The Statistical Indicators

Indicators used to measure morbidity

- Incidence rate – measures the frequency **new cases** from a specific disease appear within a certain population during a defined time span (months, years) – frequently used for **acute illnesses**
- **Annual incidence** = $\frac{\text{no. of new cases} \times 10^n}{\text{no. of new persons within the risk population}}$
- **Cumulative incidence** = $\frac{\text{no. of new cases} \times 10^n}{\text{no. of people without ilness from the population with risk at the beginning of the study}}$
- **Secondary attack index** = $\frac{\text{no. of new cases among contacts}}{\text{total no. of contacts}}$
- **Incidence attack rate** – used in cases of population exposure for a limited time period – epidemics, diseases with short incubation period – food poisoning.

Indicators used to measure morbidity

- **Disease prevalence** – the **total number of cases** (new and old) within a population, at a certain moment in time (moment prevalence, point prevalence) or during a time frame (period prevalence) frequently used for **chronical diseases**.

- **Moment prevalence** = $\frac{\text{total no. of cases (new+old)} \times 10^n}{\text{total no. of people examined at that moment}}$

- **Period prevalence** = $\frac{\text{total no. of cases (new+old)} \times 10^n}{\text{total no. of people at risk during that timeframe}}$

- **Hospitalized morbidity** studies the disease frequency within a population of hospitalized patients: = $\frac{\text{no. of “X” disease cases x100}}{\text{total no of hospitalized people}}$

Specific mortality indicators

- **Gross mortality** = $\frac{\text{number of deaths in a timeframe} \times 10^n}{\text{population number in a timeframe}}$

- **Infant mortality** = $\frac{\text{no. of dead children aged <1year during one calendar year} \times 1000}{\text{no. living nb. registered during that year}}$

- **Fatality** = $\frac{\text{no. of deaths caused by "X" disease in a timeframe} \times 100}{\text{no. of "X" disease cases within that timeframe}}$

- It expresses the disease's severity

- **Lethality** = the share of deaths grouped according to a certain criteria (sex, age, cause of death) in the total number of deaths **(proportional mortality)**

Socio-demographic indicators

- **Birth rate**– No. live nb registered in one year x 1000 / no. of the inhabitants of that period
- **Life expectancy** – the average number of years that a person hopes to live according to the mortality of the population age groups from where the person comes from
- **Potential life years lost through premature deaths** – the number of years that an individual died before the age of X years not lived
- **Demographic growth rate** – (no. of live births (nb) - no. deaths) + no. immigrants
- **Natural growth of the population** – no. of live births - no. deaths recorded in one year x 1000 / no. of inhabitants on July 1

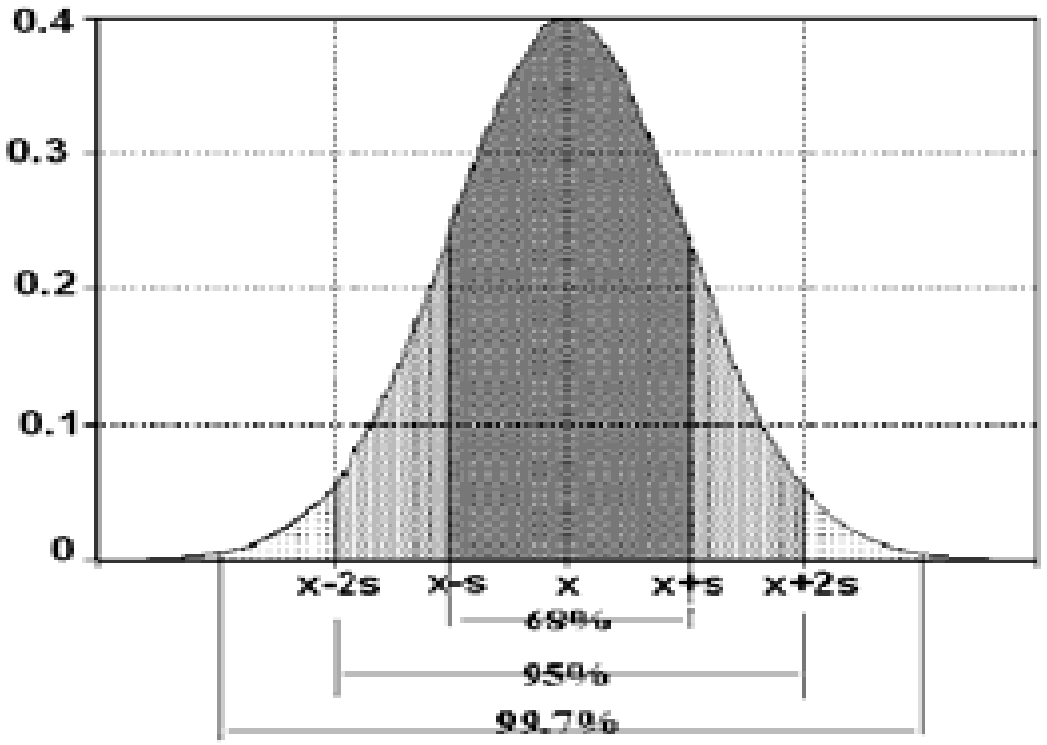
Socio-demographic indicators

Average hospitalization time – $\frac{\text{no. days of hospitalization that year}}{\text{no. sick patients + no. sick people in the hospital at 31.12}}$

Turnover the sick people on the bed – $\frac{\text{no. hospitalized patients (exiled + discharged)}}{\text{no. of hospital beds}}$

Comparing Averages

- Studying the type of distribution
- Gaussian distribution - parametric tests - t test
- Non-gaussian distribution – non-parametric tests



Normal distribution (Gaussian)

- 50% of the values are on the left side of the curve and 50% on the right;
- Approximately 68% of the values are likely to be in the range (x - 1S; x + 1S);
- Approximately 95% of the values are likely to be within the range (χ-2S; χ + 2S);
- Approximately 99.7% of the values are likely to be in the range (x - 3S; x + 3S);

Percentage comparison

Contingency table 2 x 2

	B +	B -	Total
E1	a	b	a+b
E2	c	d	c+d
Total	a+c	b+d	

- **Based on this, the hi² test is calculated**

The power of the association between the risk factor and the disease is shown by:

RR = risk of disease in the presence of the risk factor / risk of disease in the absence of the risk factor

$$RR = \frac{P(B+/E+)}{P(B+/E-)} = \frac{a/a+b}{c/c+d}$$

Odd ratio = probability of exposed people to become ill / probability of un-exposed people to become ill

$$OR = \frac{P(B+/E+)}{P(B-/E+)} \Big/ \frac{P(B+/E-)}{P(B-/E+)} = \frac{a/b}{c/d}$$

- **<u>The risk to those exposed</u> is the likelihood that an exposed person will become ill.**
- It is calculated on a lot such as the example in the table, the ratio of the number of those who have done the disease being exposed (48), and the number of all exposed (200)
- So, in the table, the risk to those exposed is 48/200, ie 0.24 or 24%.

		Boala		
		"+" prezentă	"- "absentă	Total
Factor Risc	Expuşi"+"	**48**	**152**	200
	Neexpuşi"-"	**36**	**1964**	2000
	Total	84	2116	2200

- **<u>The risk to the unexposed</u> is the likelihood that an unexposed individual will become ill**
- It is calculated on a lot like the example in the table, the ratio of the number of those who did the disease to being unexposed (36), and the number of all unexploded (2000)
- So, in the table below, the risk to the unexposed is 36/2000, ie 0.018 or 1.8%.

		Boala		
		"+" prezentă	"- "absentă	Total
Factor Risc	Expuşi"+"	**48**	**152**	200
	Neexpuşi"-"	**36**	**1964**	2000
	Total	84	2116	2200

- **Relative risk**
- **<u>Relative Risk is the ratio of the risk to the exposed and the risk to the unexposed.</u>**
- As the risk to those exposed is 24%, the risk to those unexposed is 1.8%
- **<u>Relative Risk is</u>** 24/1,8=13, 3

- The relative risk tells us how many times the probability of illness is when you are exposed than when you are unexposed.
- The relative risk being 13.3 means that the exposed ones have the probability of making the disease 13.3 times higher than the non-exposed

- **Interpretation**
- In general, relative risk values close to 1 show approximately the same likelihood of disease, both in exposed and unexposed, and it should be considered that the respective risk factor does not have a real influence on the occurrence of the disease

- If the relative risk is much higher than 1, it is an indication that between the risk factor and the disease is a correlation link that is usually interpreted as CAUSAL although it is not even obligatory that the risk factor be CAUSED for the occurrence disease

- Definitions
- **Odds Ratio** is the ratio between the proportion of illnesses in those exposed and the proportion of illnesses in the non-exposed ones.
- The proportion of illnesses in those exposed is the number of the number of people exposed to the disease and the number of exposed to which the disease is absent
- The rate of disease in the unexposed is the ratio of the number of non-exposed to which the disease is present and the number of unexposed cases in which the disease is absent

		Boala		
		+ prezentă	- absentă	Total
Factor Risc	Expuşi +	**50**	**150**	200
	Neexpuşi -	**40**	**1960**	2000
	Total	90	2110	2200

- In the table above, the rates of illness are:
  - In those exposed 50/150, that is, a 1 to 3 share
  - In those unexposed 40/1960, that is 1 to 49 share
- • The ratio of the two share, namely Odds Ratio, namely the ratio between 1/3 and 1/49, is 49/3 = 16.3

		Boala		
		+ prezentă	- absentă	Total
Factor Risc	Expuşi +	a	b	a+b
	Neexpuşi -	c	d	c+d
	Total	a+c	b+d	N=a+b+c+d

- The rate of exposure to Ce = a / b exposure
  Exposure rate to unexposed Cn = c / d
  Odds Ratio OR = (a * d) / (b * c)

- Interpretation

- Values close to 1 show similar odds, which means that exposure does not influence the presence of the disease

  Values well above 1 show a correlation trend between exposure and disease, a correlation that is usually considered CAUSAL, although not always the case

  Values well below 1 also show a correlation, but in this case, exposure is considered a PROTECTION factor

  In all cases, the confidence with which we interpret the value of OR is higher if the number of patients included in the table is high

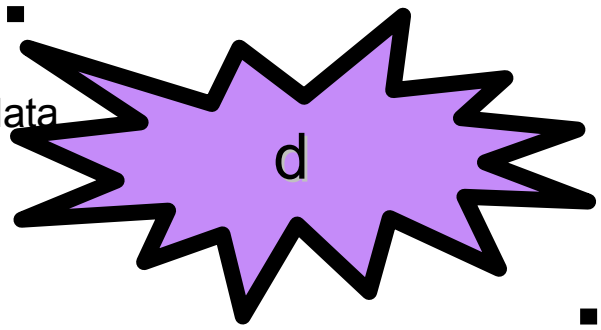
Practical application

One hundred children exposed to high lead levels in the first 12 months of life and a similar group of one hundred children who were not exposed to high lead levels in the first 12 months of life were followed for 15 years. What was the appearance of affective disorders in the two groups:

		Tulburări afective		Total
		Da	Nu	
Expuşi la plumb	**Da**	40	60	100
	Nu	5	95	100
Total		45	155	200

The relative risk of affective disorders in those exposed is:

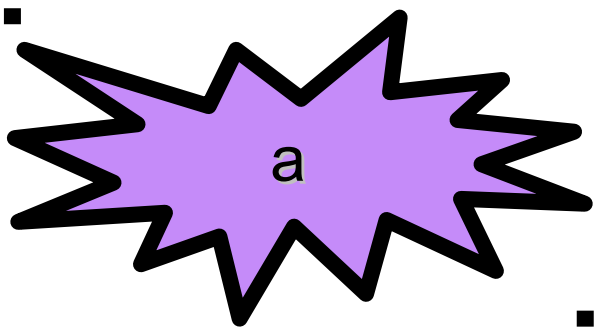
a) 2
b) 4
c) 5
d) 8
e) can not be calculated with these data



Practical application

In a community of 200,000 inhabitants, of which 50,000 women in the fertile age, 15-49 years of age, there are 2,200 births, 2,000 live births. How is natality?

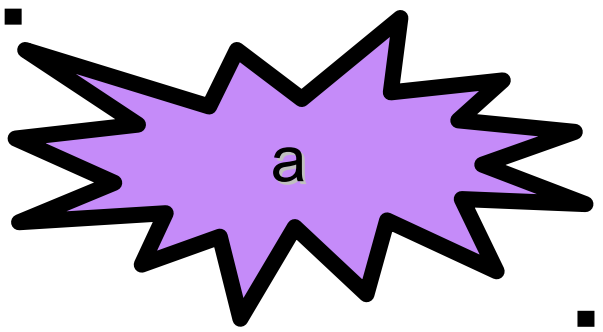
a) 10 to thousand;
b) 40 to thousand;
c) 11 to thousand;
d) 20 to thousand;
e) 44 to thousand.



Practical application

In a community with 200,000 inhabitants, over 2,000 live birth are recorded during the year, of which I die in the first month of life 5 children and between 1 and 11 months, 15 children. How much Infant Mortality Is?

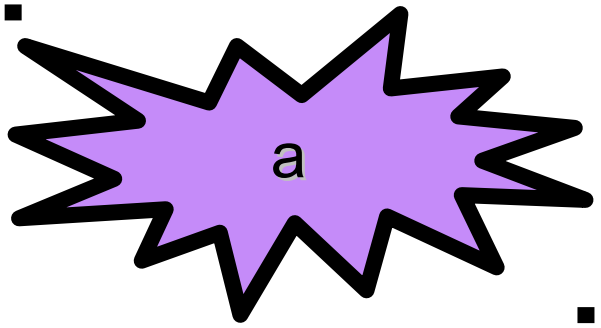
a) 10 to thousand;
b) 0,25 to thousand;
c) 0,75 to thousand;
d) 5 to thousand;
e) 15 to thousand.



Practical application

In a population of 200,000, 500 new cases of malignant tumors are recorded in one year, of which 100 die. What is the incidence of cancer in that community?

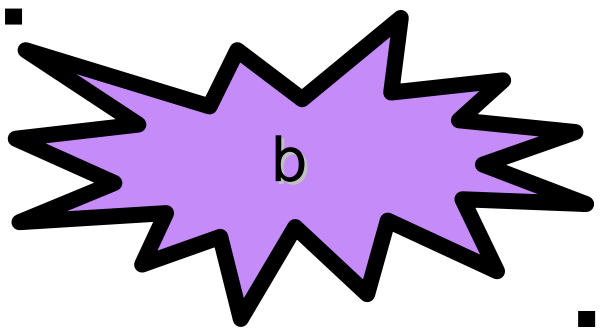
a) 250 to thousand;
b) 200 to thousand;
c) 2,5 to thousand;
d) 2 to thousand;
e) 20 to thousand.



Practical application

In a population of 200,000 people, 2,000 deaths were recorded in one year. Of these, 200 were due to CVD, 150 malignancies, 50 TB, and the rest for other causes. How much is CVD lethality?

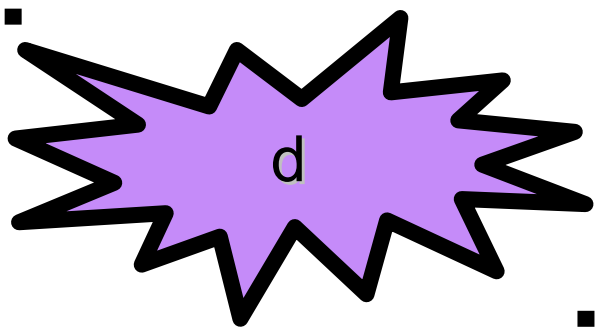
a) 1 to thousand
b) 10 to thousand
c) 10 to thousand
d) 1 to thousand
e) 15 to thousand



Practical application

"Fatality" for a given disease refers to :

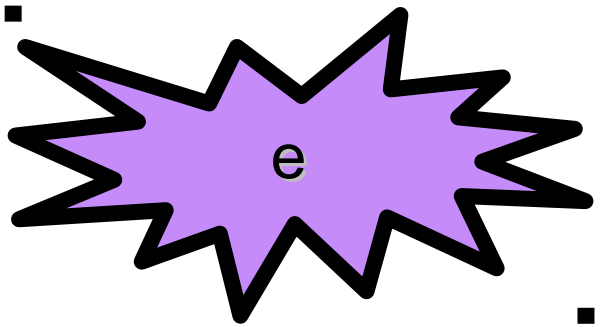
- a. mortality rate for a population of 100,000;
- b. the specific mortality rate due to the disease;
- c. a fatal outcome of any disease;
- d. the frequency of deaths among disease cases;
- e. the proportion of deaths due to the disease from total deaths.



Practical application

In a city with 100,000 inhabitants, 1000 deaths of all causes, 300 tuberculosis patients (200 of them were men) and 60 deaths due to tuberculosis (50 of them were men). Mortality specific for tuberculosis in men was :

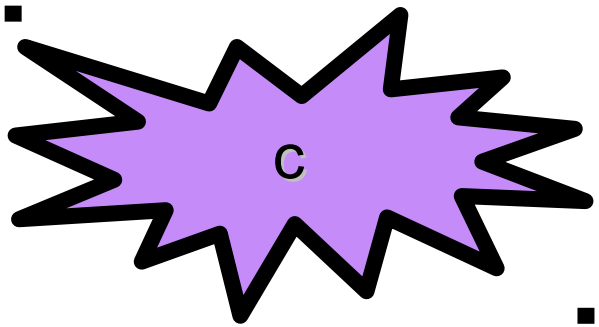
- a. 0.5‰
- b. 60/100000
- c. 50/200
- d. 50/300
- e. can not be calculated.



Practical application

In a city with 100,000 inhabitants, 1000 deaths of all causes, 300 tuberculosis sufferers (of which 200 were men) and 60 deaths due to tuberculosis (of which 50 were men). Letality through tuberculosis was *:*

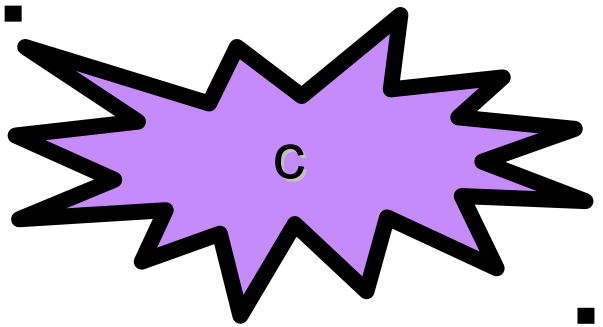
- a. 0.5‰
- b. 60/100000
- c. 60/1000
- d. 50/300
- e. can not be calculated.



Practical application

In a city with 100,000 inhabitants, 1000 deaths of all causes, 300 tuberculosis patients (of which 200 were men) and 60 deaths due to tuberculosis (50 of them were men). Tuberculosis fatality in men was :

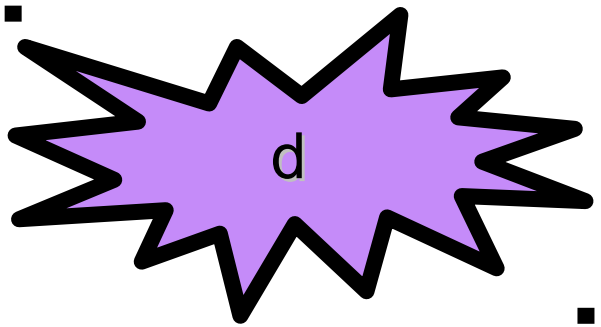
- a. 0.5‰
- b. 60/1000
- c. 50/200
- d. 50/300
- e. can not be calculated.



Practical application

In a city with 100,000 inhabitants, 1000 deaths of all causes, 300 tuberculosis patients (200 of whom were men) and 60 deaths due to tuberculosis (50 of them were men). Tuberculosis fatality was:

- a. 0.5‰
- b. 60/1000
- c. 50/200
- d. 60/300
- e. can not be calculated.



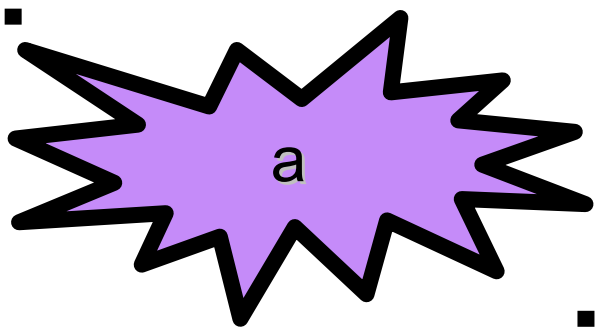
Practical application

In a calendar year, in a population of 1,000 inhabitants, live births recorded the following birth weights:

Weight at birth	No. of cases
1000 g	1
1000 - 1499 g	3
1500 - 1999 g	3
2000 - 2499 g	4
2500 g and over	7

What is the birth rate in this population?

- a. 18‰
- b. 11‰
- c. 14‰
- d. 17‰
- e. 7‰.



Practical application

The index of 40 diabetes deaths per 1000 diabetics measures:

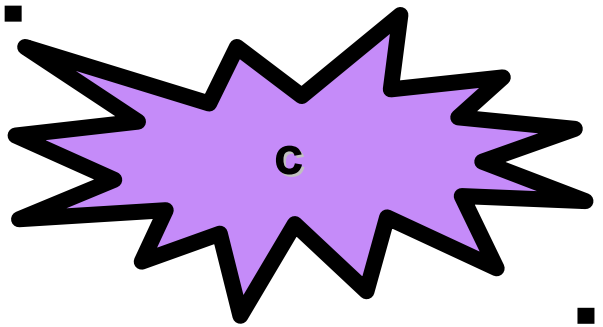
a. specific mortality;

b. lethality;

c. fatality;

d. gross mortality;

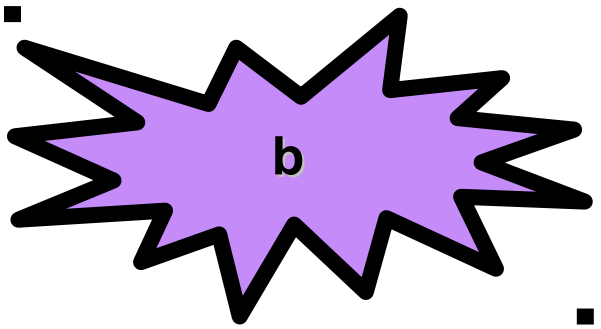
e. none of the above.



Practical application

In a study of coronary artery disease, at the initial screening (performed at 24h), 17 out of 1000 patients were found with coronary artery disease. This size expresses :

- a. the incidence of coronary artery disease;
- b. the moment prevalence of coronary heart disease;
- c. the period prevalence of coronary heart disease;
- d. the frequency of myocardial infarction attacks;
- e. none of the above.



Practical application

Of the 250 people (80 men and 170 women) participating in a picnic, 112 were ill, out of which 76 were women and 36 men.

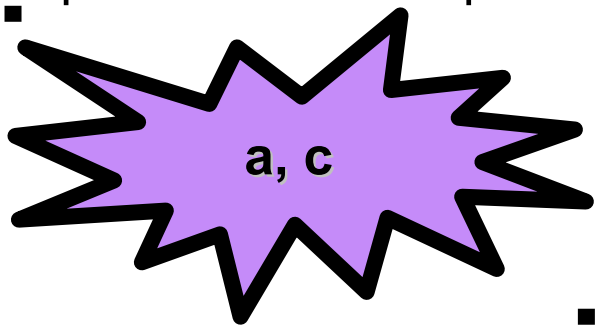
- a. the incidence for male sex was 36/112
- b. the incidence for male sex was 36/80
- c. the incidence for female sex was 76/112
- d. the incidence for female sex was 76/170
- e. the overall incidence was 112/250

b, d, e

Practical application

Identify from the examples below which are prevalence data:

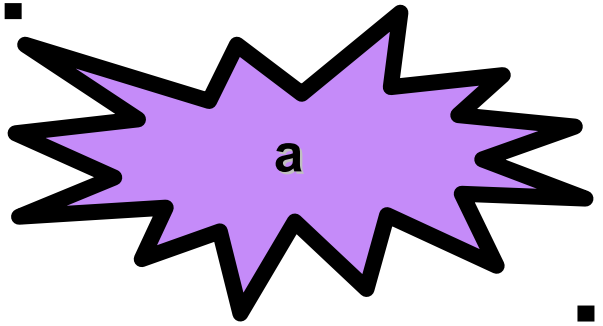
- a. the number of cases of diabetes actively detected in a community of students;
- b. the number of hospitalizations for hypertension in a population of 100,000 per year;
- c. the total number of cases of multiple sclerosis in a population of 100,000 per year;
- d. the number of episodes of illness in the people over 3 years, per year;
- e. the number of new cases of prostate cancer per 100,000 men per year.



Practical application

In a study of 500 patients and 500 witnesses, the suspected risk factor was recorded in 400 cases and 100 witnesses. The incidence of the disease in people with the present risk factor is :

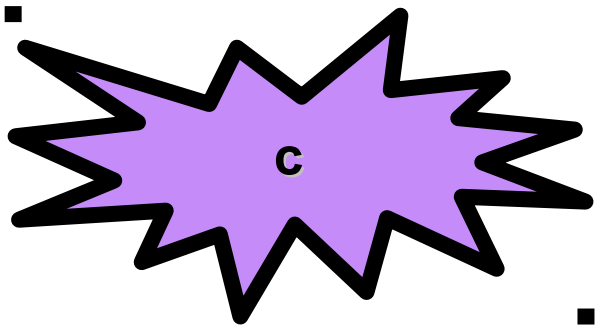
- a. 80%;
- b. 40%;
- c. 16%;
- d. 20%;
- e. can not be calculated.



Practical application

Epidemic means :

- a. a disease that has a low occurrence rate but is constantly present in a community or region;
- b. an incidence greater than 10 per 1000 inhabitants;
- c. the occurrence of the disease in excess of the expected rate for that population;
- d. seasonal respiratory diseases;
- e. annual rate of cases per 100,000 inhabitants.



Practical applications after :

- **UNIVERSITY OF MEDICINE AND PHARMACY "CAROL DAVILA" BUCHAREST FACULTY OF MEDICINE -** *Discipline of Public Health and Management*