### **REMEMBER:**

> The name of the files and sheets must be strictly followed.

# Probability of a event

Let A = {birth of a male child} Pr(A) = (number of favorable cases)/(number of possible cases)Probability of the event A is:

$$Pr(A) = \frac{Number of favorable cases}{V(A)}$$

 $\Pr(A) = \frac{Number of possible cases}{Number of possible cases},$ 

where number of favorable cases is given by those who accomplished the required criterion (e.g. birth of a male child).

### **Probability of nonA**

The probability that something happens is one minus the probability that it does not: Pr(A) = 1 - Pr(nonA)

### $Pr(A \text{ sau } B) = Pr(A \cup B)$

 $Pr(A \cup B) = Pr(A) + Pr(B) - Pr(A \cap B)$ .

#### **Independent events**

If two events A and B are independent:  $Pr(A \cap B) = Pr(A) \cdot Pr(B)$ .

### **Probabilities applications**

1. Prevalence = probability that a subject to have Alzheimer. Use the data from GoldenTest column to answer this question

2. Sensibility (Se = Pr(T|A)) = probability that a test result will be positive when the Alzheimer is present. The following events are used in this formula:  $T = \{A|z|eimer test\}$ positive} and A = {Alzheimer positive = Golden test positive}

3. Specificity (Sp = Pr(nonT|nonA)) = probability that a test result will be negative whenthe Alzheimer is not present

4. Positive predictive value (PPV = Pr(A|T)) = probability that the Alzheimer is present when the test is positive.

5. Negative predictive value (NPV = Pr(non A|nonT)): probability that the Alzheimer is not present when the test is negative.

### Working with contingency tables in Excel

- Select one cell of the table with data (e.g. A2)  $\rightarrow$  the whole database it will be selected.
- [Insert-PivotTable]. The next window will appear : •

Create PivotTable	
Choose the data that you want to analyze	
Select a table or range	
Table/Range: date!\$A\$1:\$G\$501	Left click on
O Use an external data source	an empty cell
Choose Connection	to put the
Connection name:	results in the
Choose where you want the PivotTable report to be placed	results in the
New Worksheet	same sneet
Existing Worksheet	
Location:	
OK Cancel	
Validato with OK	
Create PivotTable	
Choose the data that you want to analyze	
Select a table or range	
Table/Range: date!\$A\$1:\$G\$501	
○ Use an external data source	
Choose Connection	
Connection name:	
Choose where you want the PivotTable report to be placed	
New Worksheet	
C Existing Worksheet	
Location:	
OK Cancel	

• Using drag-and-drop option place GoldenStandard on Column and Test1 on Row Label. Drag-and-drop again the GoldenTest on **Value**. The resulted selection is similar with the one in the image bellow:

L	М	N	Calit	ori • 11 • A A S	\$ -	%	, 🔤 R	S	Т	U	V	W	X	
Count of GoldenTest	GoldenTest 🕫		в	I 🗏 🌺 - 📥 - 🖽	* 1	.00.	🛷							
Gender 🖃	negative p	ositive		Grand Total	_									
female	184			⊆opy										
male	192		2	Eormat Cells										
Grand Total	376			<u>R</u> efresh							PivotTable Fie	ld List		-
				<u>S</u> ort	F	Â↓	Sort A to Z				Choose fields to add to report:		ort:	•
				Filter	+	Z↓ A↓	S <u>o</u> rt Z to A							
			<b>v</b>	Subtotal "GoldenTest"			More Sort Options.							
				Expand/Collapse	•									
			4	<u>G</u> roup						_	_			
			4	Ungroup						_				
				Move	Þ						Drag fields between areas below:		elow:	
			×	Remove "GoldenTest"						V Report Hiter Colu	Column Lac	Dels		
		0	i Field Settings						Pow Labels S Valu			Values	•	
				PivotTable Options						Gender T	values			
		(		Show Fiel <u>d</u> List							Gender		Journe of Gold.	
				Defer Layout Update Update										

## !!! Check if the total is equal with the sample size!!!!

.

 $\circ$   $\;$  Use sort option to have in the first column the positive values:

L	M	N	Cali	bri • 11 • A A \$	- 9	6, 5	R	S	Т	U	V	W	X	Y
Count of GoldenTest	GoldenTest 🕫		в	I	1.00	.00 \$.0 🎸								
Gender 🖃	negative	positive	_	Grand Total	-									
female	184			⊆opy										
male	192		1	Eormat Cells										
Grand Total	376	i i		<u>R</u> efresh						P	ivotTable Fie	ld List		<b>•</b> ×
				<u>S</u> ort →	₽	Sort A	to Z				Choose fields to add to report:		<u>-</u>	
				Fil <u>t</u> er →	Z A	Sort Z	to A							
			$\checkmark$	Su <u>b</u> total "GoldenTest"		More	Sort Option:	5						
				Expand/Collapse ►										
			*	<u>G</u> roup <u>U</u> ngroup										
			×	Move → Remo <u>v</u> e "GoldenTest"							Drag fields bet V Report Fi	ween areas t	elow: Column Lab	bels
			<b>Q</b>	Field Setti <u>ng</u> s PivotTable <u>O</u> ptions							Gender	els Σ	Values	
				Show Fiel <u>d</u> List						[	Defer Layout Update Update		ate	

 $\circ$   $\,$  Copy the contingency table in empty cells and change it to look as the one in the image bellow:

L	М	N	0
	Altzheimer=positive	Altzheimer=negative	Grand Total
Gender=female	99	184	283
Gender=male	25	192	217
Grand Total	124	376	500

• Compute the relative risk for gender using the formula:

$$RR = \frac{a/(a+b)}{c/(c+d)}$$

• RR = (99/283)/(25/217)

L	М	N	0
	Altzheimer=positive	Altzheimer=negative	Grand Total
Gender=female	99	184	283
Gender=male	25	192	217
Grand Total	124	376	500
RR	=(M13/O13)/(M14/O1	4)	

- Interpret the obtained results using the following rules:
  - RR  $\sim 1 \rightarrow$  association between exposure and disease unlikely to exist.
  - RR >> 1 → increased risk of disease among those that have been exposed.
  - RR << 1  $\rightarrow$  decreased risk of disease among those that have been exposed

L	М	N	0			
	Altzheimer=positive	Altzheimer=negative	Grand Total			
Gender=female	99	184	283			
Gender=male	25	192	217			
Grand Total	124	376	500			
RR	3	3 Since RR = 3 $\rightarrow$ gender is a risk factor for Alzheimer				