100
80
60
40
20
0
Mean
0
2
4
6
8
10
12
14
16
18


$\sqrt{\frac{(x_1-\bar{x})^2+(x_2-\bar{x})^2+\ldots+(x_N-\bar{x})^2}{N-1}}$
120
100
80
60
40
20
0
0
2
4
6
8
10
12
14
16
18
Mean
Deviation


!!! Positive deviation: deviation²
Positive deviation
Mean
Mean deviation ?
$\sqrt{\frac{(x_1-\bar{x})^2+(x_2-\bar{x})^2+\ldots+(x_N-\bar{x})^2}{N-1}}$
120
100
80
60
40
20
0
0
2
4
6
8
10
12
14
16
18

$$\sqrt{\frac{(x_1-\bar{x})^2+(x_2-\bar{x})^2+\ldots+(x_N-\bar{x})^2}{N-1}}$$

Actually, instead of lines are squares (deviation^2)

Example

- No. of tooth for 6 patients: 20, 24, 26, 25, 25, 30
- Arithmetic mean $\bar{X}$ =(20+24+26+25+25+30)/6=25
- Standard deviation:
- $S = \sqrt{\frac{(20-25)^2+(24-25)^2+(26-25)^2+(25-25)^2+(25-25)^2+(30-25)^2}{6-1}}=$
- $=\sqrt{\frac{(-5)^2+(-1)^2+1^2+0^2+0^2+5^2}{5}} = \sqrt{\frac{25+1+1+25}{5}} = \sqrt{\frac{52}{5}} = \sqrt{10.4} = 3.22$

10.4 is the variation

Mean deviation from the mean :-P

Standard Deviation - example

Ex. In a hepatitis A epidemic, a sample of 6 persons had clinical symptoms after 24, 25, 29, 29, 30, 31 days.

X = 24, 25, 29, 29, 30, 31 - the individual data, $\bar{X}$ = 28

1. $X - \bar{X}$ = -4, -3, 1, 1, 2, 3 (each data minus arithmetic mean)
2. $(X - \bar{X})^2$= 16, 9, 1, 1, 4, 9 (square)
3. $\Sigma(X - \bar{X})^2$ = 16+9+1+1+4+9 = 40 (sum)
4. $\Sigma(X - \bar{X})^2 /(n-1)$ = 40/5 = 8 (divide by 6-1=5) = variance
5. $\sqrt{\sum (X - \bar{X})^2 /(n-1)}$ = 2.83 This value is the standard deviation

Standard Deviation - example

Cholesterol values are given for 10 patients: 200, 180, 140, 160, 180, 150, 170, 110, 230, 170

	Cholesterol *(X)*	**X-$\overline{X}$**	**(X-$\overline{X}$)²**
	200	31	961
	180	11	121
	140	-29	841
	160	-9	81
	180	11	121
	150	-19	361
	170	1	1
	110	-59	3481
	230	61	3721
	170	1	1
Sum	1690	**0**	9690
$\overline{X}$	**169**	**(X-$\overline{X}$)²/(n-1)**	**1076.6**
		St.Dev.	**32.8**

Deviation from mean

Positive deviation from mean

Characteristics of the study population

Fifty-three T2DM patients with normo or microalbuminuria were included in the study. Their median eGFR of 89.30 (67.86-99.50) mL/min was near the normal range. Clinical and biological characteristics of the studied subject are presented in Table 1.

Table 1.

Descriptive clinical and biological characteristics of the studied sub

Parameters	Patients (n=53)
Male n (%)	34 (64.20)
Age (years)	64.98±10.62
Diabetes duration (years)	8.00 (6.00-15.00)

Arithmetic mean, standard deviation

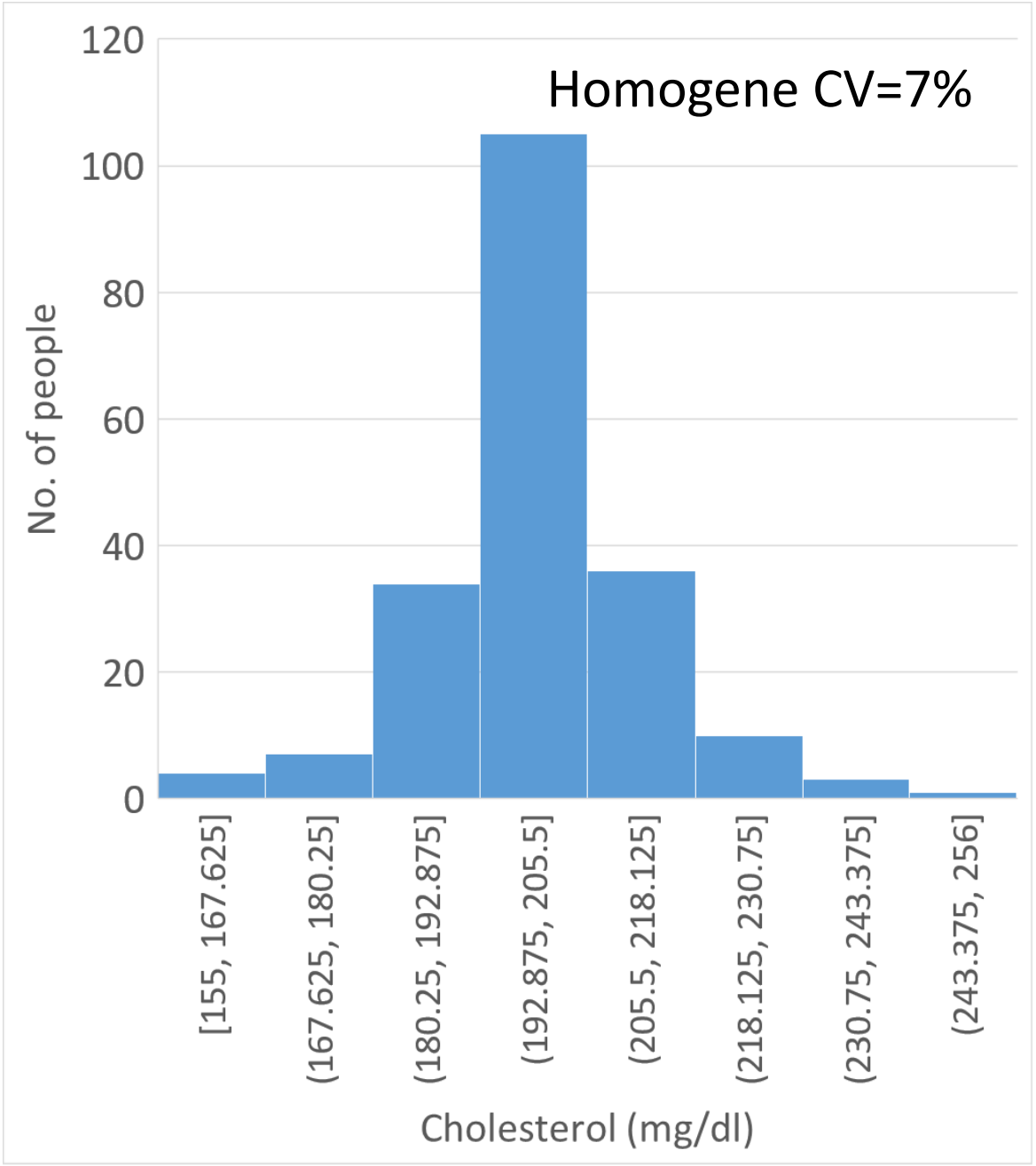
median, IQR

Bondor CI, Potra AR, Rusu CC, Moldovan D, Bolboacă SD, Kacso IM. RELATIONSHIP OF OXIDATIVE STRESS TO URINARY ANGIOTENSIN CONVERTING ENZYME 2 IN TYPE 2 DIABETES MELLITUS PATIENTS. Acta Endocrinol (Buchar). 2016 Apr-Jun;12(2):150-156

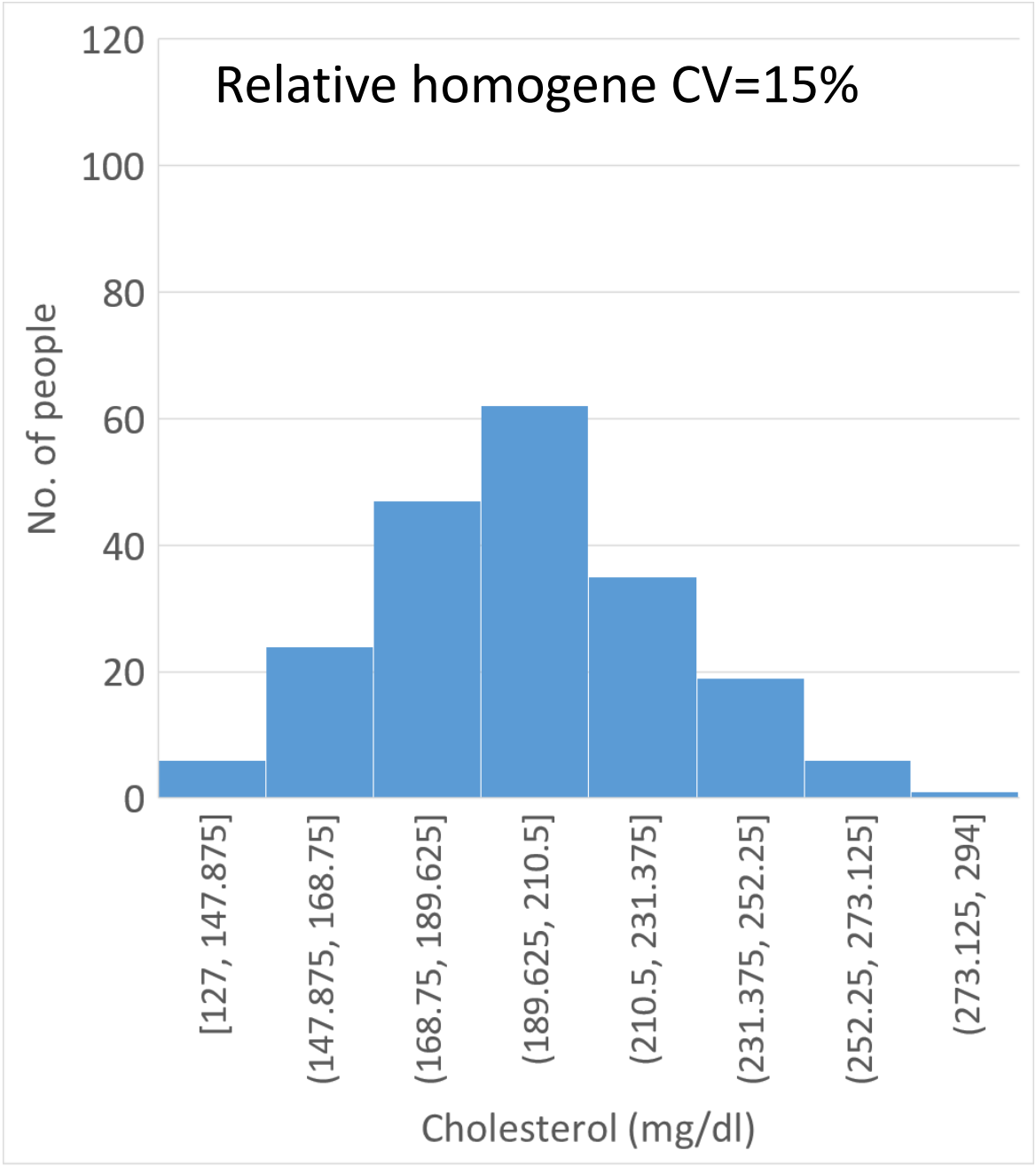
Other measures

- **The coefficient of variation** (CV=s/$\bar{X} * 100$)
  - interpretation
    - 0% ≤ CV < 10% data are homogene
    - 10% ≤ CV < 20% data are relative homogene
    - 20% ≤ CV < 30% data are relative heterogene
    - 30% ≤ CV data are heterogene

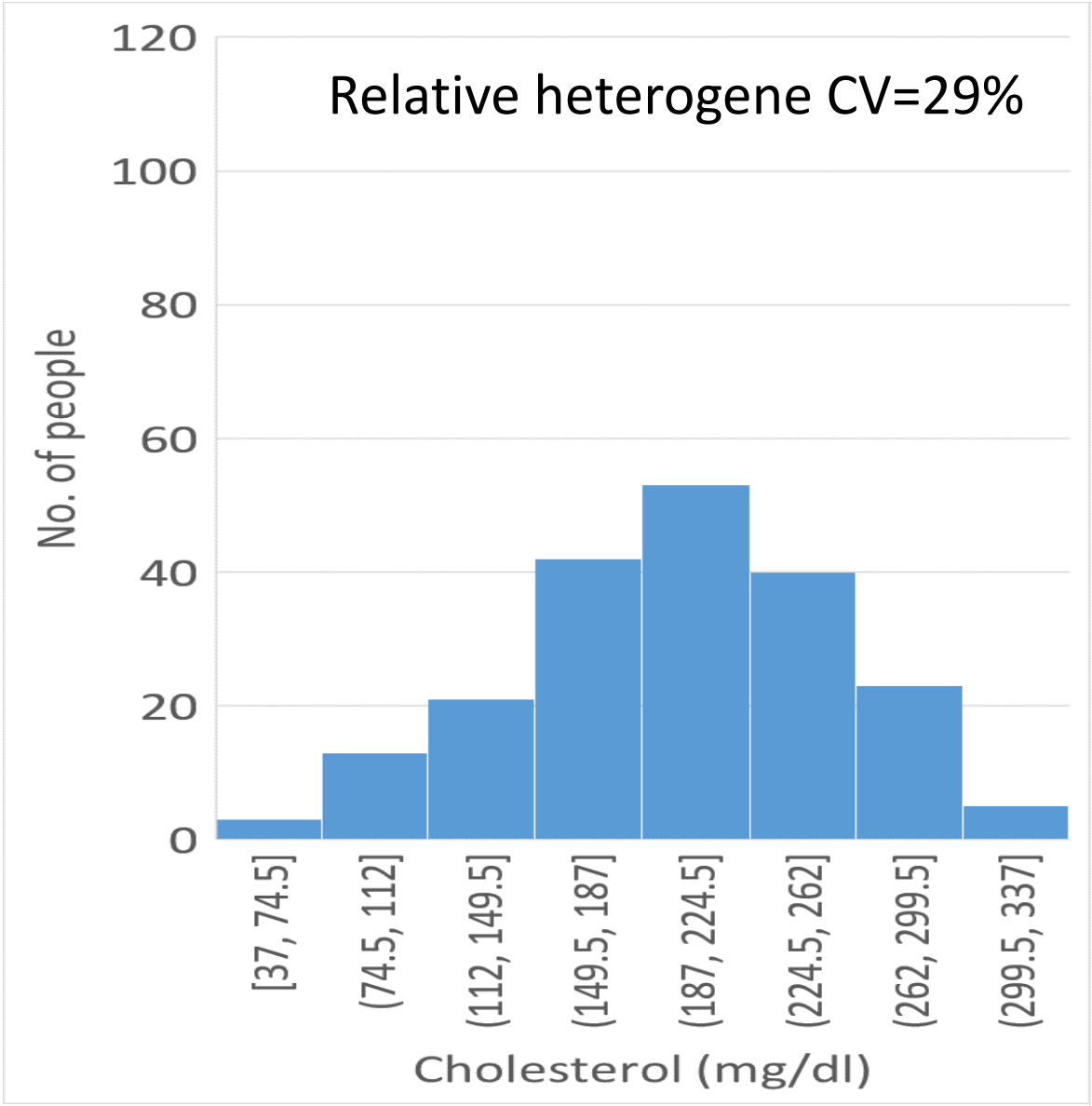
- where s=standard deviation, $\bar{X}$=arithmetic mean



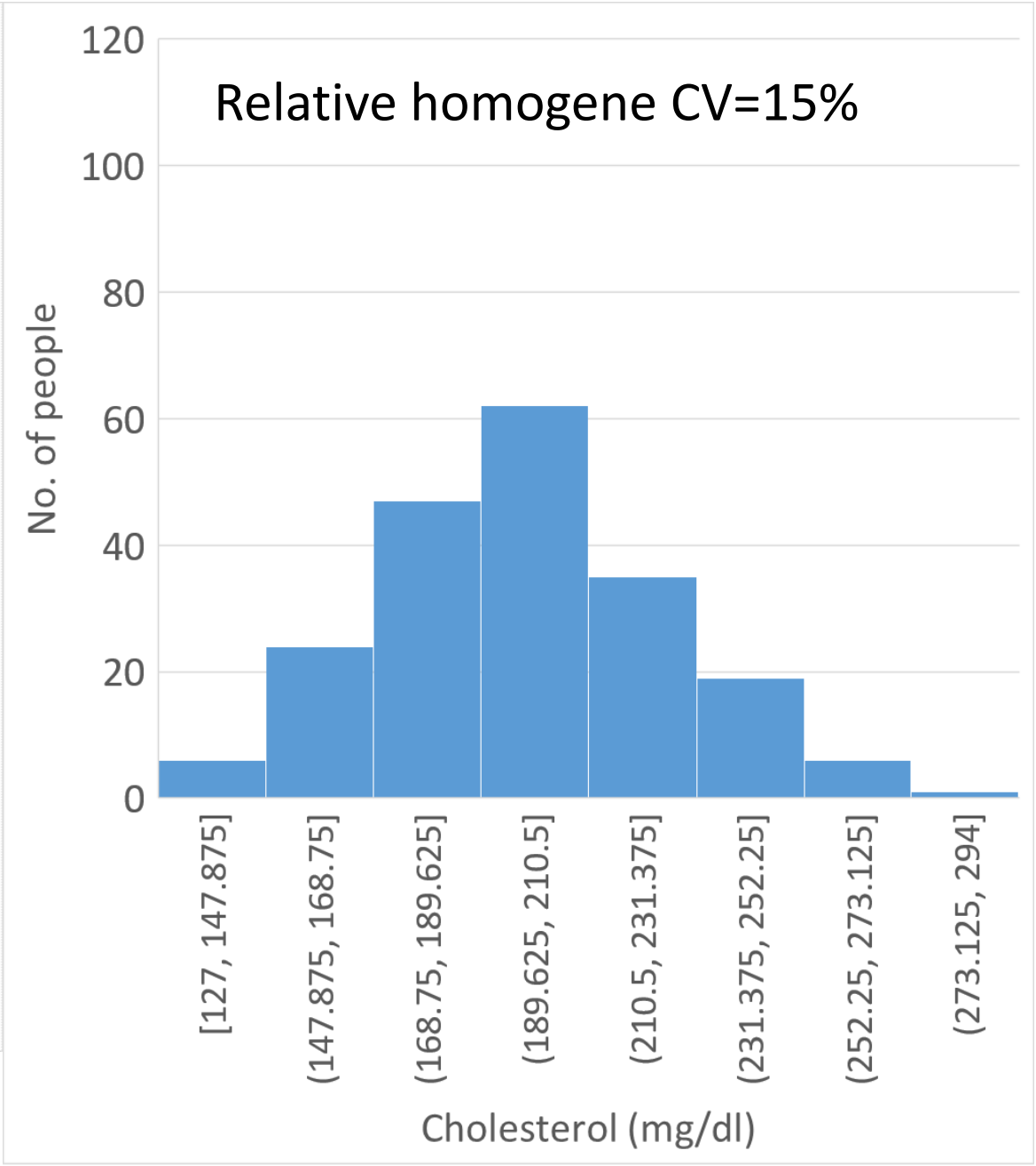
100 patients



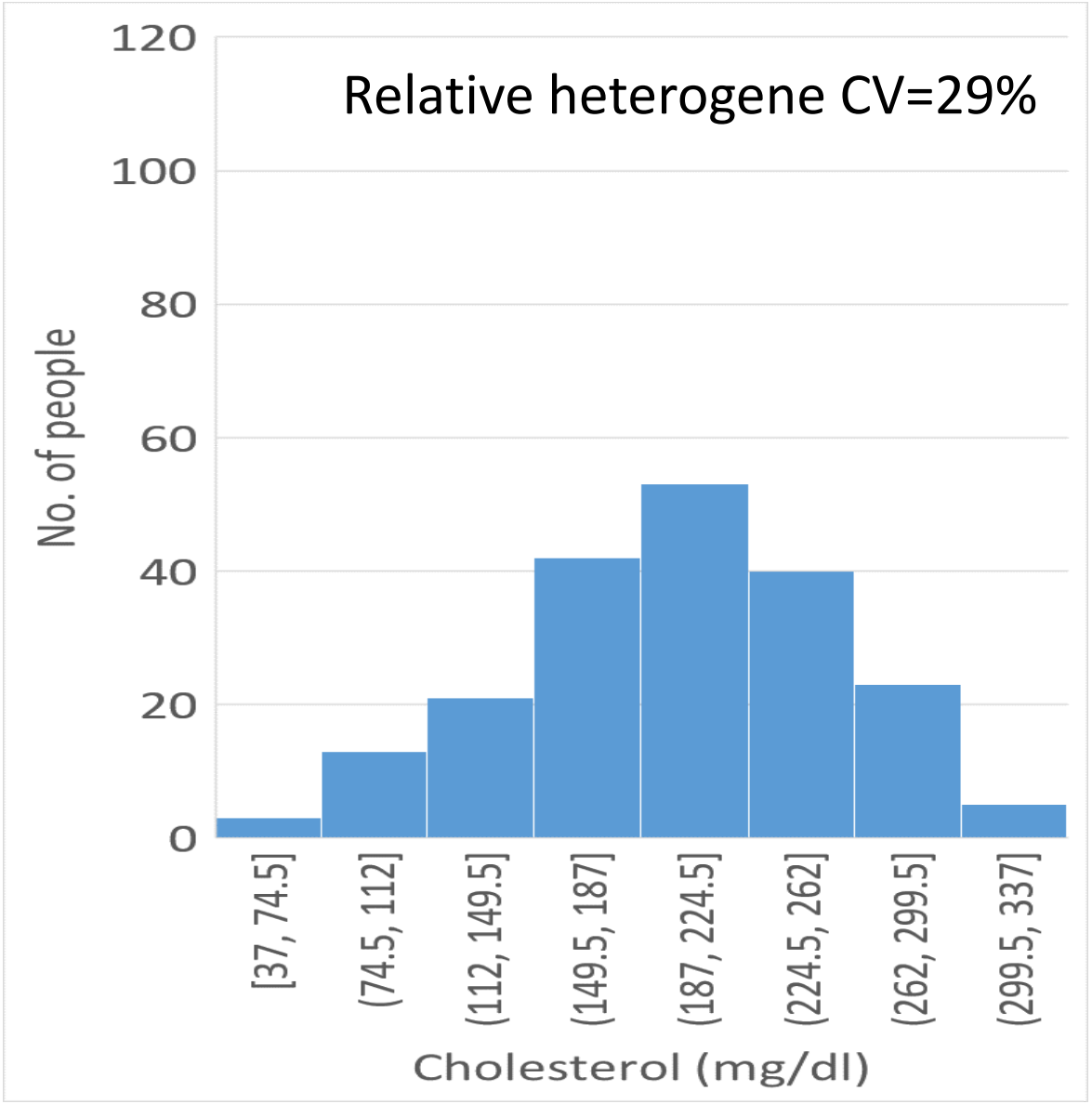
100 patients



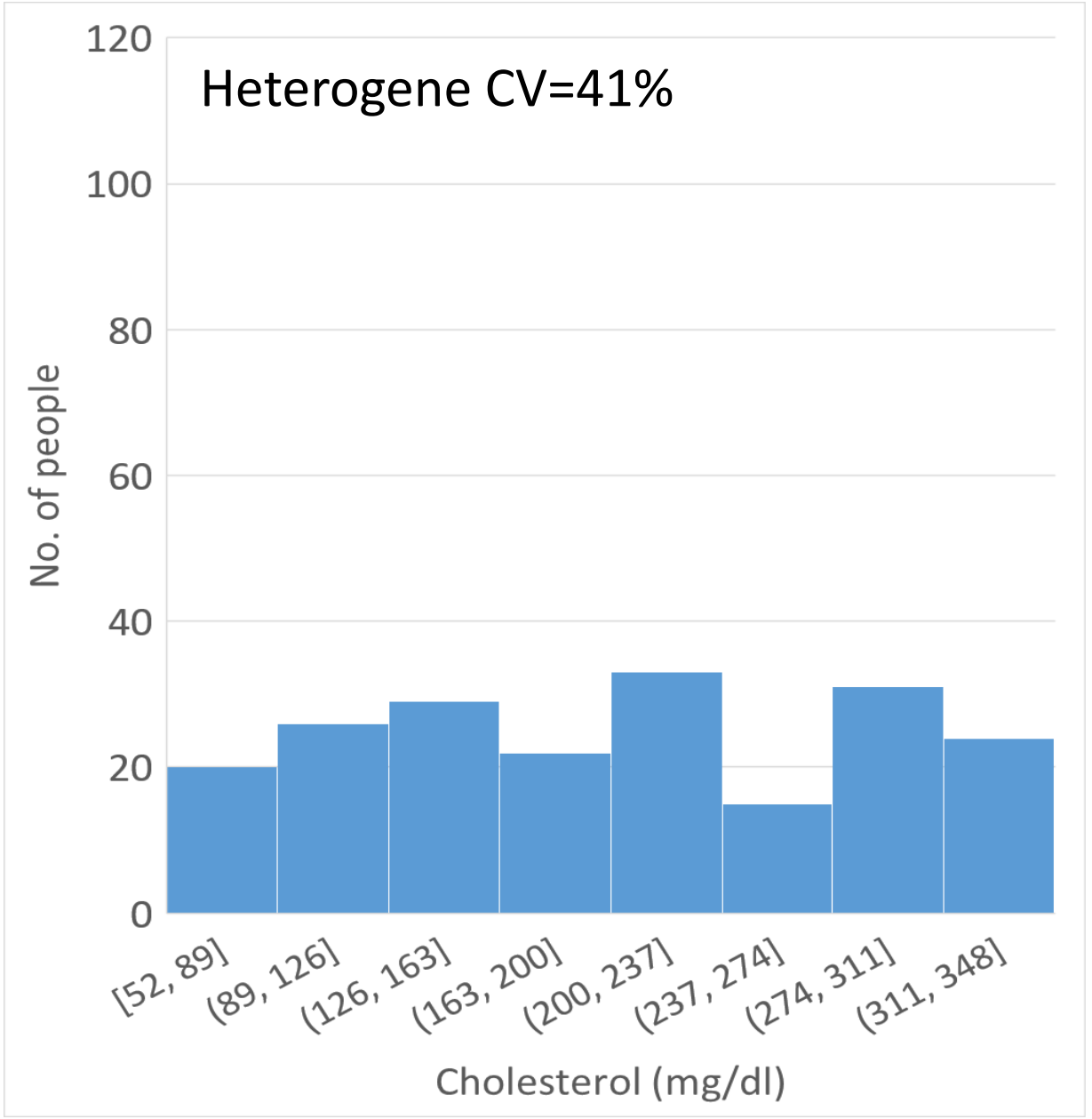
100 patients



100 patients



100 patients



100 patients

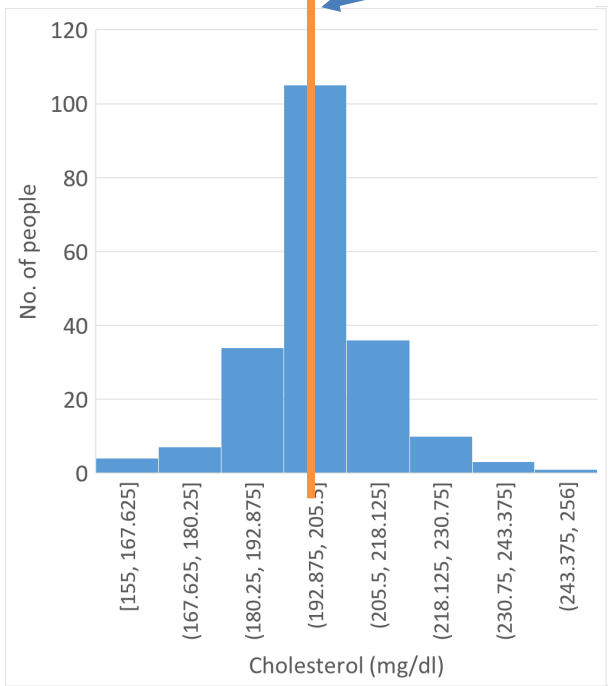
homogene = values are in vicinity of the arithmetic mean
heterogene = values are not in vicinity of the arithmetic mean

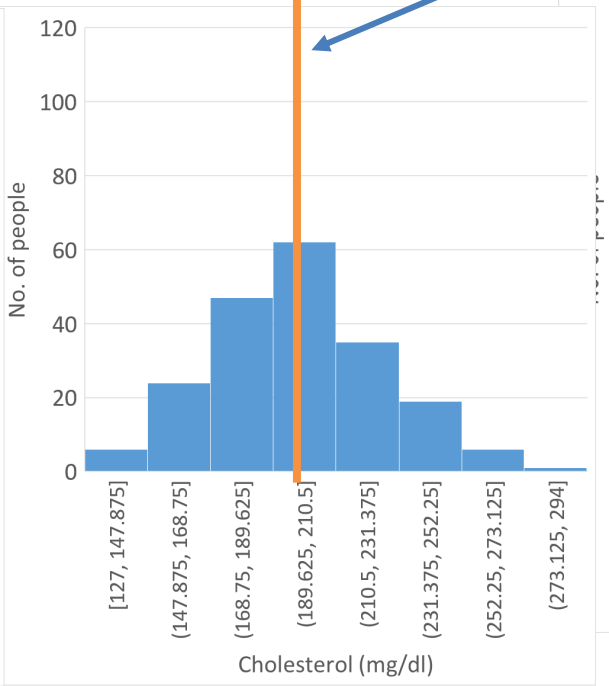
Homogene
CV=7%

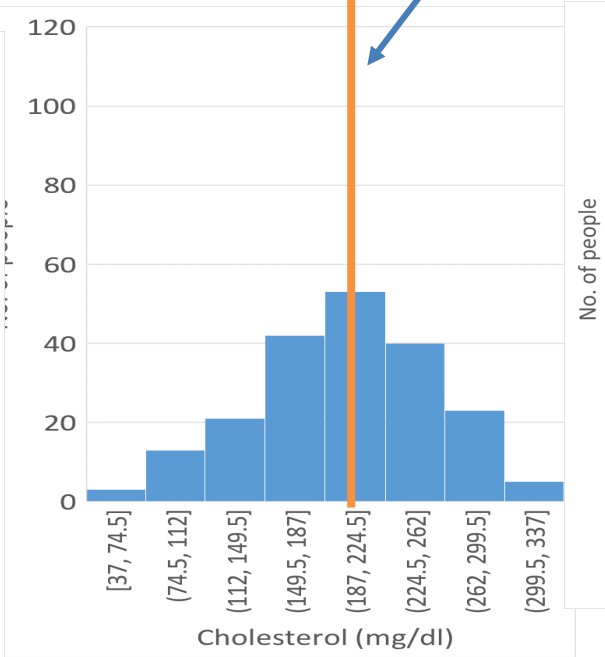
Relative homogene
CV=15%

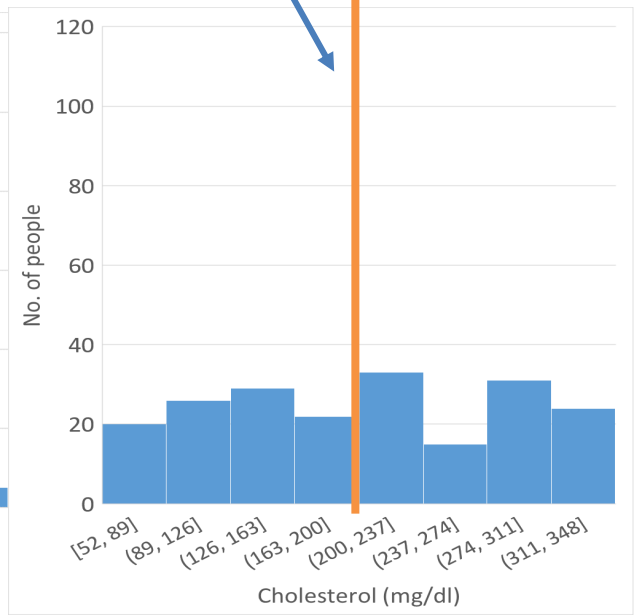
Relative heterogene
CV=29%

Heterogene
CV=41%









100 patients

100 patients

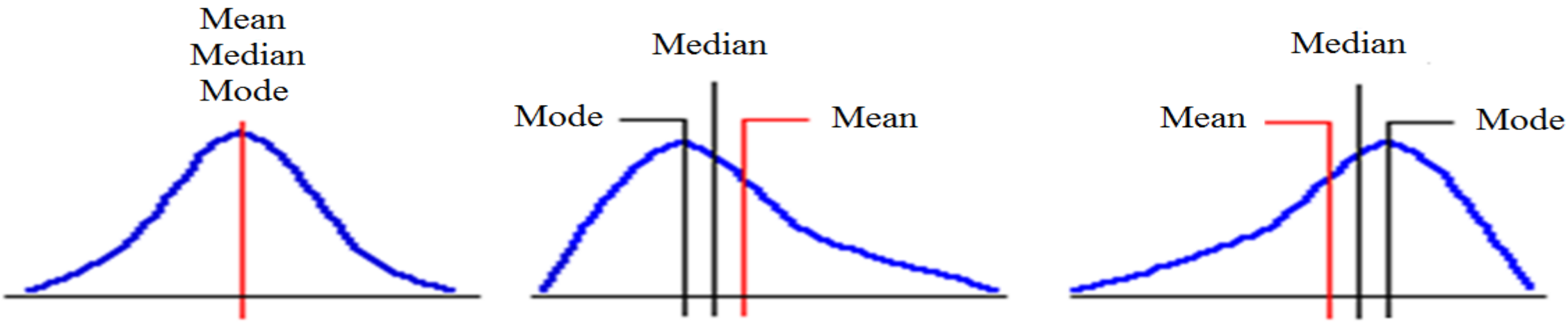
Other measures

- **The standard error** ($E_s = s/\sqrt{n}$)

- where s=standard deviation, n=number of data

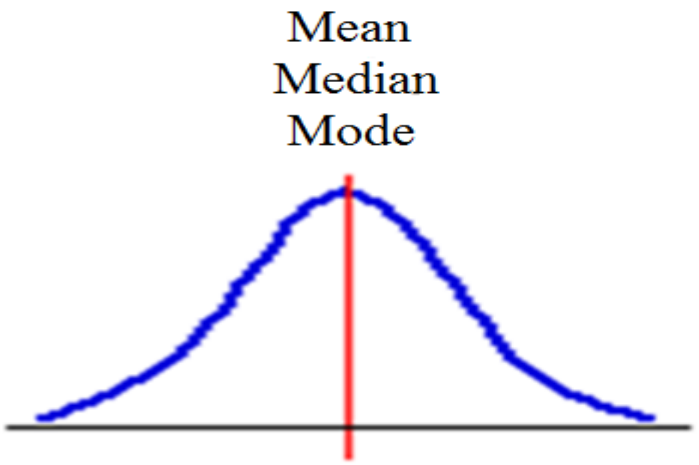
Measure of centrality - applicability

How to interpret the mean, median and mode:

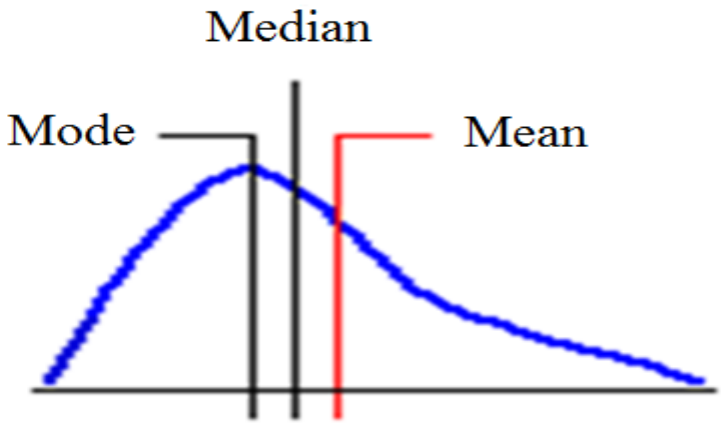


Measure of centrality - applicability

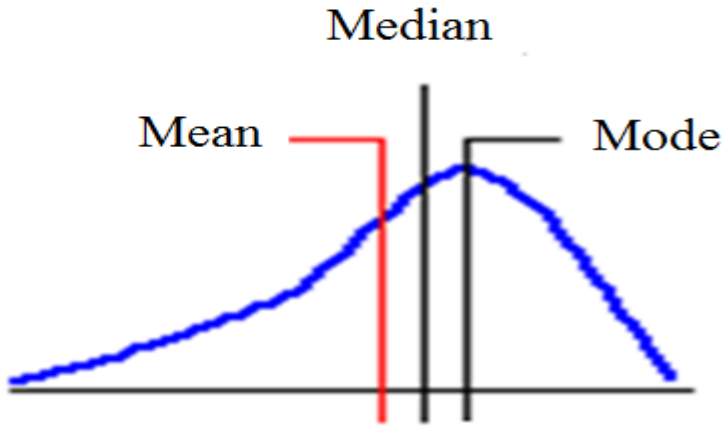
How to interpret the mean, median and mode:



Symmetric



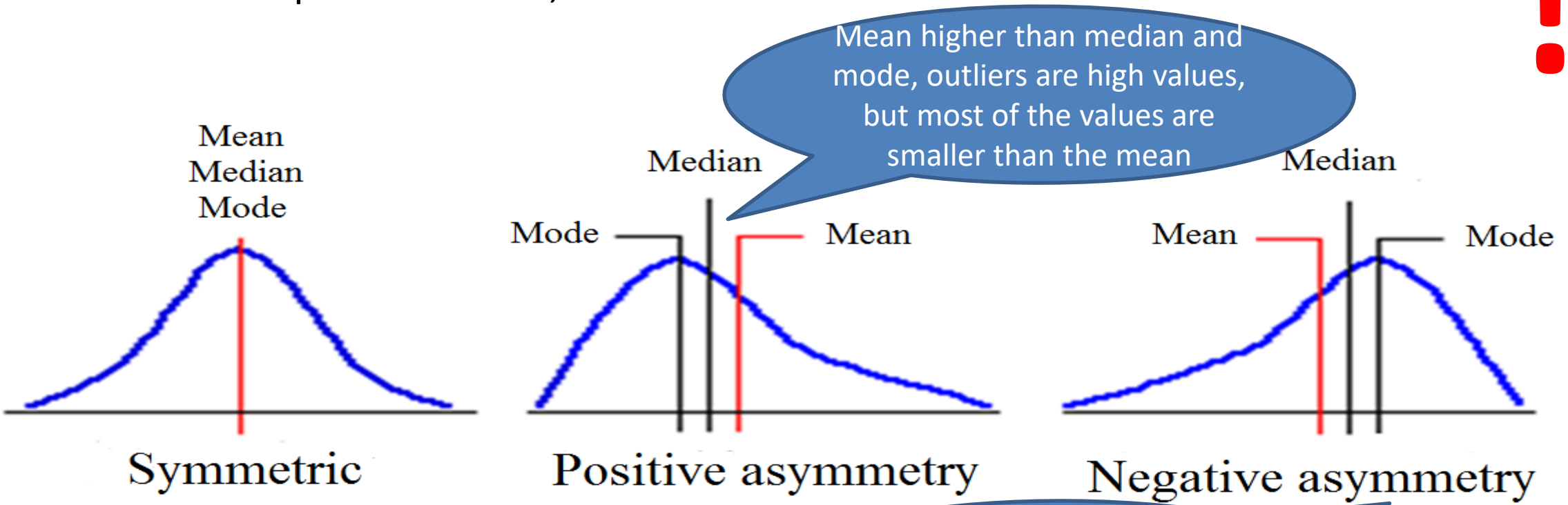
Positive asymmetry



Negative asymmetry

Measure of centrality - applicability

How to interpret the mean, median and mode:



Skewness

- Skewness – Asymmetry measure

$$S_K \approx \frac{1}{n} \frac{\sum_{i=1}^{n} (X_i - \bar{X})^3}{s^3}$$

where:

s = sample standard deviation , $\bar{X}$ = arithmetic mean

Median = 2900 €

Arithmetic mean = 5500 €

2400€ 2600 €

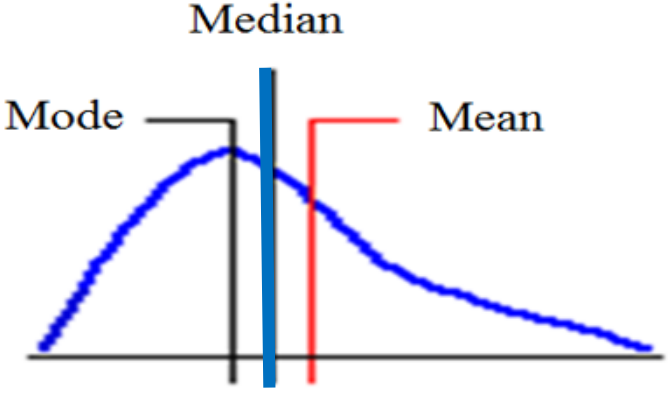
2900 € 2900 €

5 values

3200 €

19000 €

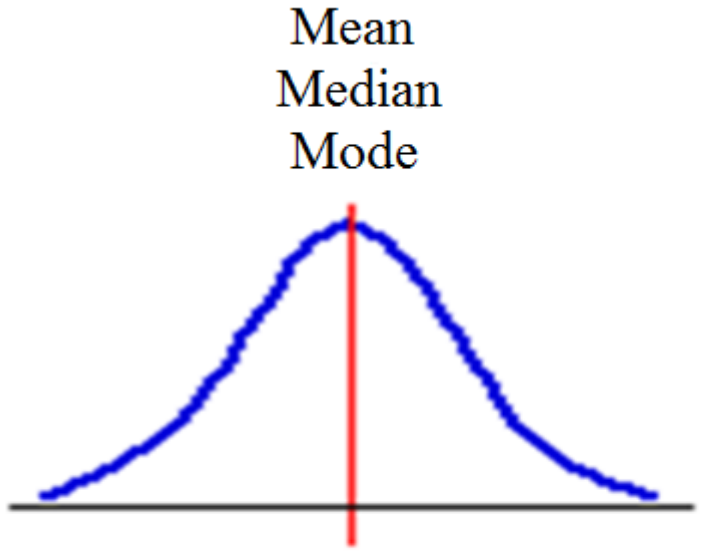
1 value



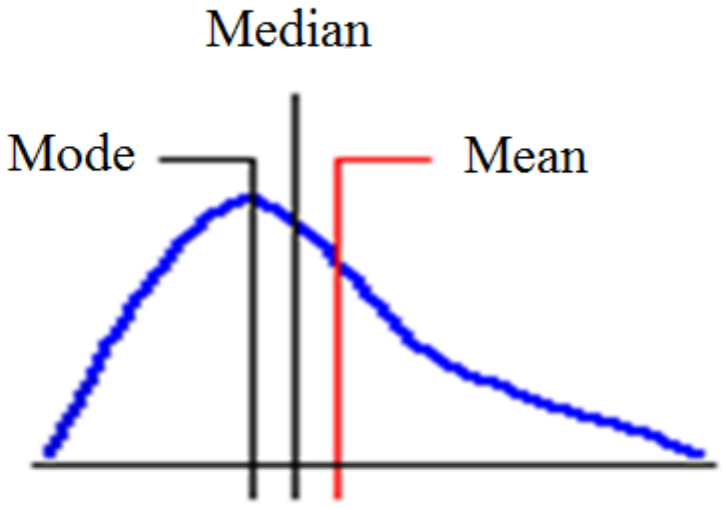
Positive asymmetry

Skewness – Asymmetry measure

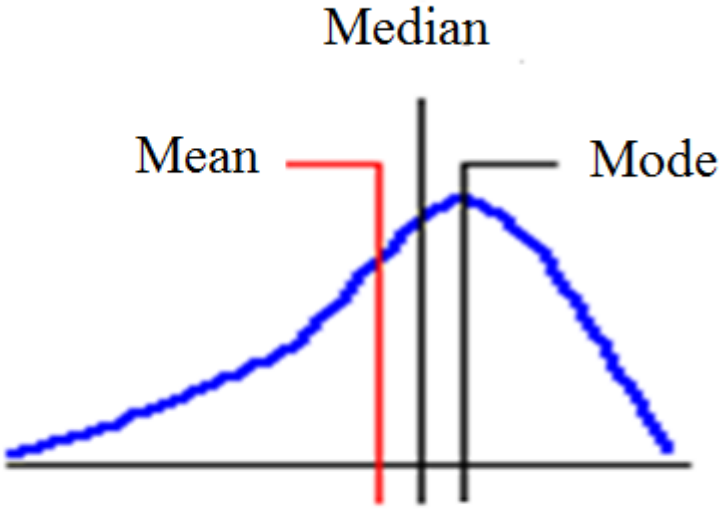
- **Skewness** is a measure of the asymmetry of the distribution of a quantitative variable.



Symmetric



Positive asymmetry



Negative asymmetry

Skewness=0
symmetrical distribution

Skewness>0
asymmetry to the right

Skewness<0
asymmetry to the left

Kurtosis

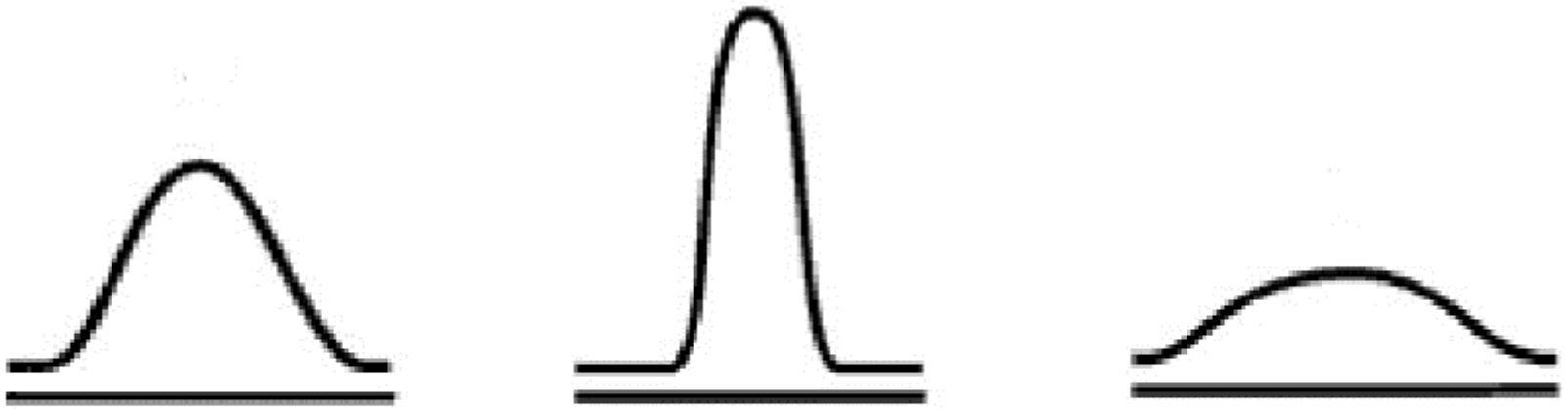
- Kurtosis – Peackedness, flatness, tailedness measure

$$K_E \approx \frac{1}{n} \frac{\sum_{i=1}^{n} (X_i - \bar{X})^4}{s^4} - 3$$

s = sample standard deviation , $\bar{X}$ = arithmetic mean

Kurtosis - Peakedness, flatness, tailedness measure

- Kurtosis is a measure of the "tailedness" of the distribution of a variable



Mesokurtic
kurtosis=0

Leptokurtic
kurtosis>0

Platykurtic
kurtosis<0

Series 1

1
1
2
3
5
6
6
7
93
94
94
95
97
98
98
100

Percentile 0^{th} =minimum

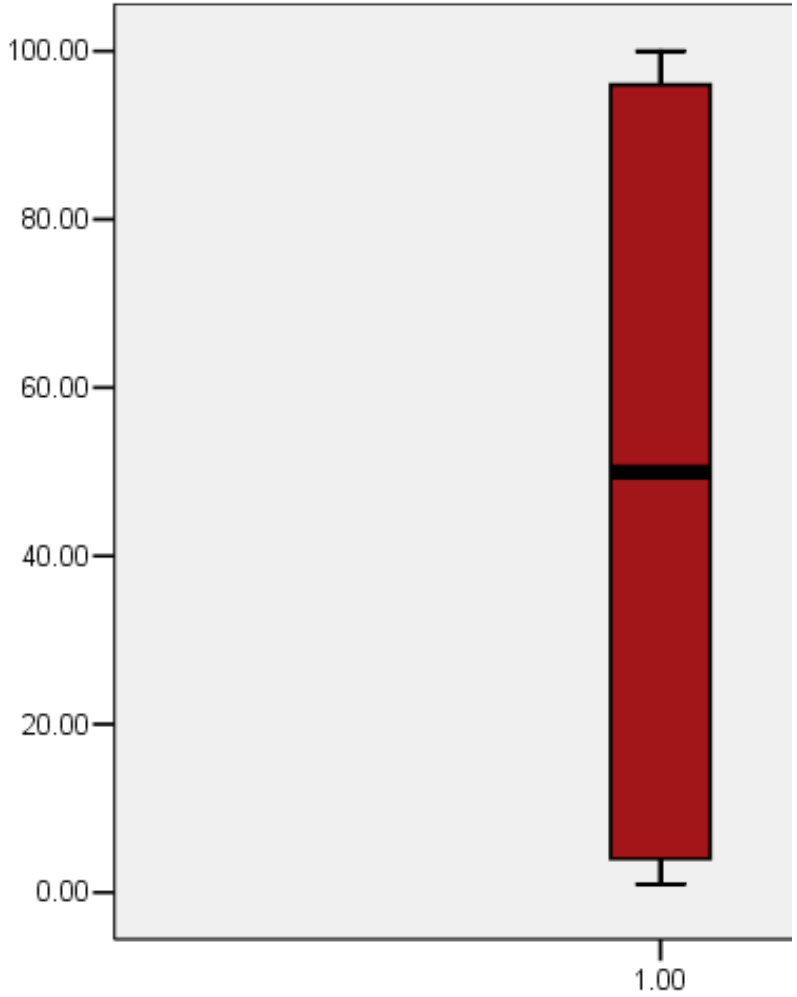
Percentile 25^{th} =(3+5)/2= 4

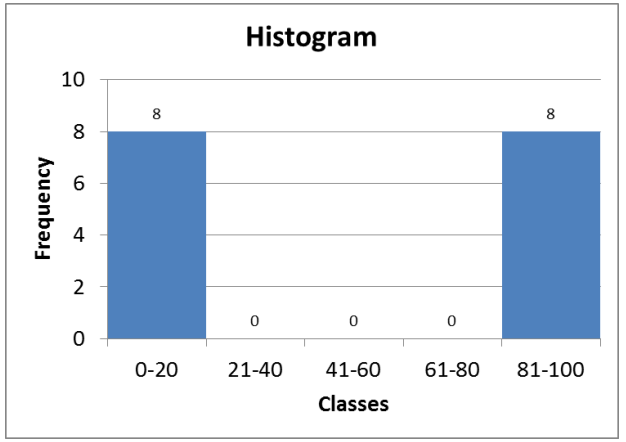
Median =(7+93)/2=50

Percentile 75^{th} =(95+97)/2=96

Percentile 100^{th} =maximum

Between minimum and percentile 25^{th} is a small distance, but 25% of data are in this interval





Series 1

1
1
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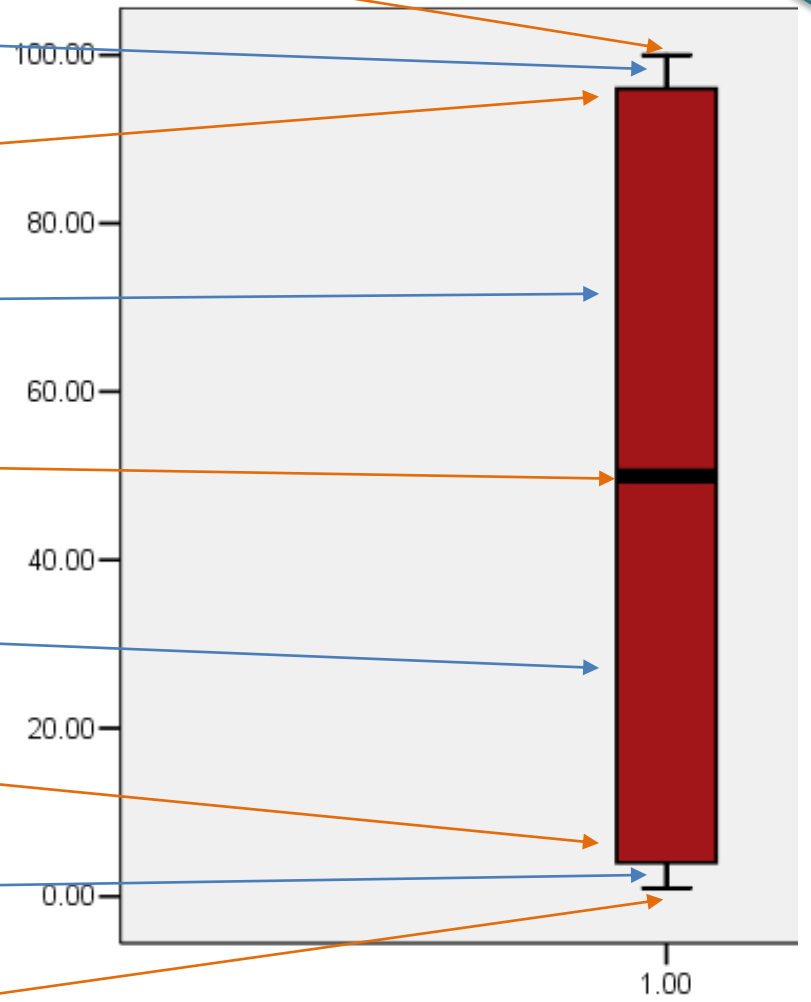
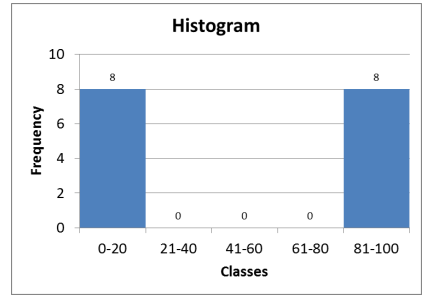




Series 2

1

Percentile 0^{th} =minimum

44

45

46

48

Percentile 25^{th} =(46+48)/2= 47

48

49

50

50

Median =(50+50)/2=50

51

52

52

54

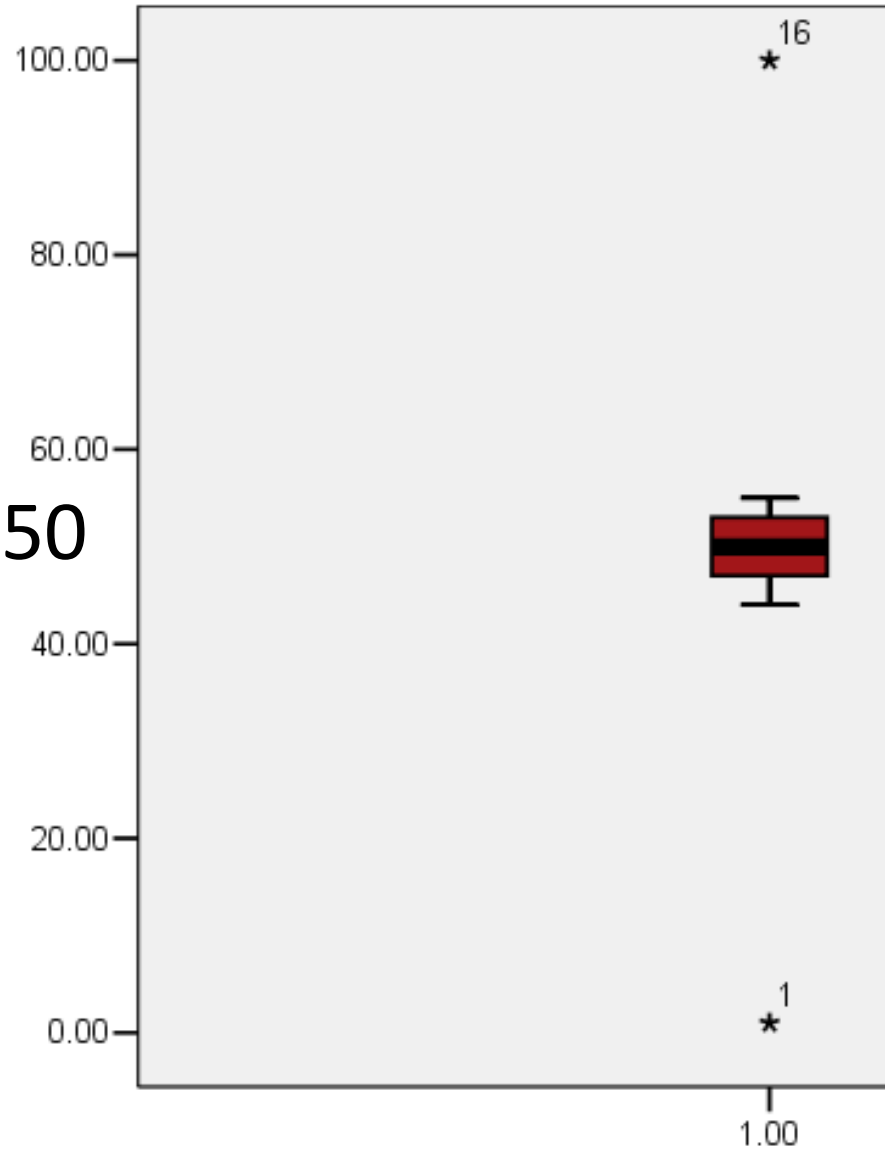
Percentile 75^{th} =(52+54)/2=53

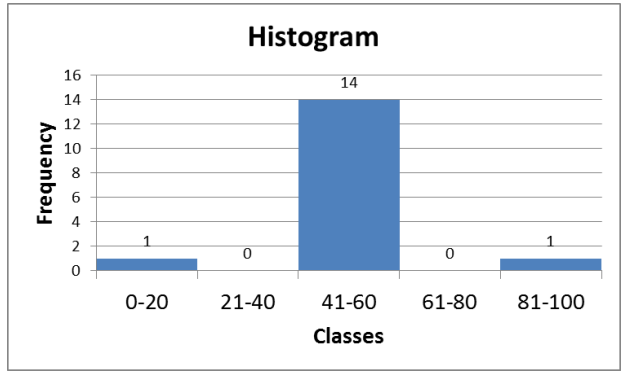
55

55

100

Percentile 100^{th} =maximum





Series 3

Percentile 0^{th} =minimum

1

11

24

29 → Percentile 25^{th} =(29+36)/2= 32.5

36

41

45

49 → Median =(49+51)/2=50

51

55

59

64 → Percentile 75^{th} =(64+71)/2=67.5

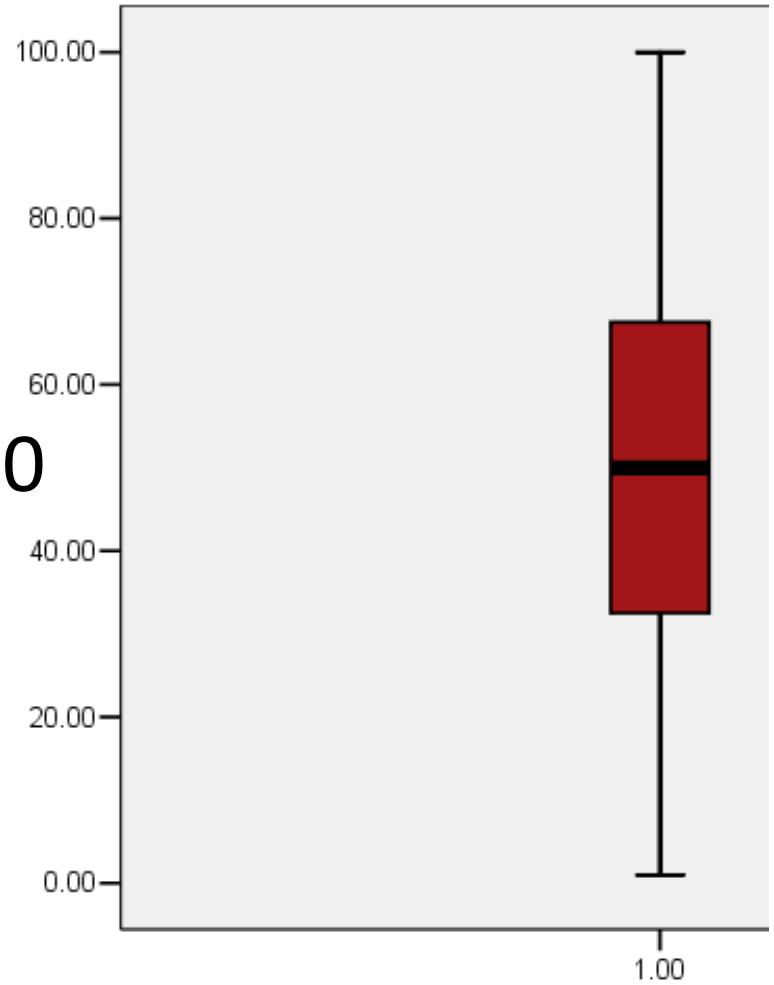
71

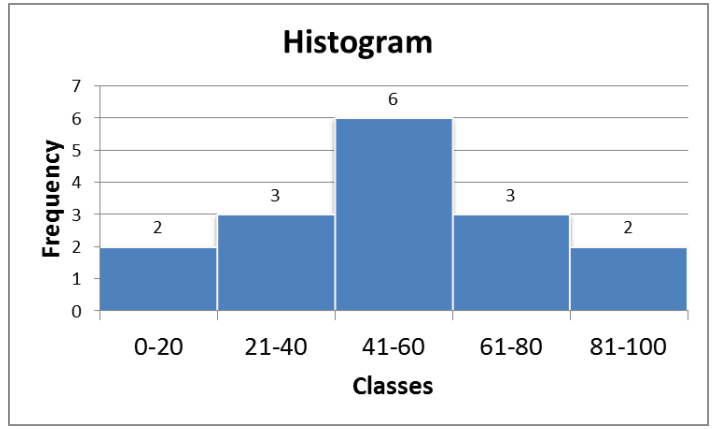
76

88

Percentile 100^{th} =maximum

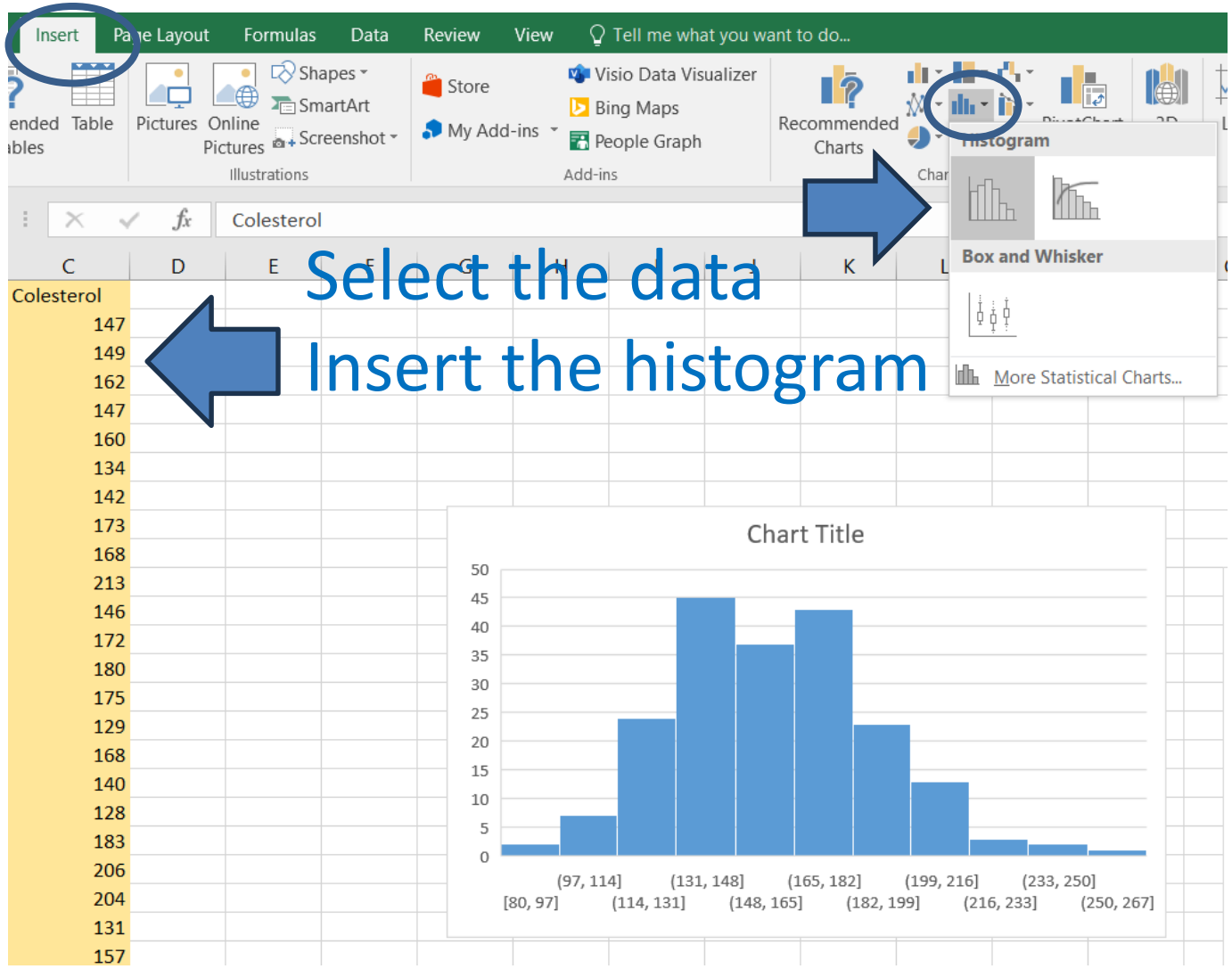
100





Centrality measurements	Functions	Formulas
Arithmetic mean	=AVERAGE(ARRAY)	
Median	=MEDIAN(ARRAY)	
Mode	=MODE.MULT(ARRAY) =MODE.SINGL(ARRAY)	
Central value		=(MAX(ARRAY)+MIN(ARRAY))/2
Dispersion		
Range		=MAX(ARRAY)-MIN(ARRAY)
Variation	=VAR.S(ARRAY)	
Standard deviation	=STDEV.S(ARRAY) =SQRT(VAR.S(ARRAY))	
Standard error		=STDEV.S(ARRAY)/SQRT(COUNT(ARRAY))
Coeficient of variation		CV =STDEV.S(ARRAY)/AVERAGE(ARRAY) CQV =(QUARTILE.INC(ARRAY,3)- QUARTILE.INC(ARRAY,1))/(QUARTILE.INC(ARRAY,3) +QUARTILE.INC(ARRAY,1))
Asymmetry		
Asymmetry	=SKEW(ARRAY)	
Kurtosis	=KURT(ARRAY)	

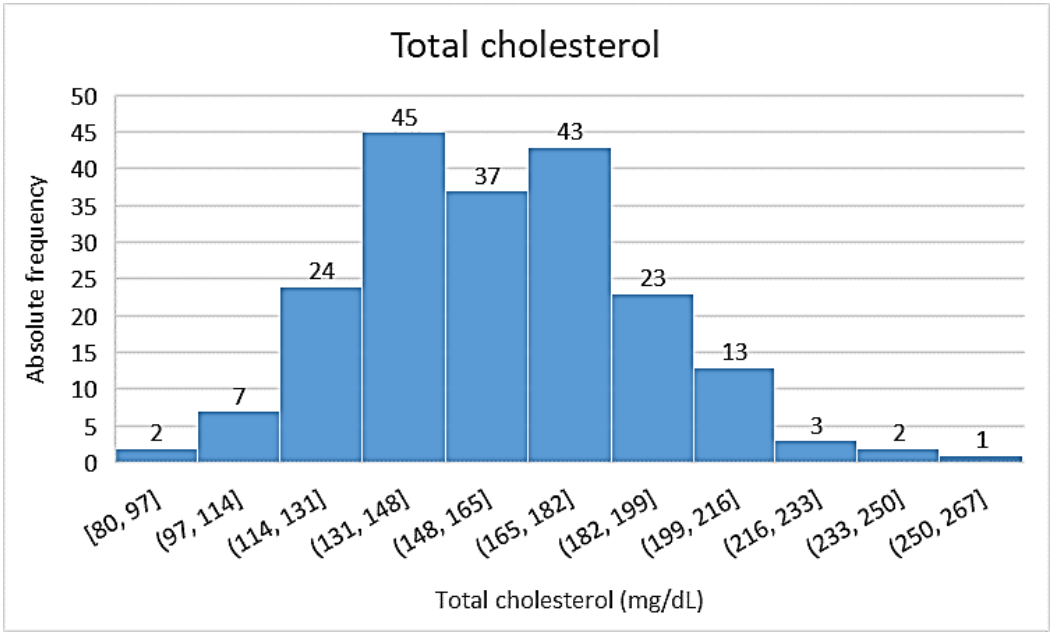
where ARRAY is the selection of cells containing the values of the variable of interest.



Select the data

Insert the histogram

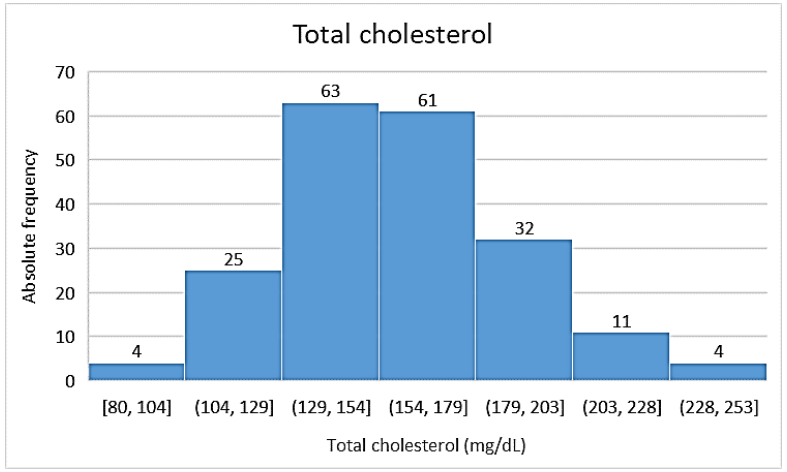
add title and axis titles

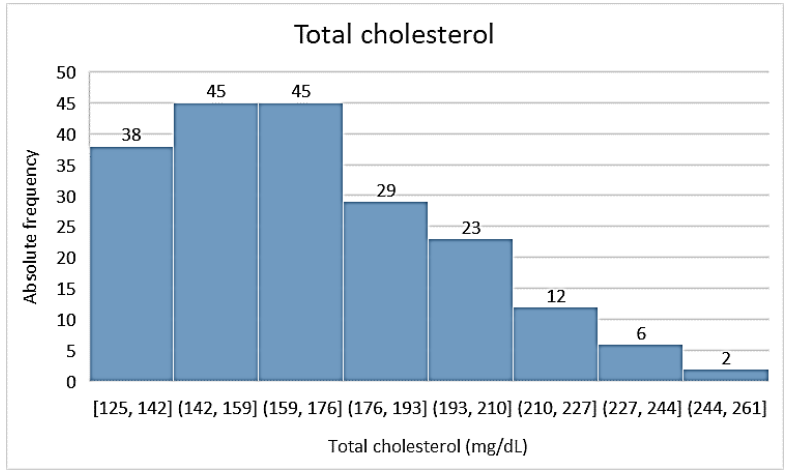


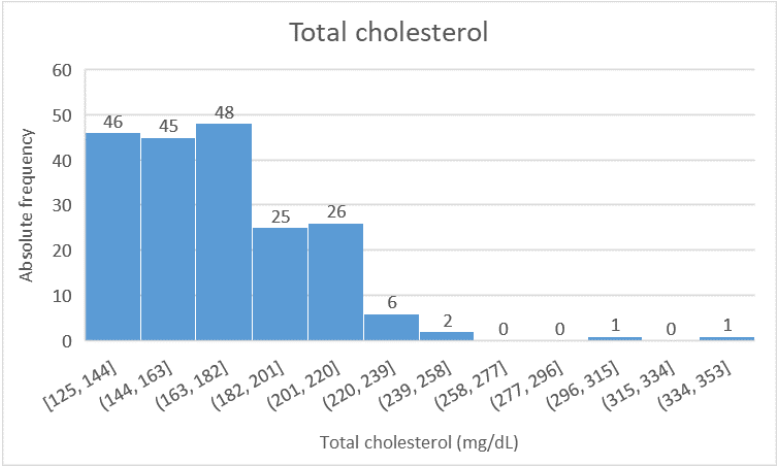
Variable name → Ox axis, “No. of subjects” or “Absolute frequency” → Oy axis.
Axis Ox must have unity of measurements!!!

Interpretations (see also Lecture about distributions)

- asymmetry
- peakedness, flatness, tailedness
- outliers, extreme cases
- distribution shape







Summarizing Numerical Data (Continuous, Discrete)

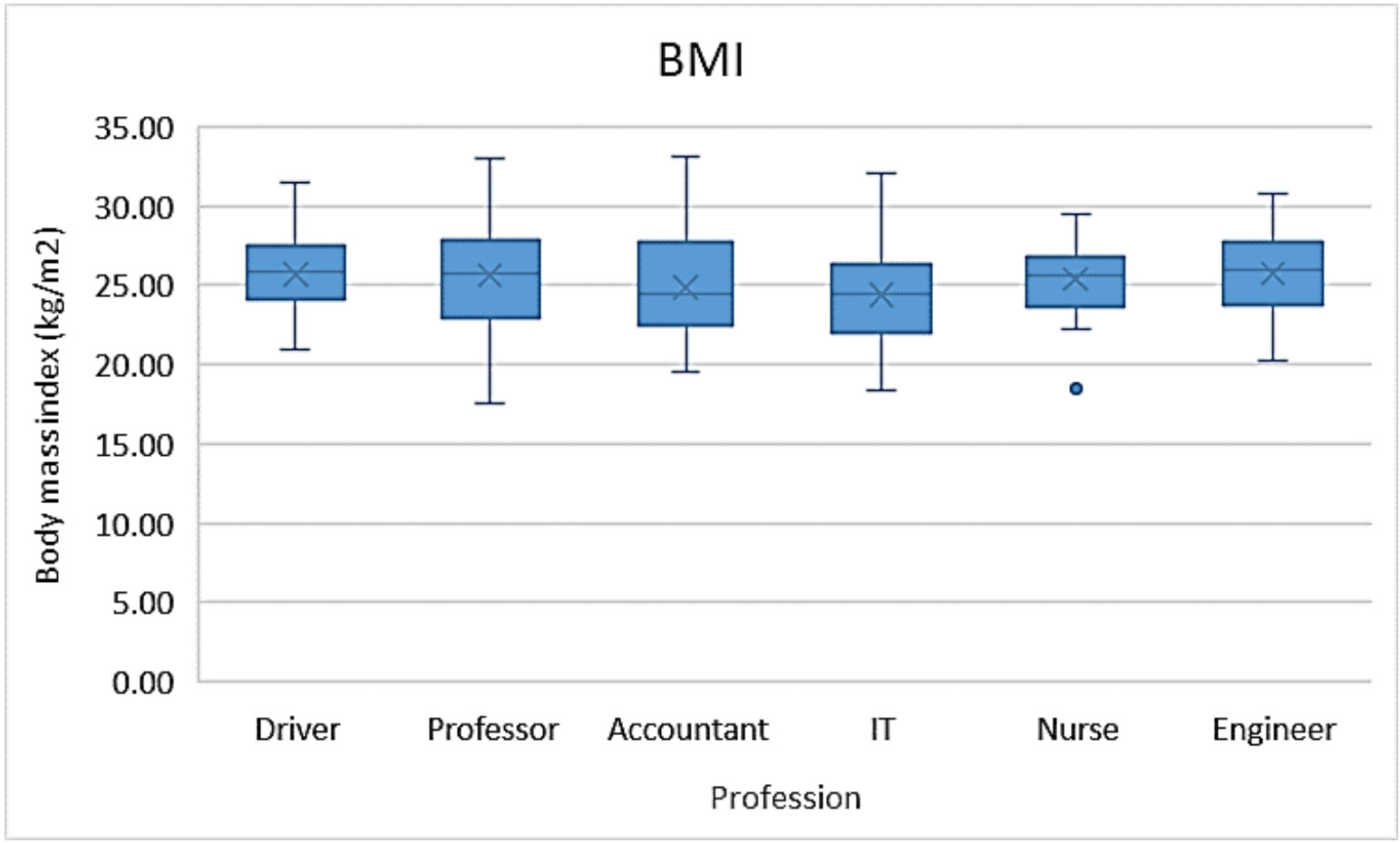
- Measure of central tendency
  - Arithmetic mean
  - Median
  - Mode
- Measure of spread
  - Variances
  - Standard Deviation
  - Coefficient of variation
  - Standard error
- Other measures
  - Skewness
  - Kurtosis
  - Quartile
  - Percentile
- Charts
  - Histograms (continuous)
  - Columns /bar (discrete)

The relationship between two variables (from which one is quantitative or both are quantitative)

The relationship between two variables (one quantitative, one qualitative)

	A	B
1	Profession	Body mass index
2	Driver	25.66
3	Driver	27.45
4	Driver	22.33
5	Driver	26.27
6	Driver	25.96
7	Driver	25.24
8	Driver	25.05
9	Driver	28.19
10	Driver	31.52
11	Driver	28.07
12	Driver	23.36
13	Driver	21.99
14	Driver	25.80
15	Driver	25.81
16	Driver	24.39
17	Driver	20.90
18	Driver	26.76
19	Driver	27.68
20	Professor	32.98
21	Professor	31.10
22	Professor	23.72
23	Professor	28.09
24	Professor	22.92
25	Professor	25.76
26	Professor	21.38
27	Professor	19.13
28	Professor	25.28
29	Professor	27.47
30	Professor	24.89

- Box-whisker plot



The relationship between two variables (one quantitative, one qualitative)

- Box-whisker plot

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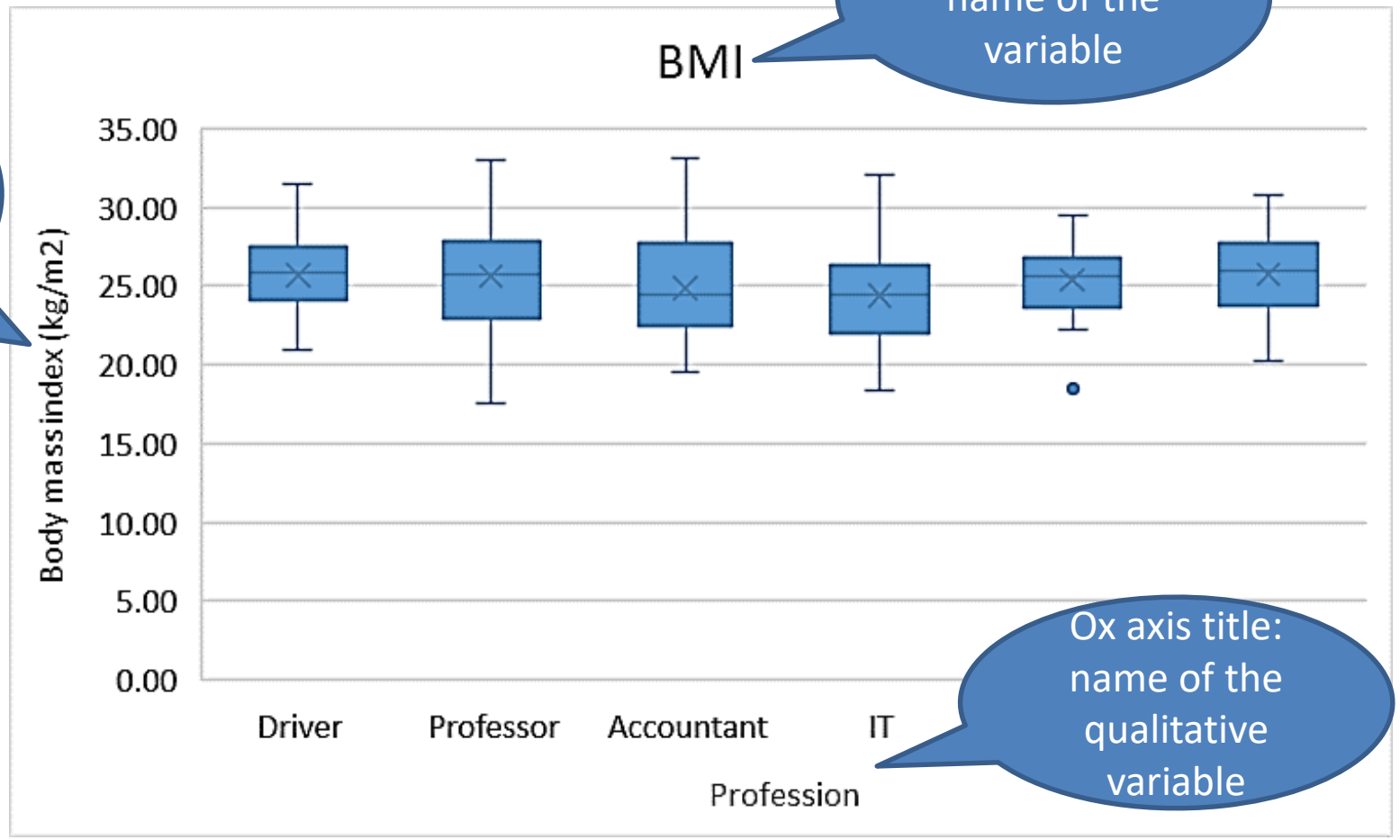
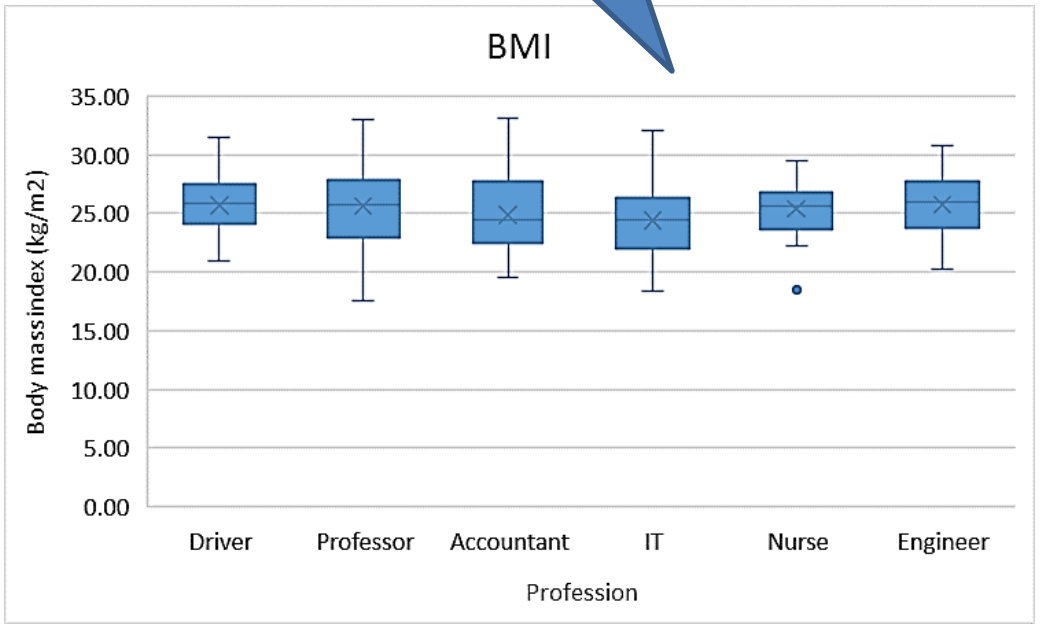
11	Driver	
12	Driver	
13	Driver	
14	Driver	
15	Driver	
16	Driver	
17	Driver	
18	Driver	26.76
19	Driver	27.68
20	Professor	32.98
21	Professor	31.10
22	Professor	23.72
23	Professor	28.09
24	Professor	22.92
25	Professor	25.76
26	Professor	21.38
27	Professor	19.13
28	Professor	25.28
29	Professor	27.47
30	Professor	24.89

Oy Axis title: name of the quantitative variable and unity of measurements!!!

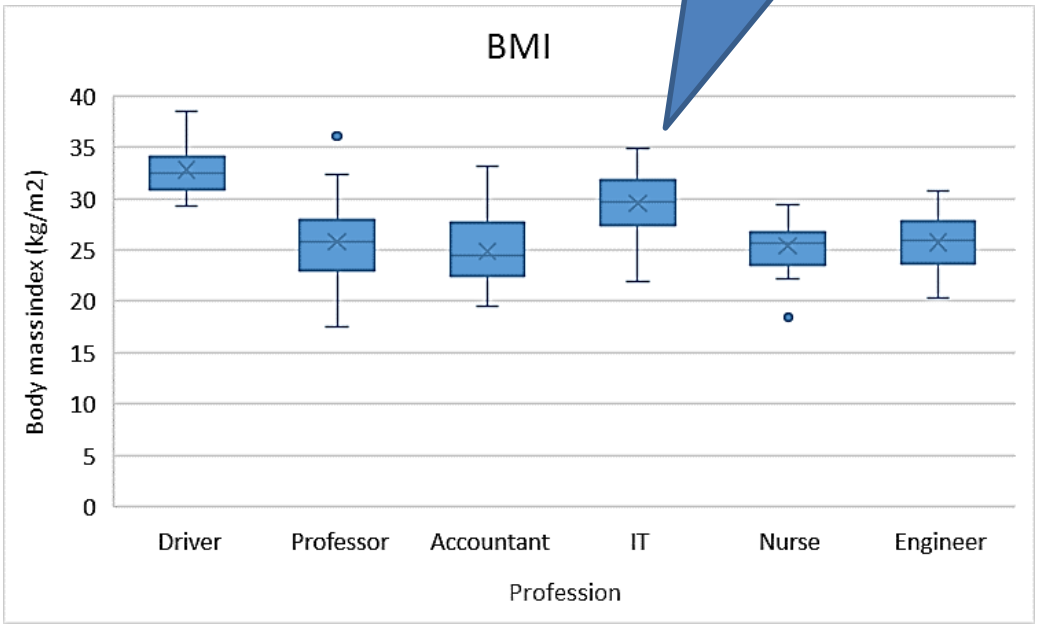


Interpretation (see also lecture about statistical tests)

No major differences between professions about the distribution of BMI



Drivers and IT had higher BMI than the other professions



Statistics - two variables (one quantitative, one qualitative)

Professions

BMI (kg/m^2)	IT	Driver	Professor	Accountant	Nurse	Engineer
Mean	29.82	32.79	25.77	24.83	25.38	25.72
Standard Error	0.50	0.60	0.77	0.75	0.46	0.49
Median	29.78	32.54	25.73	24.50	25.67	26.00
Mode	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Standard Deviation	2.55	2.53	3.95	3.53	2.44	2.63
Sample Variance	6.53	6.38	15.58	12.44	5.95	6.90
Kurtosis	-0.57	0.38	1.12	0.05	1.03	-0.52
Skewness	-0.06	0.66	0.35	0.54	-0.51	-0.25
Range	10.51	9.16	18.56	13.63	11.01	10.51
Minimum	24.43	29.28	17.51	19.51	18.46	20.27
Maximum	34.93	38.44	36.07	33.13	29.47	30.78
Sum	775	590	670	546	710	745
Count	26	18	26	22	28	29

there is not one value with the highest frequency

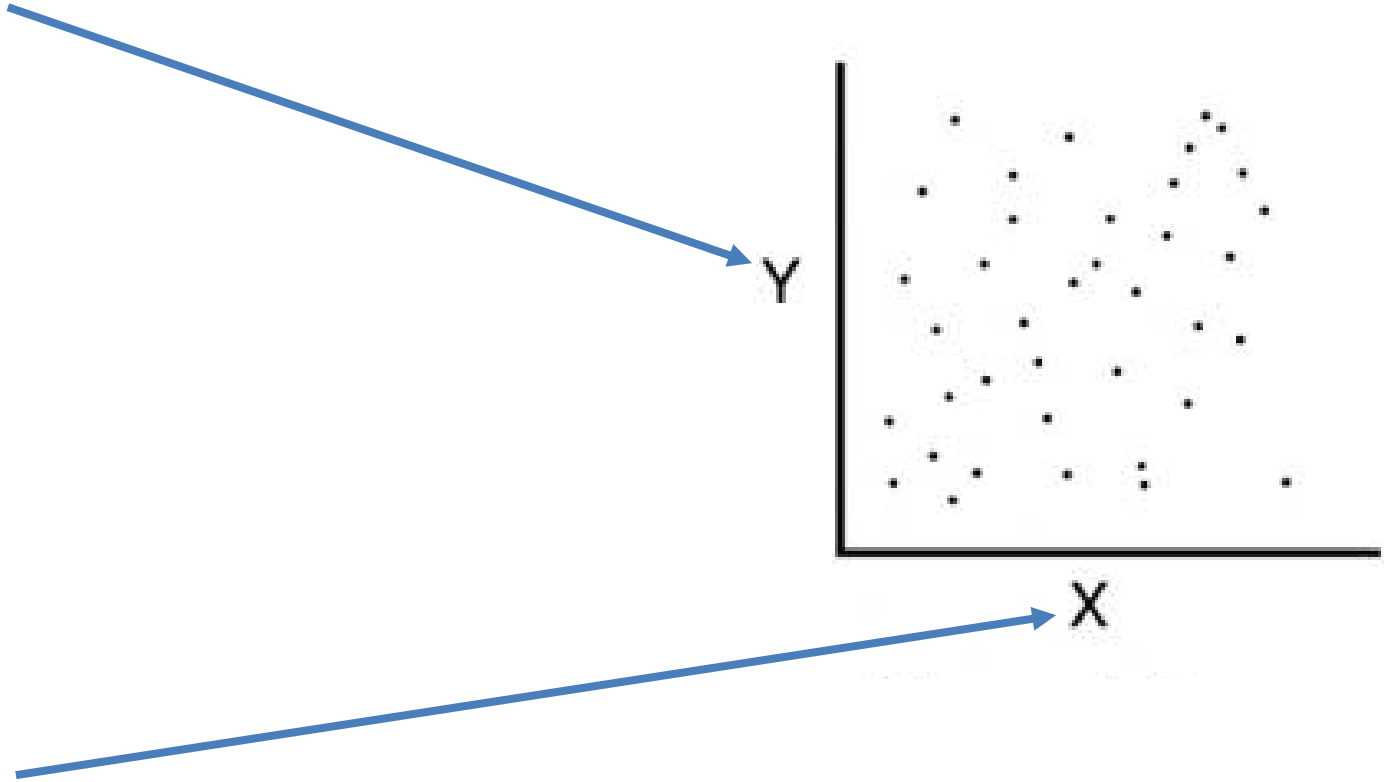
no. of people in each group

XY Scatter chart

- The relationship between two quantitative or ordinal (scores) characteristics
- How is the relationship?

XY scatter chart

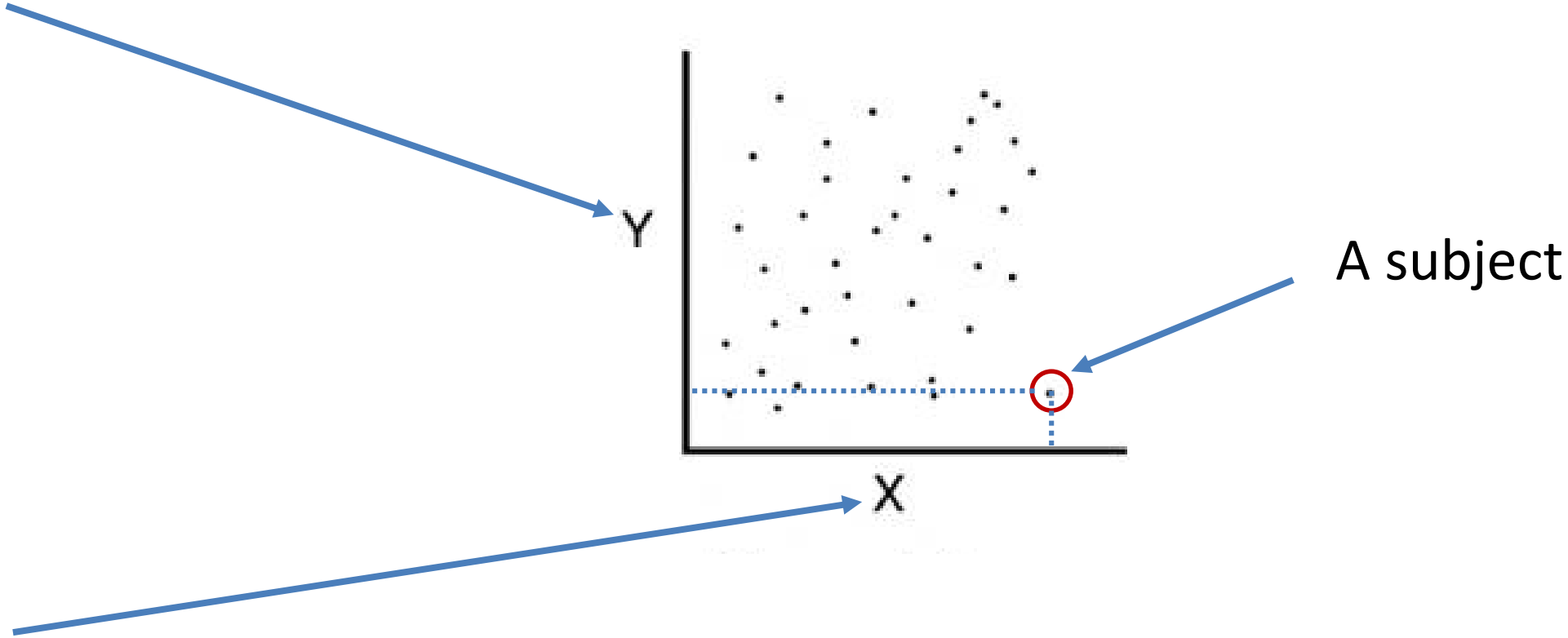
Y – quantitative variable or ordinal (score)



X – quantitative variable or ordinal (score)

XY scatter chart

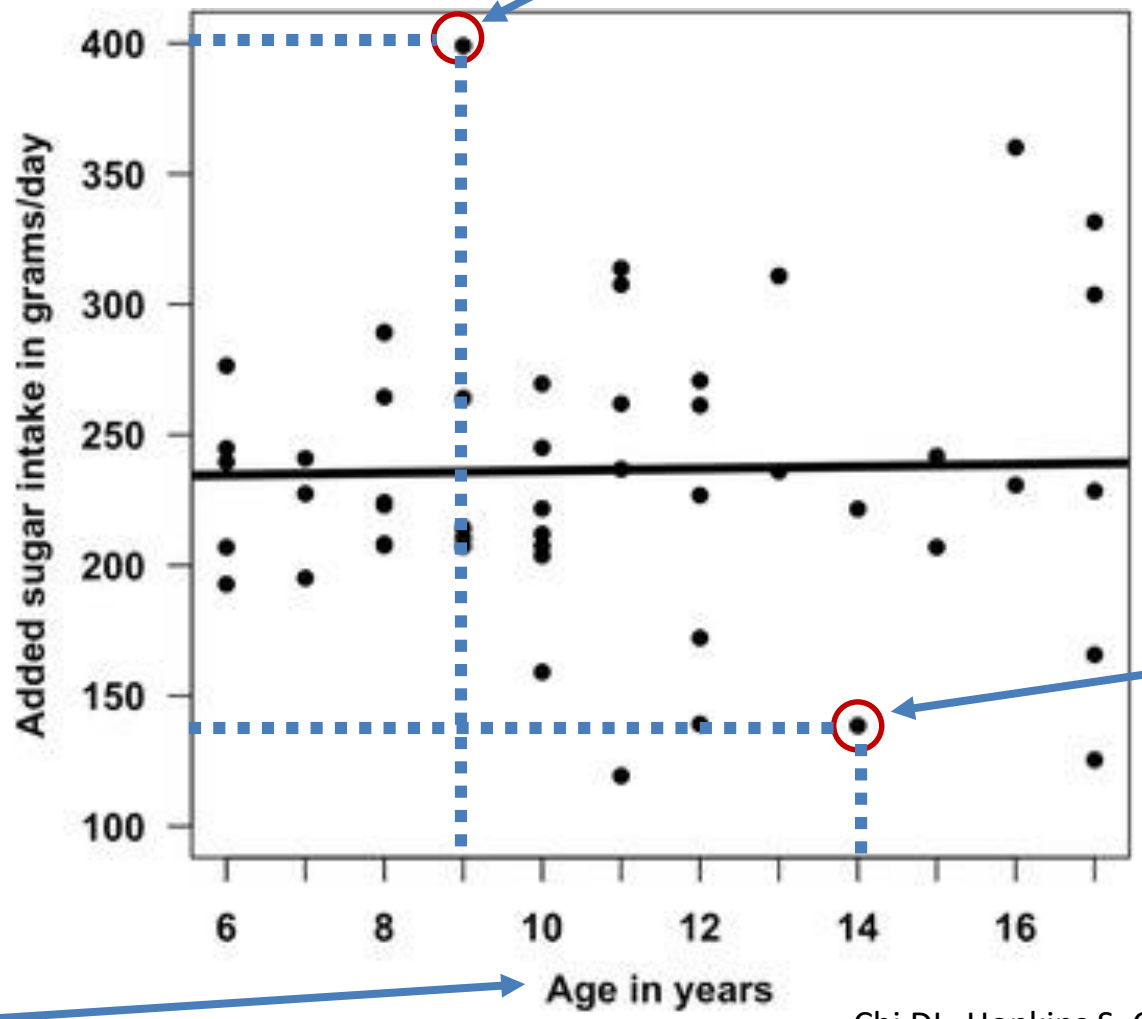
Y – quantitative variable or ordinal (score)



X – quantitative variable or ordinal (score)

Y – quantitative variable - Sugar intake

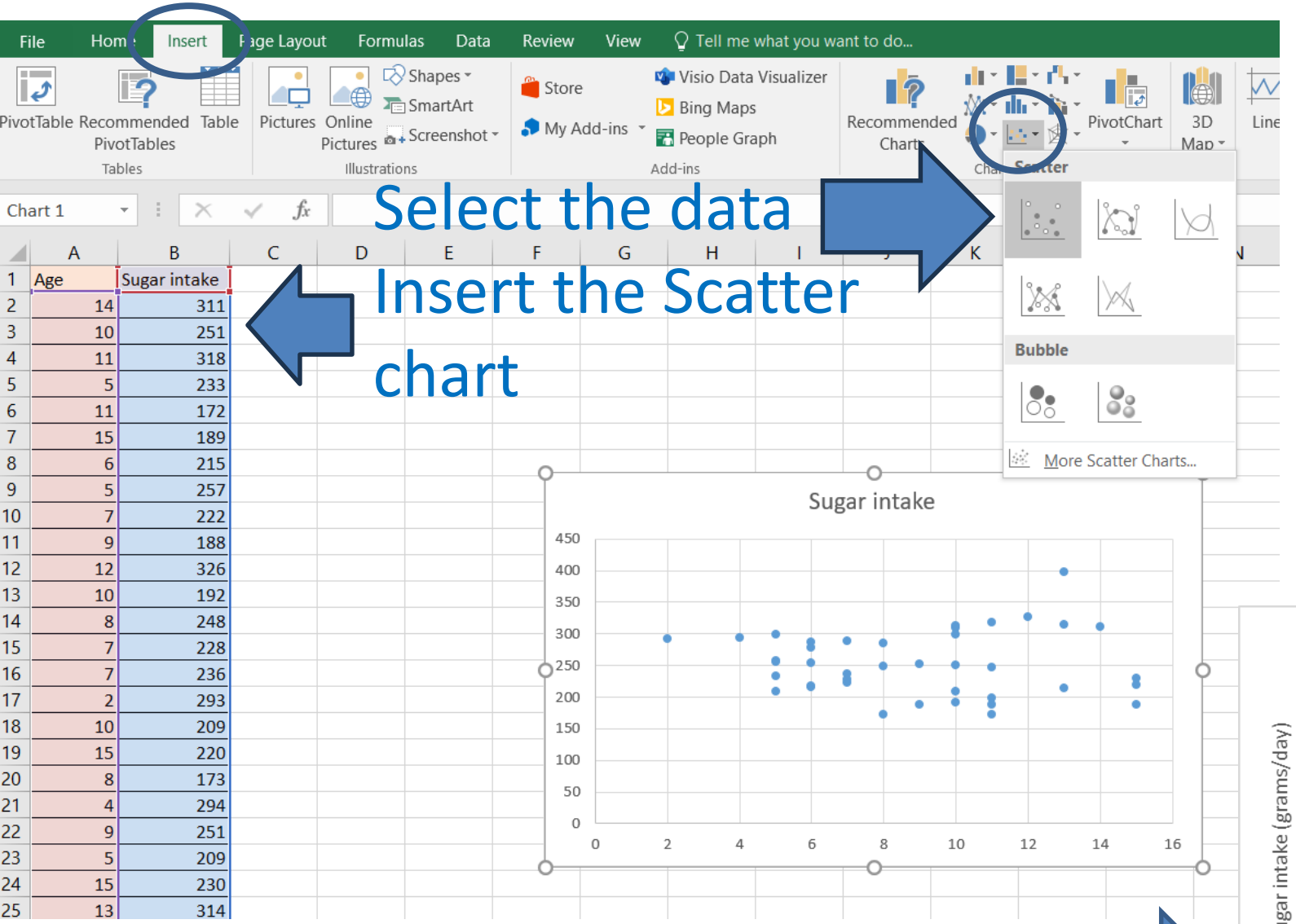
A subject with age=9 years and 400 grams/days sugar intake



A subject with age=14 years and 140 grams/days sugar intake

X – quantitative variable - Vârsta

Chi DL, Hopkins S, O'Brien D, Mancl L, Orr E, Lenaker D. Association between added sugar intake and dental caries in Yup'ik children using a novel hair biomarker. BMC Oral Health. 2015 Oct 9;15(1):121.

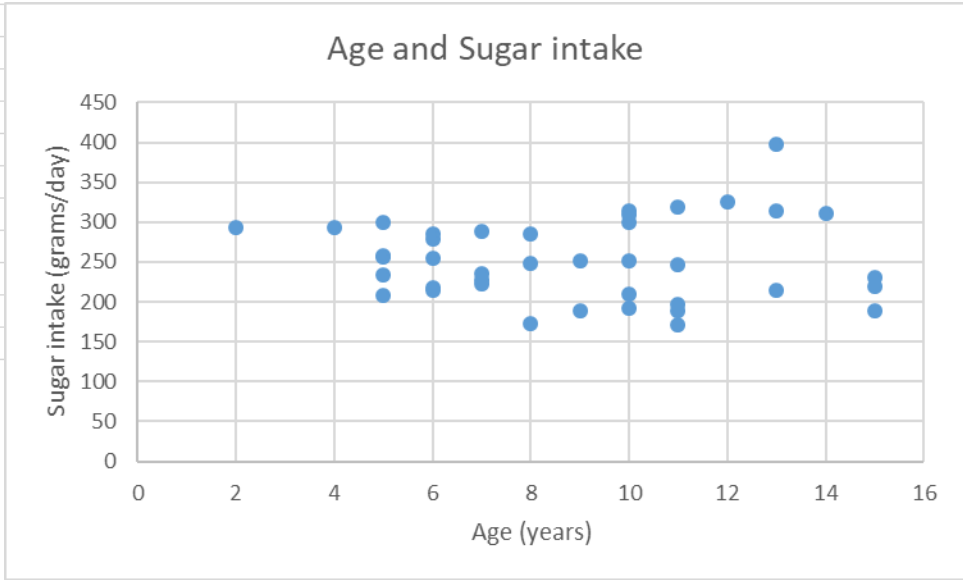


	A	B
1	Age	Sugar intake
2	14	311
3	10	251
4	11	318
5	5	233
6	11	172
7	15	189
8	6	215
9	5	257
10	7	222
11	9	188
12	12	326
13	10	192
14	8	248
15	7	228
16	7	236
17	2	293
18	10	209
19	15	220
20	8	173
21	4	294
22	9	251
23	5	209
24	15	230
25	13	314

Select the data

Insert the Scatter chart

add title and axis titles



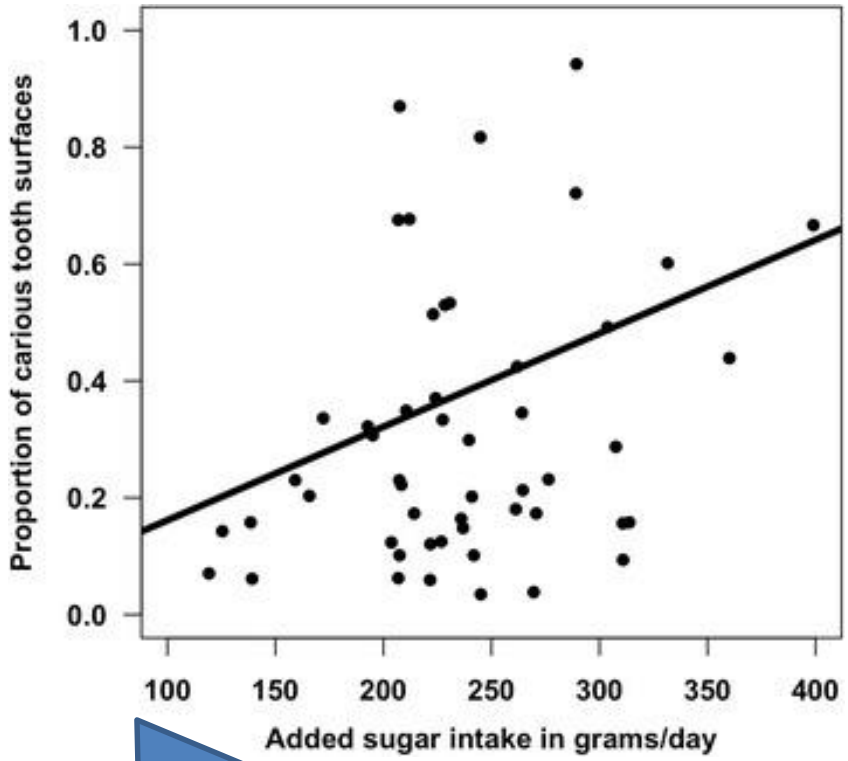
First variable → Ox axis, second variable → Oy axis.
Each axis must have unity of measurements!!!

Scenario

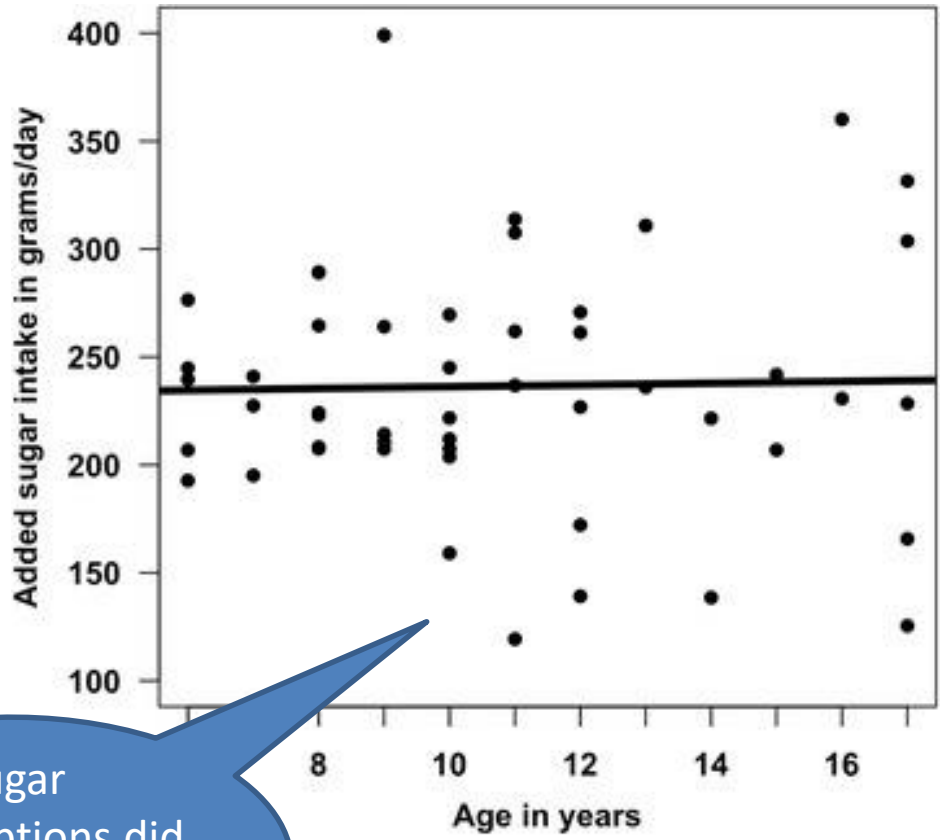
- In this study, they used a validated hair-based biomarker to measure added sugar intake in Alaska Native Yup’ik children ages 6–17 years (N = 51). They want to demonstrate “that added sugar intake would be positively associated with tooth decay”.

[Chi DL, Hopkins S, O'Brien D, Mancl L, Orr E, Lenaker D. Association between added sugar intake and dental caries in Yup'ik children using a novel hair biomarker. BMC Oral Health. 2015 Oct 9;15(1):121.]

Interpretations (see also Lecture about correlation)



Proportions of carious tooth surface depend on the quantity of sugar intake, quantity increase, surface increase too



Sugar consumptions did not depend by age

[Chi DL, Hopkins S, O'Brien D, Mancl L, Orr E, Lenaker D. Association between added sugar intake and dental caries in Yup'ik children using a novel hair biomarker. BMC Oral Health. 2015 Oct 9;15(1):121.]

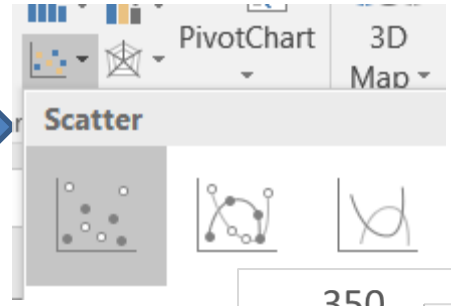
XY Scatter chart

- Two variables – can have different unities of measurements

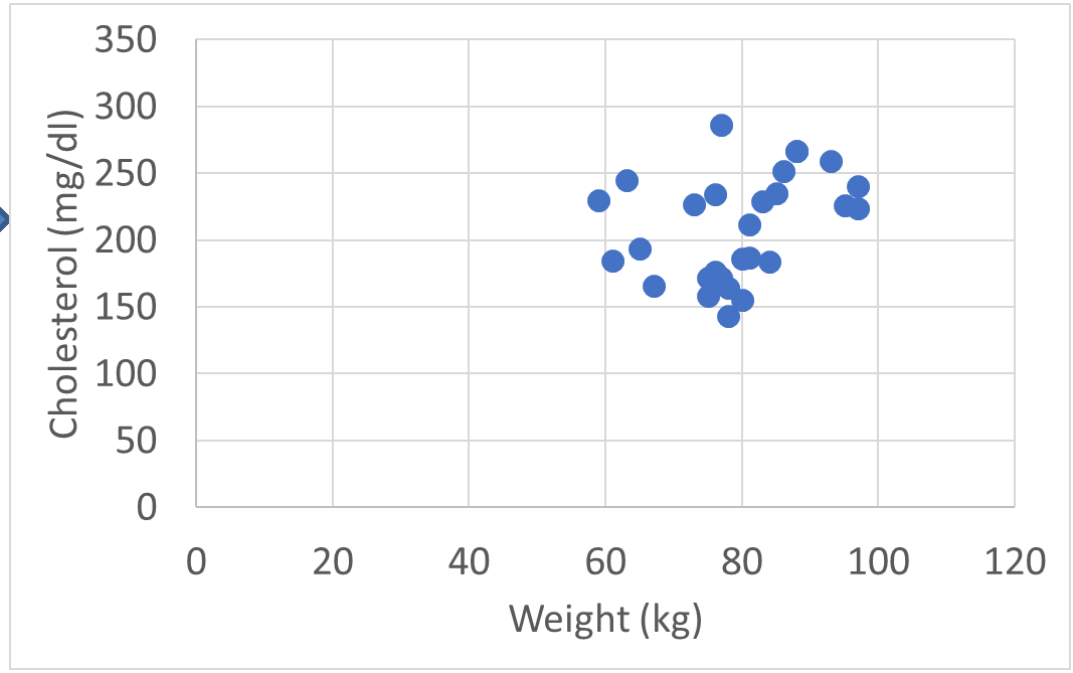
B	C
Weight (kg)	Cholesterol (mg/dL)
81	212
76	176
97	224
78	164
76	234
86	252
75	172
84	184
78	143
67	166
73	227
93	259
80	155
83	229
77	286
88	267
75	158
81	187
61	185
77	172
95	226
59	230
65	194

B	C
Weight (kg)	Cholesterol (mg/dL)
81	212
76	176
97	224
78	164
76	234
86	252
75	172
84	184
78	143
67	166
73	227
93	259
80	155
83	229
77	286
88	267
75	158
81	187
61	185
77	172
95	226
59	230
65	194
63	245
80	186
88	267
97	240

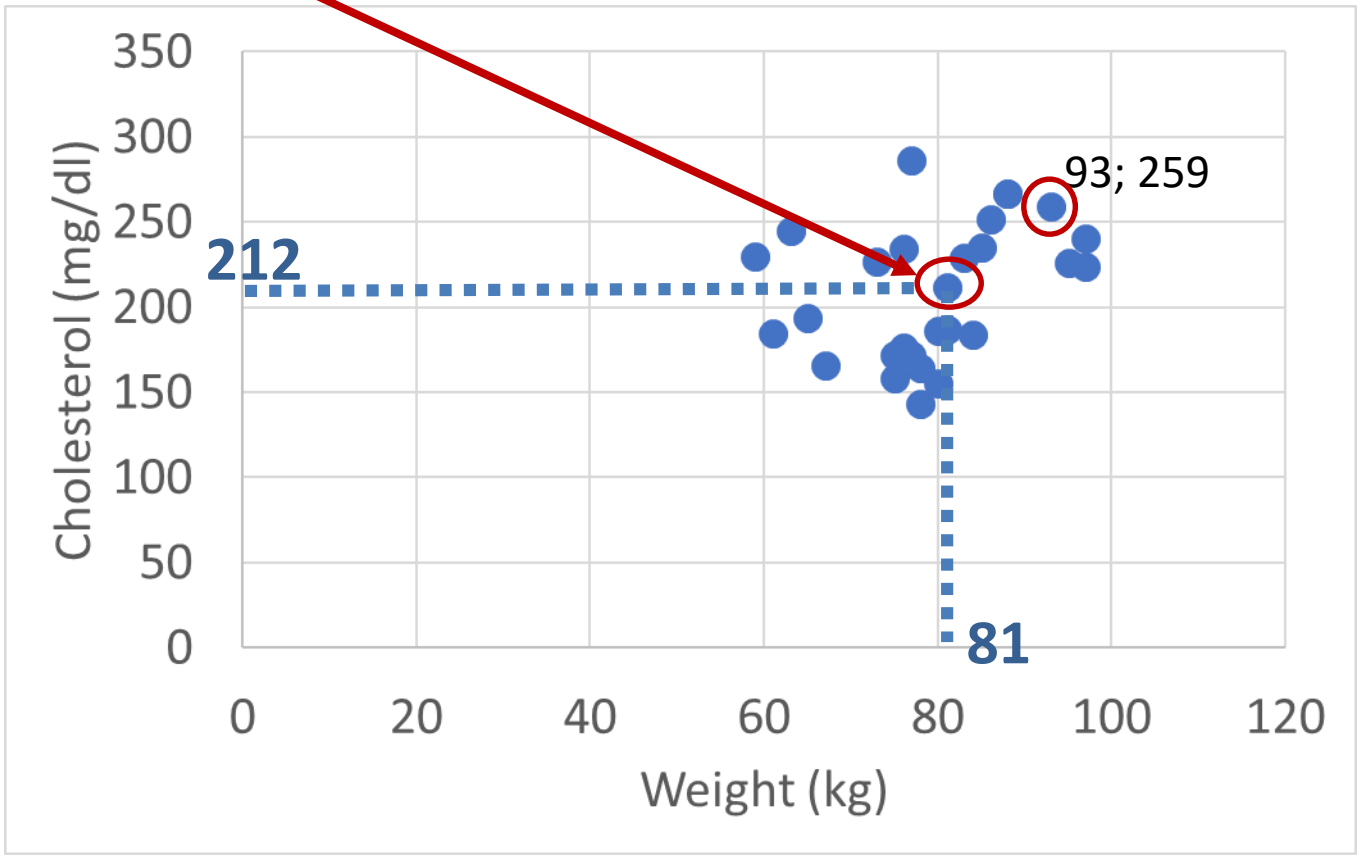
Select both column



Insert XY Scatter chart



B	C
Weight (kg)	Cholesterol (mg/dL)
81	212
76	176
97	224
78	164
76	234
86	252
75	172
84	184
78	143
67	166
73	227
93	259
80	155
83	229
77	286
88	267
75	158
81	187
61	185
77	172
95	226
59	230
65	194
63	245
80	186
88	267
97	240
85	235



Reccomendations

- A table should be self-explanatory.
  - Title
  - Definitions of columns
  - Definitions of rows
  - Units of measurements in the titles of each column / row (if it is applied)

Reccomendations

- A table should be self-explanatory.
  - Abbreviations and symbols must be explained at the bottom of the table (in the legend)
  - Brief descriptive heading: what? when? where?
  - Total on rows and columns (if it is applied)

- Make it simple

  2 or 3 small tables instead of one big table

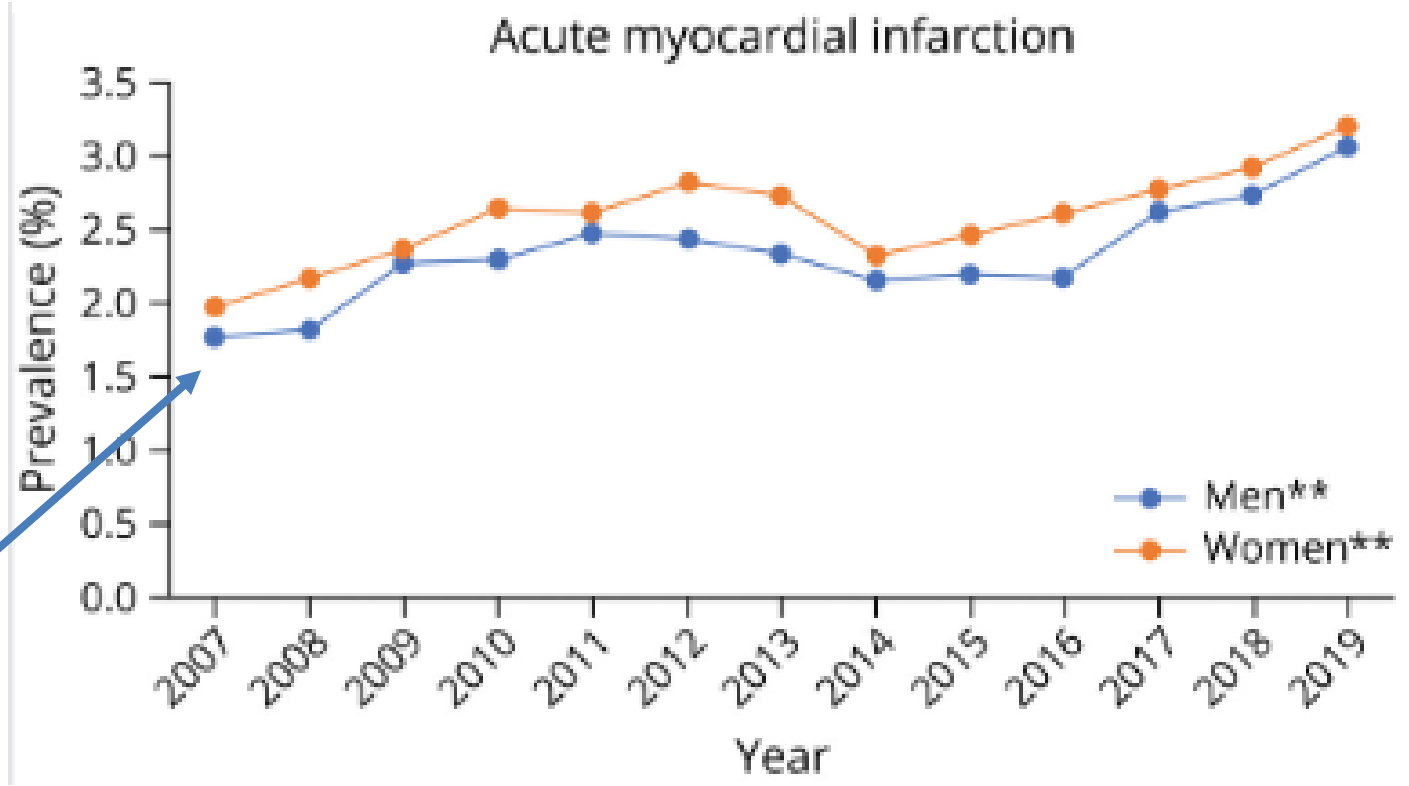
Reccomendations

- A chart should be self-explanatory.
  - Title
  - Definitions of axes (if it is applied)
  - Units of measurements for each axis (if it is applied)
  - Legend (if it is applied)

Other charts

Line charts

- qualitative variable:
  - hypertension
- quantitative variable:
  - time



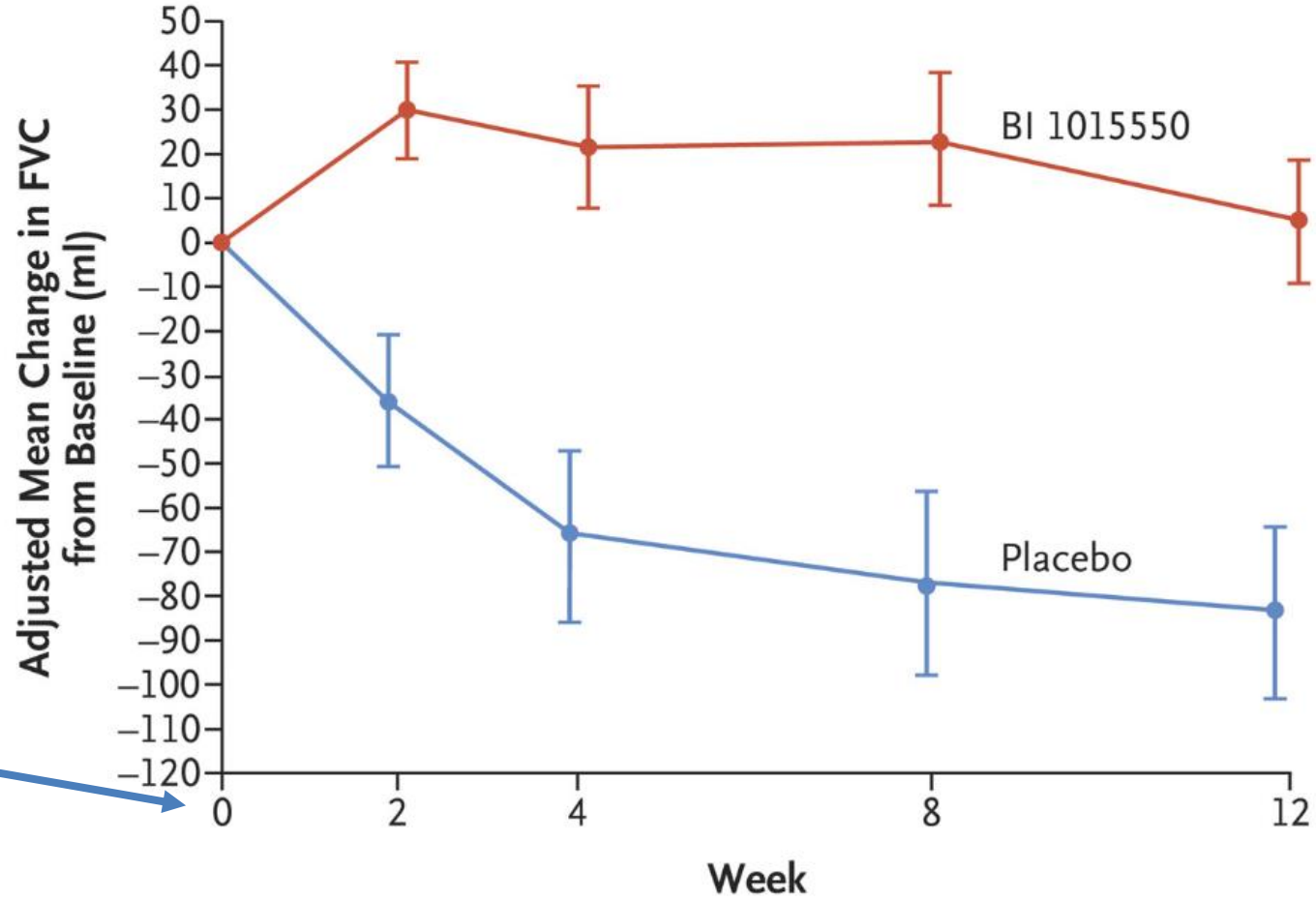
Trends in the frequency of nonInfectious complications after acute ischemic stroke admission in the united states according to sex

Ahmed R, Mhina C, Philip K, Patel SD, Aneni E, Osondu C, Lamikanra O, Akano EO, Anikpezie N, Albright KC, Latorre JG, Chaturvedi S, Otite FO. Age- and Sex-Specific Trends in Medical Complications After Acute Ischemic Stroke in the United States. Neurology. 2023 Mar 21;100(12):e1282-e1295.

Other charts

Line charts

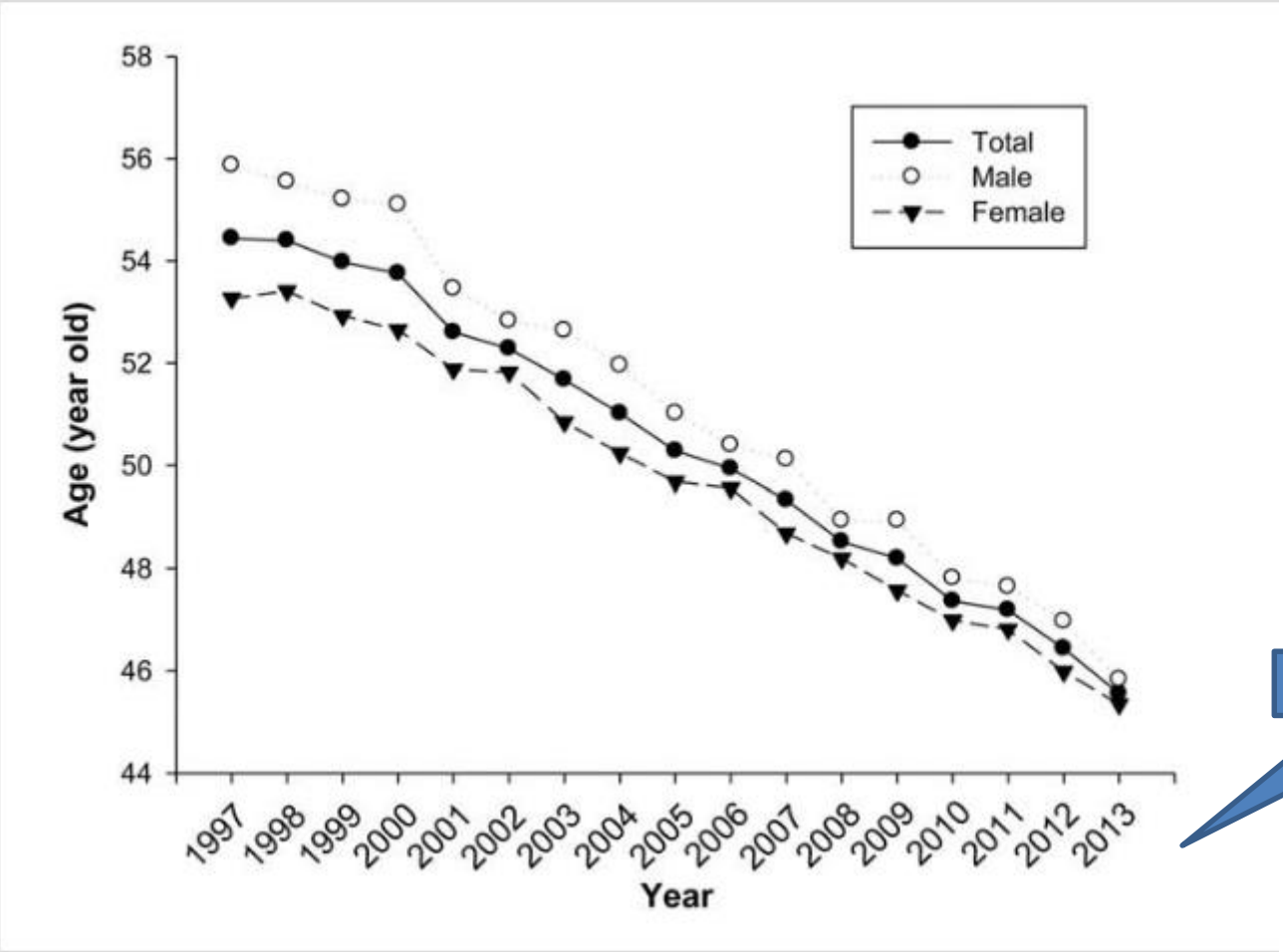
- quantitative variable:
  - FVC (forced vital capacity)
    - mean, standard error
- quantitative variable:
  - time



Change in FVC over time for subjects with BI 1015550 versus placebo

Richeldi L, Azuma A, Cottin V, Hesslinger C, Stowasser S, Valenzuela C, Wijsenbeek MS, Zoz DF, Voss F, Maher TM; 1305-0013 Trial Investigators. Trial of a Preferential Phosphodiesterase 4B Inhibitor for Idiopathic Pulmonary Fibrosis. N Engl J Med. 2022 Jun 9;386(23):2178-2187.

Line charts with arithmetic means

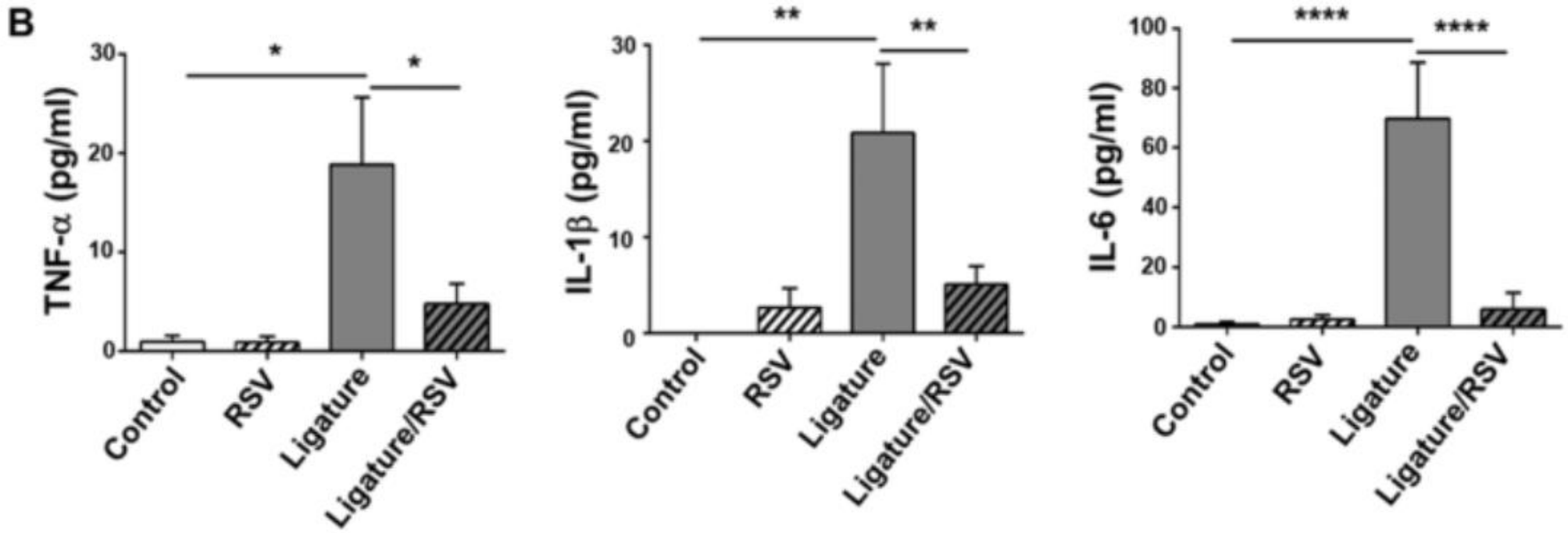


Mean age of patients with periodontitis in Taiwan. The mean age for periodontitis was shown a decrease pattern from 1997 to 2013.

Time

Yu HC, Su NY, Huang JY, Lee SS, Chang YC. Trends in the prevalence of periodontitis in Taiwan from 1997 to 2013: A nationwide population-based retrospective study. Medicine (Baltimore). 2017 Nov;96(45):e8585.

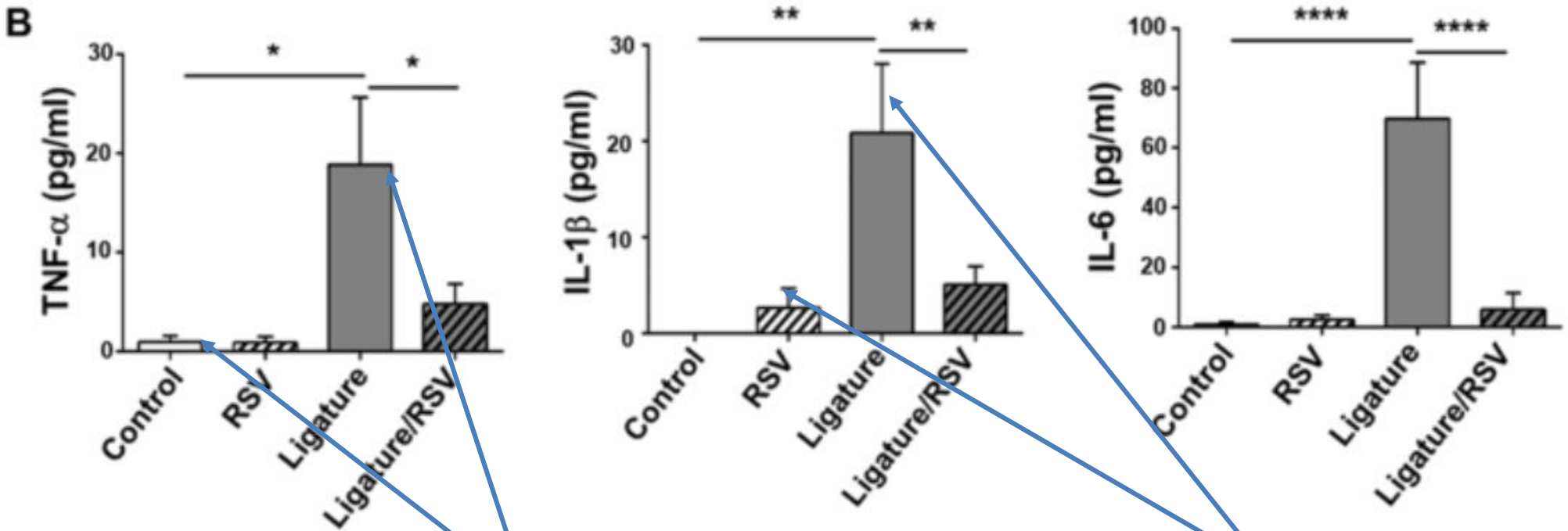
Mean error plot



- Ligature placement (paradontosis disease induced in mice) notably increased the serum levels of pro-inflammatory cytokines, and rosovastatin (RSV) completely inverted such increases.
- (**B**) Levels of TNF-α, IL-1β and IL-6 from the mice
- means + SE

Suh, J.S., Lee, S.H., Fouladian, Z. *et al.* Rosuvastatin Prevents the Exacerbation of Atherosclerosis in Ligature-Induced Periodontal Disease Mouse Model. *Sci Rep* **10**, 6383 (2020).

Mean error plot



arithmetic mean

Standard error – the variation of the mean between different samples

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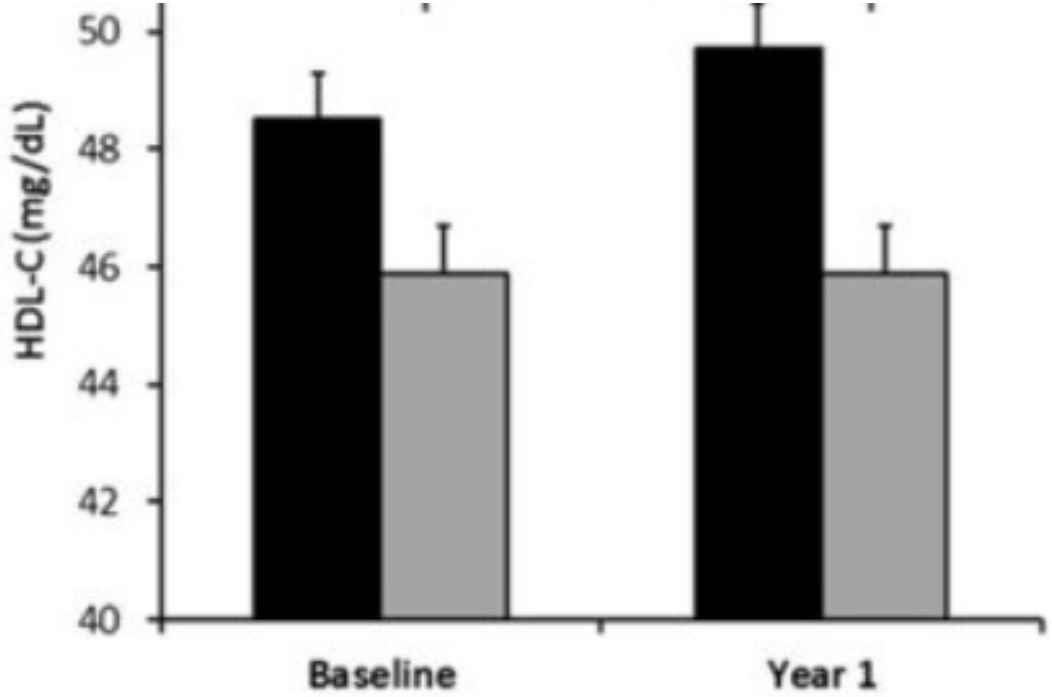
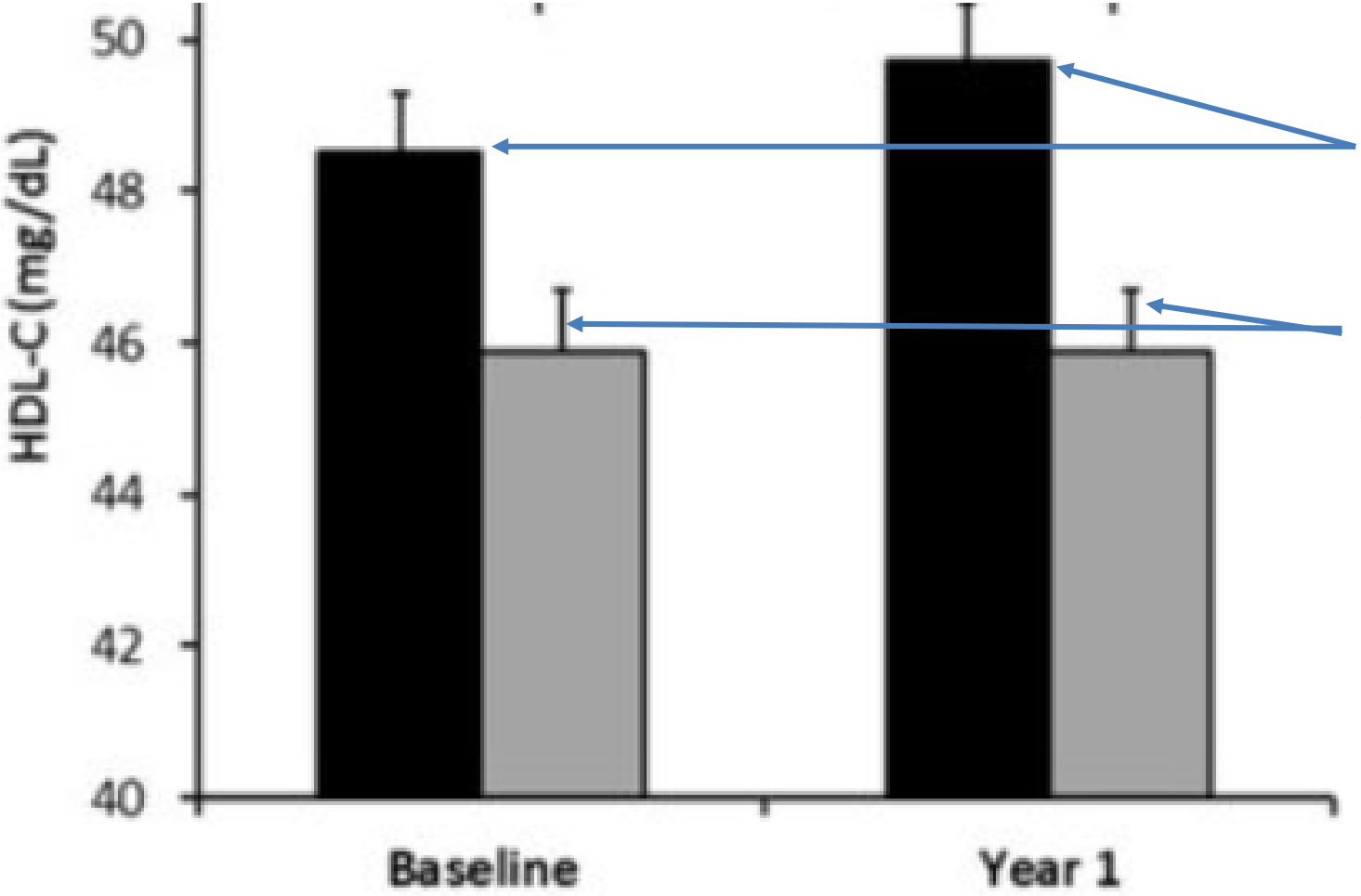


- Error-plot
- HDL-cholesterol in subjects treated with Metformin at baseline and after one year
- 221 African Americans

Zhang C, Gao F, Luo H, Zhang CT, Zhang R. Differential response in levels of high-density lipoprotein cholesterol to one-year metformin treatment in prediabetic patients by race/ethnicity. Cardiovasc Diabetol. 2015 Jun 12;14:79.

- Error-plot



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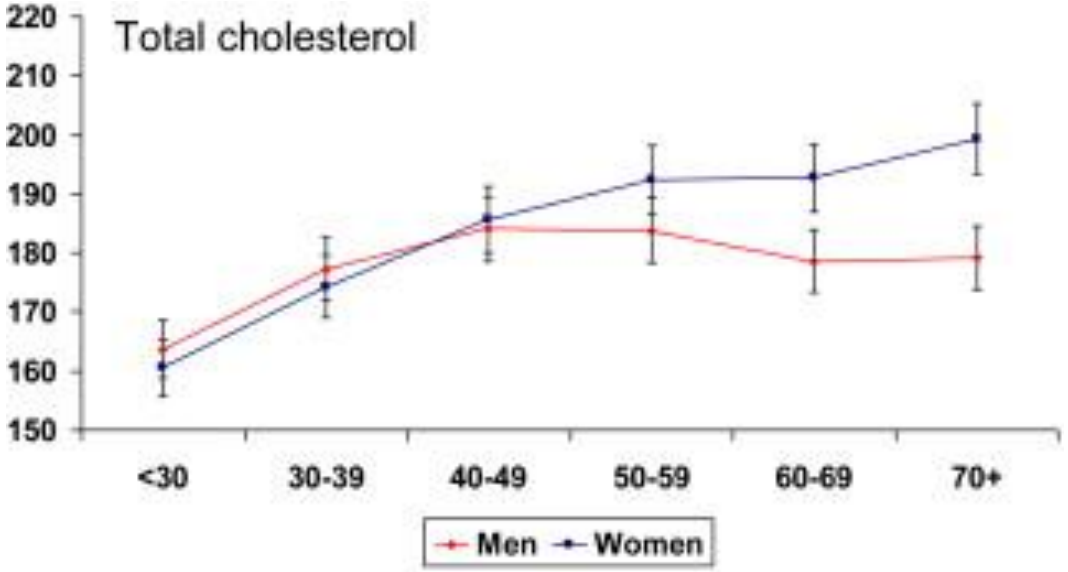
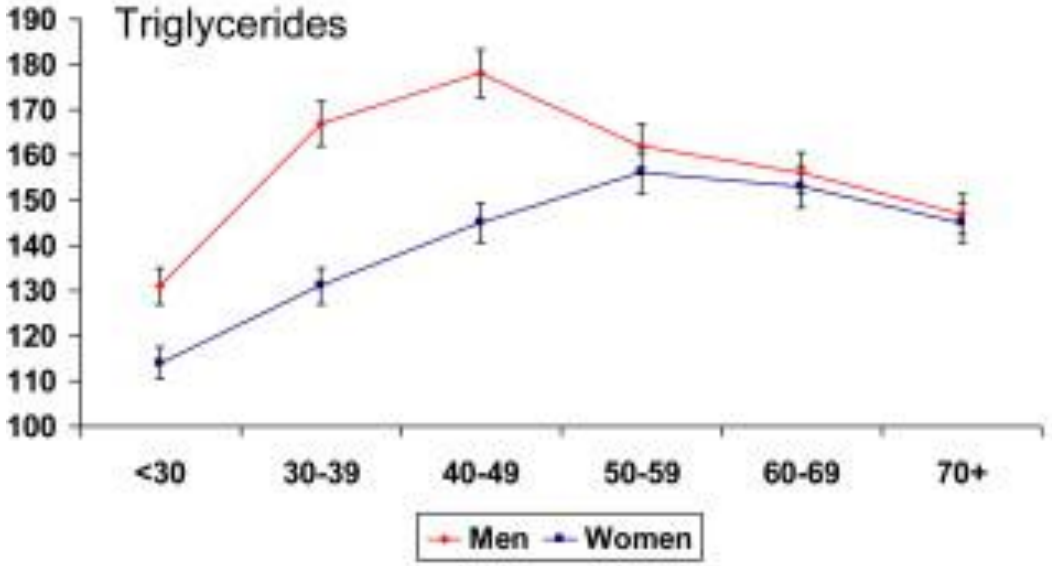
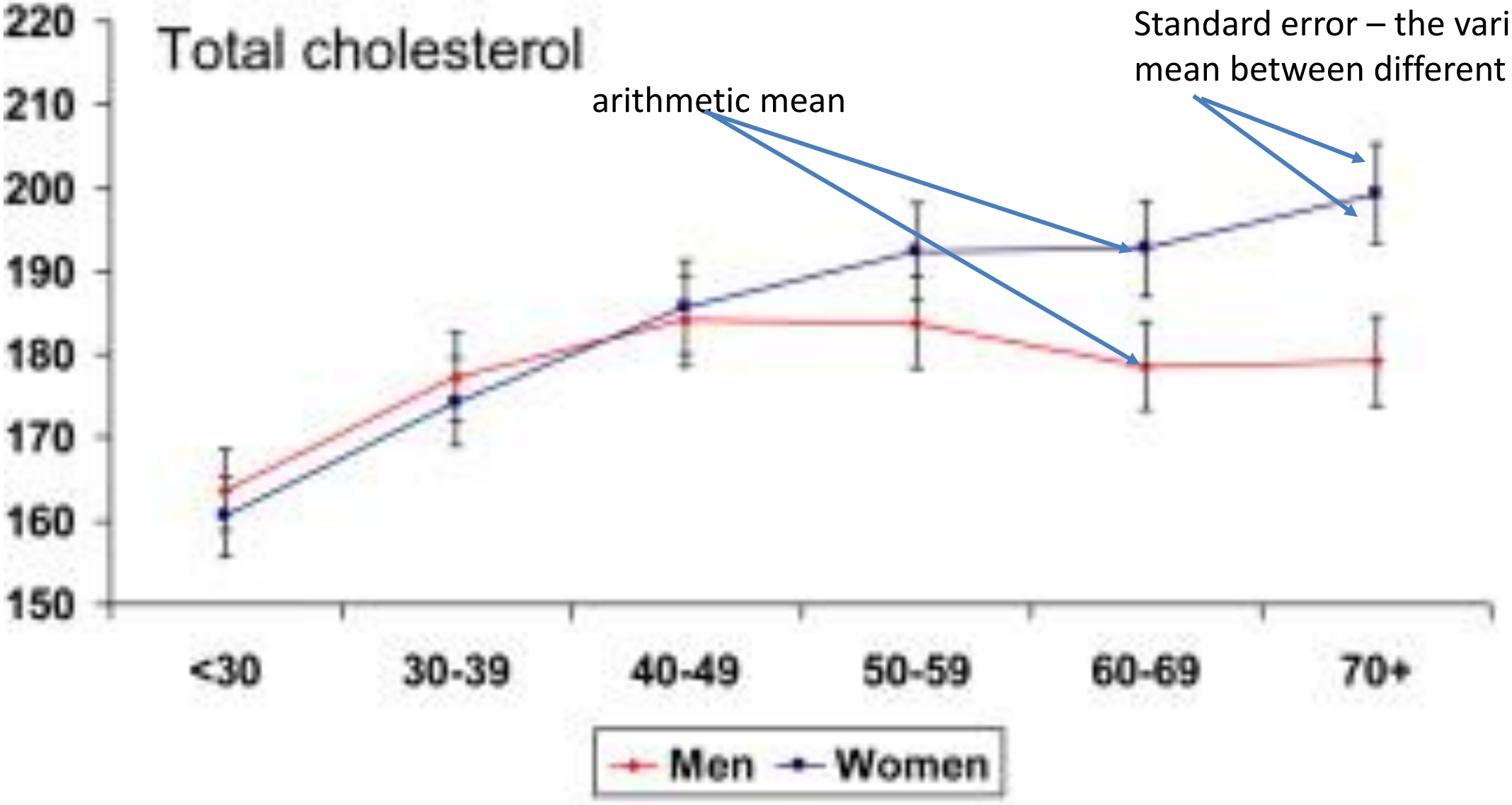




- 6123 subjects (men 3388)
- Age-group specific levels of total cholesterol, triglycerides (mg/dl) in women and men.

Guptha S, Gupta R, Deedwania P, Bhansali A, Maheshwari A, Gupta A, Gupta B, Saboo B, Singh J, Achari V, Sharma KK. Cholesterol lipoproteins and prevalence of dyslipidemias in urban Asian Indians: a cross sectional study. Indian Heart J. 2014 May-Jun;66(3):280-8.



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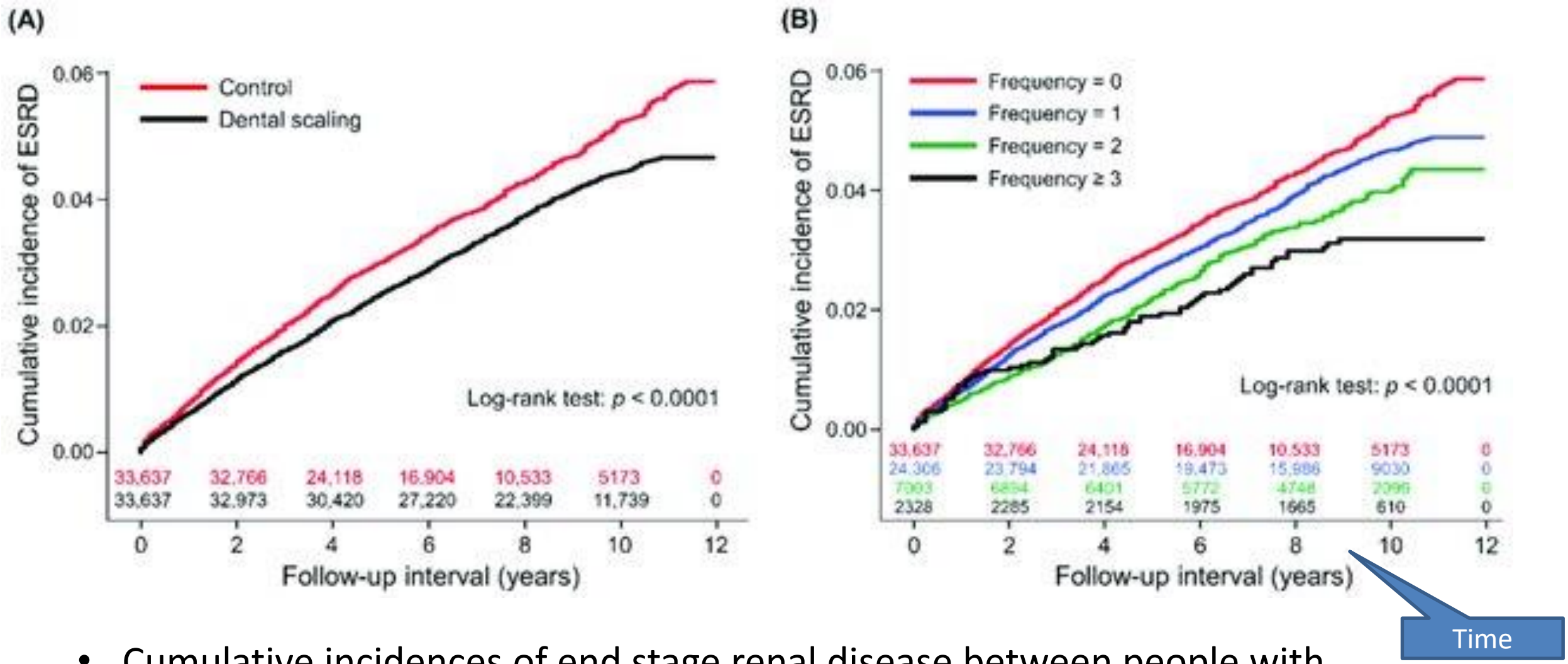

- Cumulative incidences of end stage renal disease between people with periodontitis and without dental scaling treatment (A), and with a varying frequency of dental scaling (B), with the number of subjects at risk.

Chung YH, Kuo HC, Liu HY, Wu MY, Chang WJ, Chen JT, Cherng YG, Chen TJ, Dai YX, Wu HL, Liu WC, Tai YH. Association between Dental Scaling and Reduced Risk of End-Stage Renal Disease: A Nationwide Matched Cohort Study. Int J Environ Res Public Health. 2021 Aug 24;18(17):8910.

Summarizing Numerical Data (Continuous, Discrete)

One quantitative variable

- Measure of centrality
  - Arithmetic mean
  - Median
  - Mode
- Measure of spread
  - Variances
  - Standard Deviation
  - Coefficient of variation
  - Standard error
- Measures of asimmetry
  - Skewness
  - Kurtosis
- Measures of location
  - Quartiles
  - Percentiles
- Charts
  - Histograms

Two quantitative variables

- Charts
  - XY Scatter
  - line charts

One qualitative, one quantitative variable

- Charts
  - Box-whiskers
  - Error plot
  - Line

Theoretical exam – example of questions

*In a study the researcher are interested in the oral hygiene of children. They ask 10 children (a sample) about the number of tooth brushing per day. These are their responses: 1, 2, 3, 2, 1, 0, 2, 0, 2, 2. Which of the following are the correct mean, standard deviation and coefficient of variation?

- A. 1.5, 0.97, 0.65
- B. 1.5, 0.92, 0.61
- C. 1.5, 0.97, 0.31
- D. No answer is correct
- E. 1.5, 0.85, 0.57

Theoretical exam – example of questions

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Theoretical exam – example of questions

*In a study the researcher measure the degree of upper first right premolar inclination for 10 patients. They obtain 10 different values of the tooth inclination, one for each patient: 11, 13, 12, 17, 14, 9, 8, 11, 10, 7. Arithmetic mean is 11.2, standard deviation is 2.97. How many data are in the interval mean±standard deviation (in percentages)? What is the minimum percentage of data in the interval mean±standard deviation to have a normal distribution? Which of the following are the correct answers?

- A. 60, 68.3
- B. 100, 95.4
- C. No answer is correct
- D. 70, 68.3
- E. 80, 95.4

Theoretical exam – example of questions

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Theoretical exam – example of questions

The following statements about median are TRUE:

- A. It is not affected by extreme values
- B. It is a useful parameter for nominal data
- C. Has a poor sample stability
- D. It is affected by the skewed distribution of data
- E. It is useful for qualitative ordinal data

Theoretical exam – example of questions

The following statements about median are TRUE:

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Double histogram for discrete variable: number of missing teeth

Pediatric Dentistry - a Clinical Approach, 3ed.

CHAPTER 4. Tooth Development and Disturbances in Number and Shape of Teeth

Göran Koch, Irma Thesleff, and Sven Kreiborg

Mechanisms of normal and abnormal tooth development

Teeth develop as epithelial appendages from the ectoderm covering aspects of tooth development at the microscopic level have been de more recent research has started to uncover the molecular details dental cell differentiation and extracellular matrix formation, and m normal tooth development has been elucidated by experimental stu models, and studies in human molecular genetics have led to the ic dental aberrations.

Principles of tooth development

Tooth development starts from placodes, local thickenings of the de epithelium at the sites of future dental arches. The placodes bud to condenses around the bud. Rapid growth and folding morphogenes stage of development. The shape of the tooth crown becomes estal locations and heights of tooth cusps are set by additional foldings a odontoblasts and ameloblasts differentiate during the bell stage, ar dentin and enamel, respectively. Differentiation, matrix deposition,

between hypodontia in the primary and permanent dentition. The prevalence of supernumerary teeth varies between 0.3 and 0.6%. Ninety percent of all supernumerary teeth a ...llary anterior region.

Numerical variations in the permanent dentition

Hypodontia is more frequent in the permanent than in the primary dentition, with a prevalence reported between 6 and 10% excluding the third molar. The most affected teeth ...order, the mandibular second premolar (around 40%), the maxillary second premolar (around 20%), and the mandibular central incisor (around 4%). Hypodontia in the permanent dentition usually affects two or more teeth in 50% of cases (F... ...sia and anodontia are rare. Symmetrical hypodontia often occurs for maxillary lateral incisors and second premolars. There is a particular relation between hypodontia and microdontia in the maxillary laterals and strong evidence that this form of hypodontia is inherited as an auto... ...al.

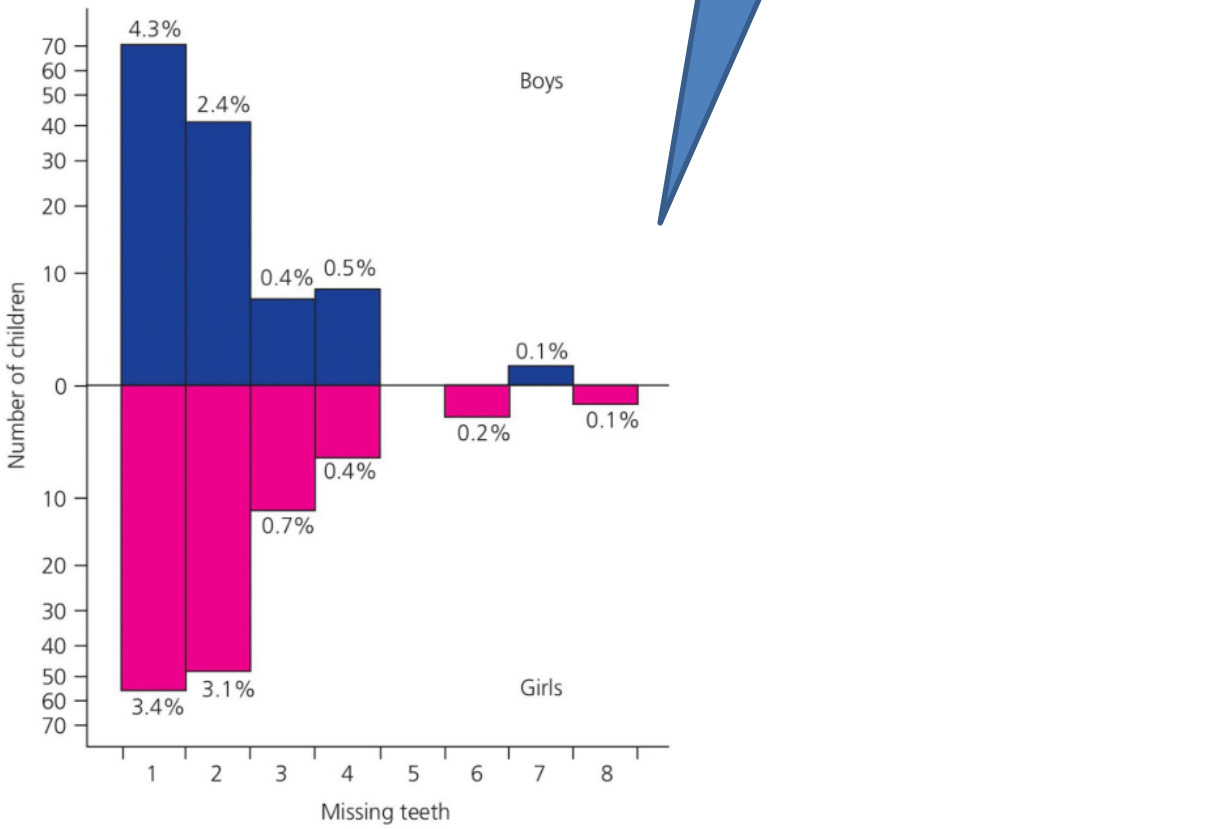

Figure 4.5 Distribution of children according to number of missing teeth. The horizontal axis shows the number of missing teeth per child. The vertical axis is logarithmic and shows the absolute number of children. The proportion of children is given above each column.

Source: Rølling 1980 [4], figure 1. Reproduced with permission of John Wiley & Sons.

Hyperdontia, or supernumerary teeth, are found with a frequency of 0.1–3.6%. The most frequent supernumerary tooth is the mesiodens in the midline of the maxilla (Figure 4.6) or a supernumerary lateral incisor in the maxilla. Supernumerary teeth are common in children with clefts and in several syndromes, e.g., cleidocranial dysplasia, Kreiborg–Pakistani syndrome, familial adenomatous polyposis (FAP), and tricho-rhino-phalangeal syndrome.

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Journal
Annals of Human Biology ›
Volume 41, 2014 - Issue 4

Box-whiskers plot with the 5 quartiles for continuous variable: Tooth formation time (years)

164
Views
16
CrossRef citations to date
0
Altmetric

Research Paper

Combining radiographic and histological d or dental development to compare growth in the t and the present

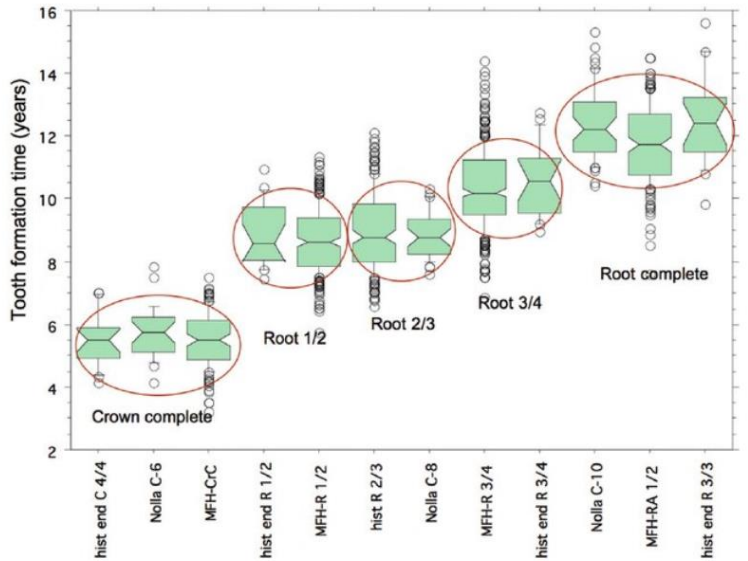
M. Christopher Dean, Helen M. Liversidge & Fadil Elamin

Pages 336-347 | Received 29 Apr 2014, Accepted 01 May 2014, Published onli

Download citation https://doi.org/10.3109/03014460.2014.922

Abstract

Background: Being able to estimate the age at death of



Figure

Caption

ure 7. Box and whisker plots of age (tooth for tion time) for radiographic stages betwee crown completion and root length complete alongside histological estimates (prefix "hist") for the same fractional stages of crown and root formation. Data for crown completion and thirds of root formation as defined by Nolla (1952) are notated (prefix "Nolla"), then as by Nolla (1952), "C-6" (crown completion), "C-8" (root 2/3ds) and "C-10" (root 3/3rds). Quarters were scored by Liversidge et al. (2006) using the definitions from Moorrees et al. (1963) and are notated (prefix MFH), then "Crc" (crown complete) or "R" (root) followed by the fraction. The histological stage (prefix "hist") that best matches these are notated "C" for crown and "R" for root. Then "end" indicates that the sample contains only the last increment within that fractional stage followed by the fraction. The median value for all data are represented by the central horizontal line in the box plot (not the mean values that are given in Table 2) and the upper and lower borders of each box represent quartiles. The notch on the sides of the boxes indicate the 95% upper and lower confidence limits (circles beyond the whiskers are outliers).

Activa
Go to S

Thank you!