

Hello,

Thank you for your application to the Mentor Statistics Powerhouse preparation course for the AKT.

The course will be highly interactive and practical with an emphasis on exam technique for the AKT.

I have attached a timetable, some 'starter' questions around basic statistics needed for the AKT and a Mentor pre-course statistics paper.

You should attempt the questions in the first instance with a calculator and under timed conditions. You should then reattempt the paper using any resources you wish but make a note of what you have used.

IT IS ESSENTIAL THAT YOU ATTEMPT THE QUESTIONS AND BRING YOUR ANSWERS AND THE PACK WITH YOU ON THE DAY.

PLEASE ALSO BRING WRITING PAPER AND A CALCULATOR ON THE DAY!

I would be most grateful if you could acknowledge receipt of this pack by sending me an email.

A certificate of attendance will be provided on the day.

I do hope you will find the course highly relevant to your preparation and fun!

If you have any queries please feel free to contact me by email: mrcgpcourses@yahoo.com or phone 07967813837

See you soon!

With Best Wishes



Dr Nigel Giam

Mentor Course Director
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MBBS(Hons) MRCP MRCGP(Hons) DRCOG DCH DFRSH BSc PGCertMedEd

MENTOR MRCGP COURSES
POWERHOUSE: STATISTICS FOR THE AKT

TO APPLY: <https://www.mentormededucation.com/mentoraktpowerhousestats>

“PRACTICE MAKES PERFECT”

Zoom with Dr Nigel Giam

9AM 15MIN	REGISTRATION VIA ZOOM (LINK WILL BE SENT 24 HOURS BEFOREHAND) THE AKT OVERVIEW : TOP TIPS TO APPROACH - HIGH YIELD AREAS THINK LIKE AN EXAMINER!
1 HOUR	UNDERSTANDING AND CALCULATING RISK HOW TO APPLY STATS EQUATIONS : RISK / ODDS RATIOS / HAZARD RATIOS / NNT / NNH INFORMED RISK – THE CONCEPT OF CATES PLOTS
40MIN	SCREENING : SENSITIVITY / SPECIFICITY / PREDICTIVE VALUES CRITICAL APPRAISAL : AN EVIDENCE BASED APPROACH TO STUDY DESIGN EPIDEMIOLOGY AND THE HIERACHY OF EVIDENCE QUANTITATIVE VS QUALITATIVE STUDIES
10MIN	BREAK
1 HOUR	PLOTS : CAPER /SCATTER / FUNNEL / FORREST / L'ABBE / KAPLAN MEIER CONFIDENCE INTERVALS / P-VALUES / STATISTICAL SIGNIFICANCE METANALYSIS - BREAKING IT DOWN
END : 12.30PM	

COURSE DIRECTOR:
DR NIGEL GIAM – MRCP MRCGP

GP PROGRAMME DIRECTOR – ST MARYS GPST
MENTOR MRCGP COURSES
WWW.MENTORMEDUCATION.COM

TERMS AND CONDITIONS

1. COURSES ARE NOT TRANSFERABLE
2. CANCELLATION 4 WEEKS BEFORE THE COURSE - 50% FEES
CANCELLATION 2 WEEKS BEFORE THE COURSE – 100% FEES
3. FULL TERMS AND CONDITIONS CAN BE DOWNLOADED FROM THE WEBSITE

Basic Statistics for the AKT

DEFINITIONS

- **Risk** – the probability that an adverse event will happen
 - **Risk can be given as a % or as decimal form (e.g. 10%=0.1)**
 - **Absolute Risk (AR)** = number of adverse events/total number of people
 - **Absolute Risk in Control Group (ARC) also known as the Control Event Rate (CER)**
 - **Absolute Risk in Treatment Group (ART) also known as the Experimental Event Rate (EER)**
 - **Absolute Risk Reduction (ARR) of a treatment** = $ARC - ART$
 - **Absolute Risk Increase (ARI) of a treatment** = $ART - ARC$
 - **Relative Risk of an event happening in treatment group (RR or risk ratio)** = ART/ARC
 - **Relative Risk Reduction (RRR) of a treatment** = $1 (100\%) - RR$
 - **Number Needed to Treat (NNT)** = $1/ARR$ where ARR is given in decimal form
 - **Number Needed to Harm (NNH)** = $1/ARI$ where ARI is given in decimal form
- **Odds Ratio (OR)** – Definition
- used to give an estimate of relative risk from retrospective case-controlled studies **OR**
 - odds of an event happening in the experimental group, expressed as a proportion of odds of it happening in control group

IF RR (or OR) = 1,
there is no significant difference between treatment and control groups

Calculating the Odds Ratio (OR)

Exposure to Risk Factor :

	Cases	Controls
+ve	a	b
-ve	c	d

	Effect	No Effect
Treatment Group	a	b
Control Group	c	d

$$OR = ad/bc$$

Screening

Screening	Disease Present	Disease Absent
+ve	a	b
-ve	c	d

Sensitivity : proportion of those with disease correctly identified by the test = $a/a+c$

Specificity : proportion of those without disease correctly identified by test = $d/b+d$

Positive Predictive Value :

proportion of those who test positive who have the disease = $a/a+b$

Negative Predictive Value :

Proportion of those who test negative who do not have the disease = $d/c+d$

EPIDEMIOLOGY BASICS

Measures of morbidity frequency characterize the number of persons in a population who become ill (incidence) or are ill at a given time (prevalence). Commonly used measures are listed below.

Frequently Used Measures of Morbidity

Measure	Numerator	Denominator
Incidence proportion (or attack rate or risk)	Number of new cases of disease during specified time interval	Population at start of time interval
Incidence rate (or person-time rate)	Number of new cases of disease during specified time interval	Summed person-years of observation or average population during time interval
Point prevalence	Number of current cases (new and preexisting) at a specified point in time	Population at the same specified point in time
Period prevalence	Number of current cases (new and preexisting) over a specified period of time	Average or mid-interval population

Studies – the hierarchy of evidence

Case report: anecdotal study looking at one individual- e.g. SEA

X sectional – static : studies across a population at one point in time, allow calculation of prevalence

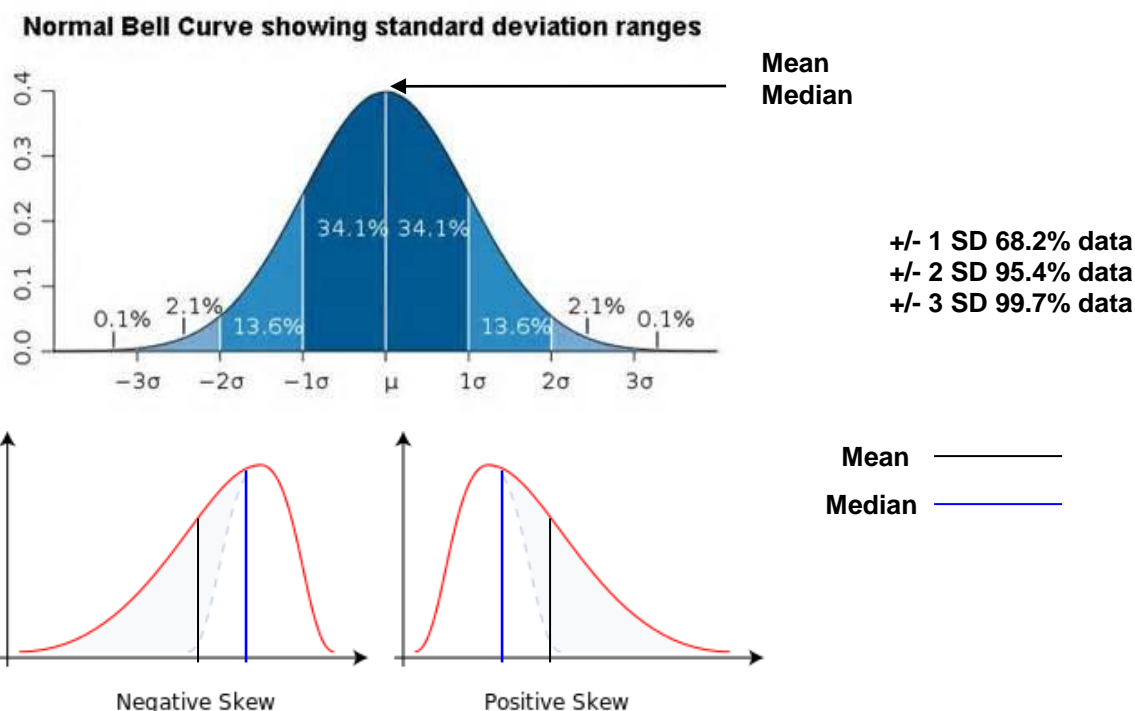
Case Control - Retrospective : cases already identified, examine exposure to risk factors in the past and match with controls, allow calculation of Odds Ratio

Cohort – Prospective e.g. RCT/Interventional, allow calculation of incidence/risk

Systematic review : analysis of studies looking at the same hypothesis

Meta-analysis : quantitative analysis using statistical power to increase the precision of a result

Distribution of Data



In skewed data, the median – the point which has half the values above, half below – is used to represent the average.

General rule of thumb: the mean is right of the median under right skew, and left of the median under left skew.

Questions to Practice

Q1

Consider the following data from a cohort trial of cholesterol reduction in patients with ischaemic heart disease:

“...in the placebo group 10% of patients died, in the simvastatin group 8% of patients died...”

Calculate the following:

The Absolute Risk Reduction of death by being on simvastatin?

The Relative Risk of death in the simvastatin group?

The Relative Risk Reduction of death by being on simvastatin?

The NNT with simvastatin to prevent 1 death?

Q2

A trial showed that 60% of patients with shingles treated with aciclovir within 24 hours of onset had a full recovery compared with 20% treated with placebo.

What is the OR (odd ratio) of recovery if treated with aciclovir compared with placebo?

What is the probability that patients treated with aciclovir have a full recovery compared to those treated with placebo?

Q3

		Outpatients Breast Cancer		GP Breast Cancer	
		Found	Not Found	Found	Not Found
Mammography	+ve	40	90	4	80
	-ve	10	810	1	720

1. Calculate the sensitivity for each group?
2. Calculate the specificity for each group?
3. Calculate the positive predictive value for each group?

Q4 : Chose the appropriate statistical test.

Fill in the boxes with **ONE** of the following **options**

<i>Samples</i>	<i>2</i>	<i>>2</i>	<i>Correlation</i>
Quantitative Parametric			
Quantitative Non-parametric			

Options:

- A Mann-Whitney-Wilcoxon
- B Pearson
- C Student t-test
- D Friedman
- E Spearman
- F Anova

PRE-COURSE STATS PAPER

TIME: 50 MINUTES

Q1: The following is an abstract of results, comparing chloramphenicol v.s. control in the treatment of conjunctivitis in adults

	CURED	FAILURE
CHLORAMPHENICOL	70	30
CONTROL	60	40

With regards to failure of treatment, calculate the following:

1. Control Event Rate
2. Experimental Event Rate
3. Absolute Risk Reduction
4. Relative Risk
5. Relative Risk Reduction
6. NNT with chloramphenicol

Q2: With regards the risk of DVT in COCP:

It is thought that third generation pills carry a risk of DVT of about 25 per 100,000 women per year of use; in comparison second generation pills carry a risk of about 15 per 100,000 women per year of use and in women who do not take the pill the risk is about 5 per 100,000 per year.

1. What is the Relative Risk Reduction of women on 2nd generation pills of having a DVT compared with women on 3rd generation pills?
2. What is the Absolute Risk Reduction of having a DVT between 3rd and 2nd generation pills?
3. What is the NNT in switching between 3rd and 2nd generation pills to prevent 1 additional case of DVT?
4. What is the NNH in causing 1 additional case of DVT in patients started on 2nd generation pills?
5. What is the NNH in causing 1 additional case of DVT in patients started on 3rd generation pills?

Q3: In this theoretical study, 900 children were recruited at age 5 and followed up for tooth decay over a 2 year period, having been exposed to different thresholds of carbonated drinks during this period. Which is the **SINGLE CORRECT** risk ratio for tooth decay in those drinking above the threshold?

	SIGNIFICANT TOOTH DECAY	NO SIGNIFICANT TOOTH DECAY
> 5 carbonated drinks/week	75	225
< 5 carbonated drinks/week	75	525

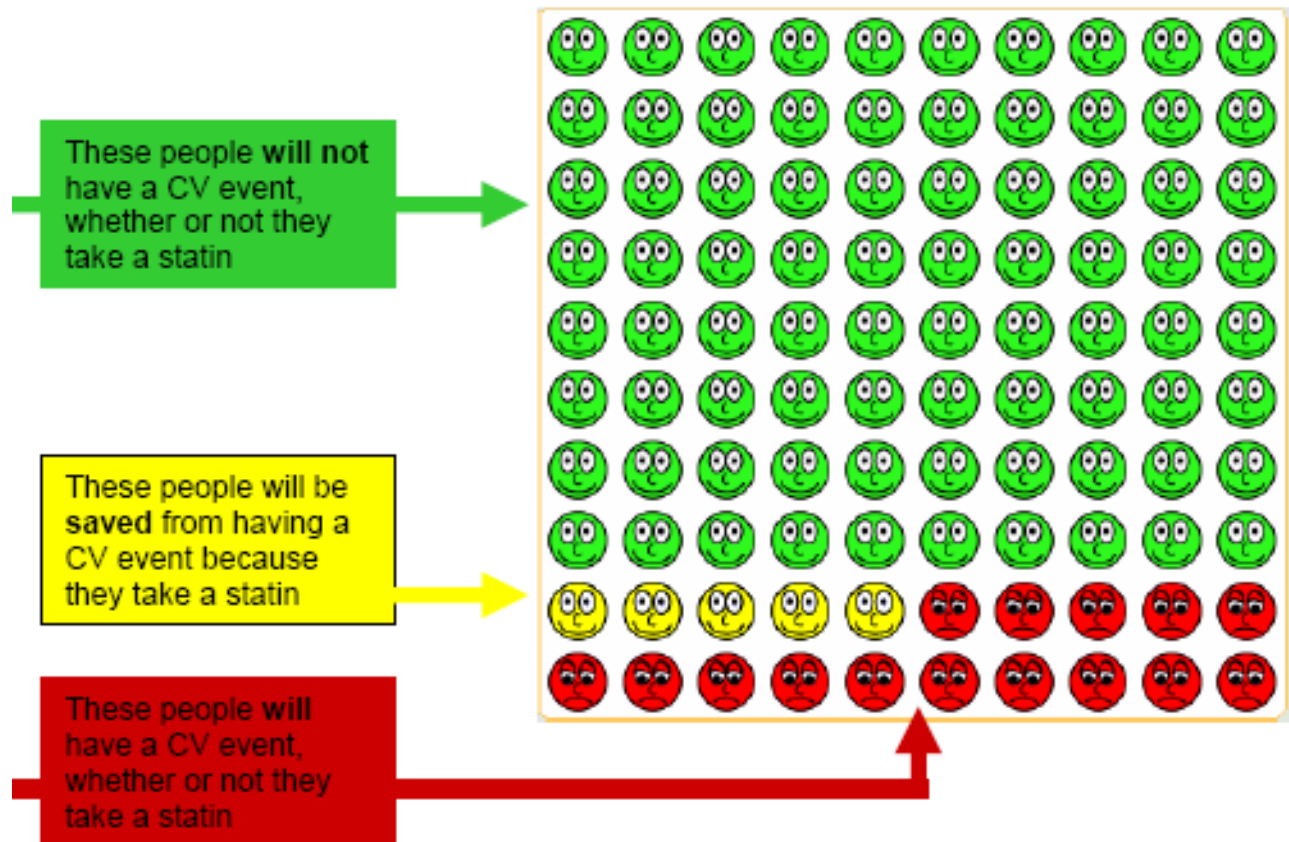
- A 0.4
B 2
C 0.5
D 3.2
E Relative risk is not an appropriate measure for this study type

Q4: A 55 year old lady comes to see you for advice. She is on combined HRT and has read (in the BMJ) that being on HRT for 5 years causes an increased risk of endometrial cancer of 50%. She has been on HRT for 5 years. The background risk of developing endometrial cancer in women not taking HRT is 6/1000.

Calculate the following:

1. The Absolute Risk of developing endometrial cancer in women taking HRT
2. The Absolute Risk Increase of developing endometrial cancer if taking HRT
3. The NNH for 1 additional case of endometrial cancer if on HRT

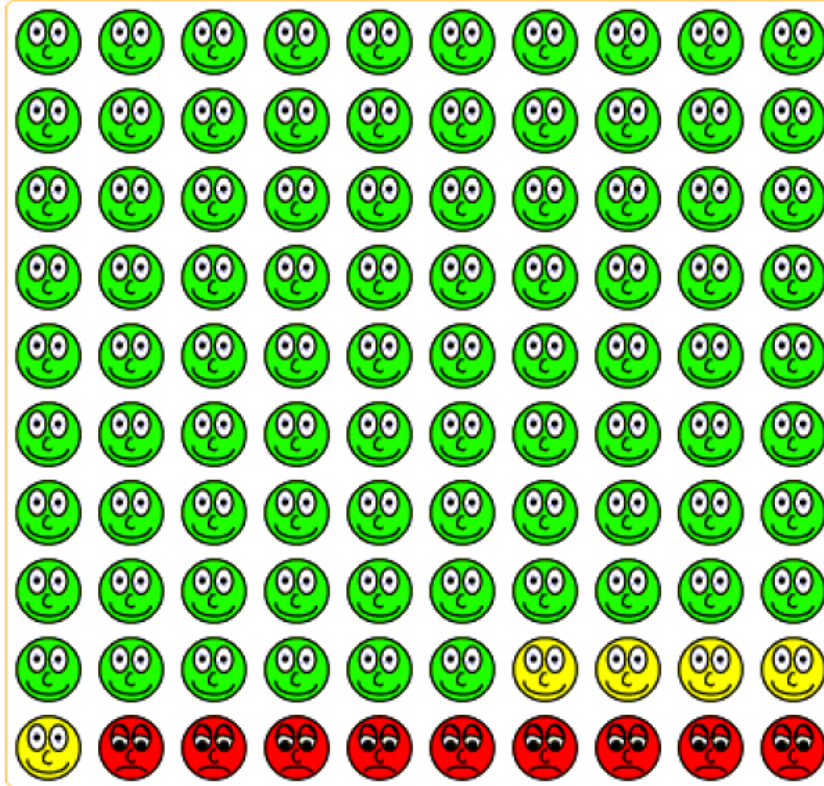
Q5: The following **CATES** plot represents 100 people receiving simvastatin over 10 years



From the plot, calculate the following:

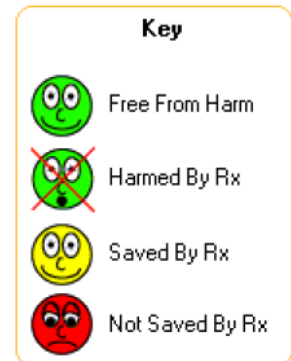
1. Control Event Rate
2. Experimental Event Rate
3. The Absolute Risk Reduction
4. The Relative Risk of a CV event in the simvastatin group
5. The RRR by being on simvastatin
6. The NNT to prevent 1 CV event

Q6: The following **CATES** plot represents 100 children who are all given antibiotics for ear infections.

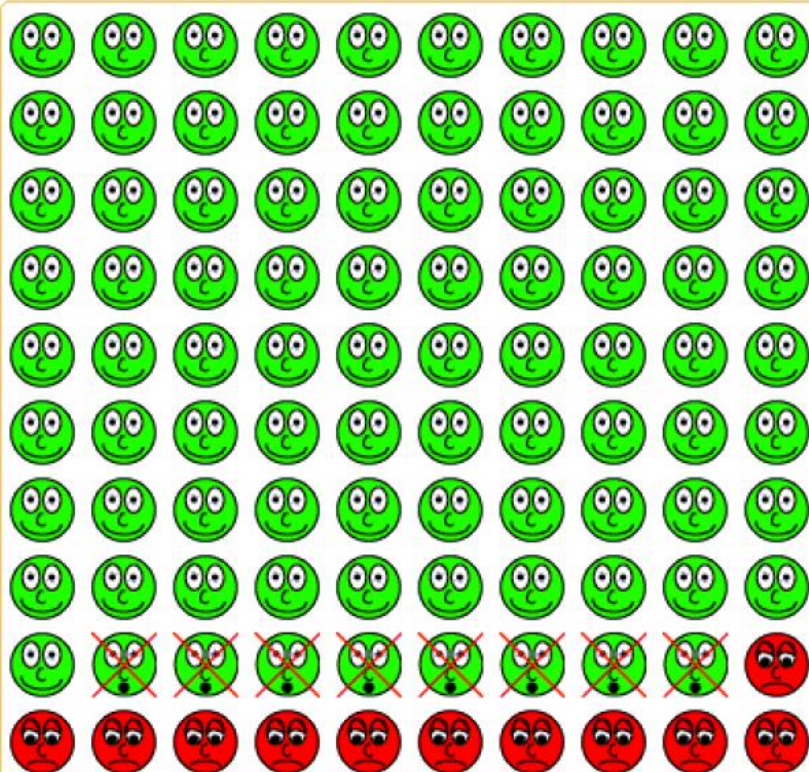


From the plot, calculate the following:

1. Control Event Rate
2. Experimental Event Rate
3. The Absolute Risk Reduction
4. The NNT



Q7: This **CATES** plot represents significant side effects in 100 children receiving antibiotics for ear infections



From the plot, select the **SINGLE** correct answer with regards to **NNH**:

- A 8
- B 10
- C 13
- D 15
- E 18

Q8: A retrospective case controlled study was undertaken to look at the odds of developing lung cancer in smokers compared to non-smokers. 100 patients with lung cancer and 100 controls were identified and their smoking status documented over the last 10 years. 80 patients with lung cancer were identified as being smokers prior to their diagnosis. 20 patients with cancer were non-smokers and 20 patients who were smokers did not have lung cancer.

Calculate the following:

1. The odds of developing lung cancer in a smoker
2. The odds of developing lung cancer in a non smoker
3. The odds ratio

Q9: Screening

Select **TWO** correct items about screening tests:

- A a highly sensitive test will have a high false negative rate
- B a highly specific test will have a low false positive rate
- C the prevalence of disease indicates the total number of new cases that present in a population each year
- D the prevalence of a disease influences the predictive value of a test
- E the negative predictive value of test indicates those who refuse to have the screening test
- F the positive predictive value tells you how good the test is at picking up people without the disease

Q10: Caper Plot

Pancreatic Cancer - "symptom-based" early diagnosis?

	New onset diabetes	Diarrhoea	Constipation	Malaise	Nausea or vomiting	Abdominal pain	Loss of weight	Jaundice	
	0.2 (0.2, 0.2)	0.2 (0.2, 0.2)	0.2 (0.2, 0.2)	0.2 (0.2, 0.3)	0.3 (0.3, 0.4)	0.3 (0.3, 0.4)	0.8 (0.7, 1.0)	21.6 (14.52)	PPV as a single symptom
	0.3 (0.2, 0.4)	0.2 (0.1, 0.3)	0.3 (0.2, 0.4)	0.3 (0.2, 0.6)	0.3 (0.2, 0.5)	0.4 (0.3, 0.5)	2.0 (1.0, 4.3)	8.9 —	Back pain
		0.4 (0.3, 0.5)	0.4 (0.3, 0.6)	0.5 (0.3, 0.9)	0.7 (0.5, 1.0)	0.9 (0.7, 1.1)	1.6 (1.0, 2.9)	22.3 —	New onset diabetes
			0.2 (0.1, 0.3)	0.3 (0.1, 0.5)	0.2 (0.2, 0.3)	0.4 (0.3, 0.5)	2.7 —	>10 —	Diarrhoea
				0.3 (0.2, 0.5)	0.6 (0.4, 0.8)	0.5 (0.4, 0.7)	1.5 (0.8, 3.0)	>10 —	Constipation
					0.5 (0.3, 0.8)	0.6 (0.4, 0.8)	0.9 (0.4, 2.1)	>10 —	Malaise
						0.9 (0.7, 1.2)	2.2 (1.1, 4.6)	14.8 —	Nausea or vomiting
						1.0 (0.8, 1.2)	2.5 (1.5, 4.4)	15.0 —	Abdominal pain
								>10 —	Loss of weight
								31.6 —	Jaundice

The background risk of pancreatic cancer is 0.25%

What is the **relative risk** of developing pancreatic cancer if the presenting symptoms are loss of weight and diarrhoea?

- A: 2.7%
- B: $2.7 \times 0.8 = 2.16\%$
- C: 97.3% risk of developing pancreatic cancer
- D: Risk 2-5%
- E: Risk of almost 3 times normal
- F: Risk of almost 11 times normal
- G: RR cannot be calculated

- <1% = white
- 1-2% = yellow
- 2-5% = orange
- >5% = red

Q11: In a population of 100 men over the age of 50 screened for prostate cancer, 10 were found to not have prostate cancer and had a negative PSA test. There were 30 false positive results. The screening test picked up 45 confirmed cases of prostate cancer with a positive PSA test.

Calculate the following:

1. How many false negative tests did the screening test pick up?
2. What is the sensitivity of the PSA test?
3. What is the specificity?
4. What is the positive predictive value of the screening test?

Q12: A study was performed to evaluate rectal bleeding in as a screening test for bowel cancer. Data from a local population of 1100 were analysed for rectal bleeding and colorectal cancer rates. Overall 100 people had colorectal cancer. Rectal bleeding was present in 400, of which 20 had colorectal cancer.

What is the **specificity** of rectal bleeding as a screening test?

- A 10% B 26% C 38% D 42% E 62% F 75% G 83%

Q13: Epidemiological Measures

What is the **SINGLE MOST** appropriate epidemiological measure to estimate the rate at which new cases of papilloma virus infection occur amongst students on a college campus?

- A Case Fatality B Incidence C Median Survival D Mortality E Prevalence

Q14: A primary care organization requires information to estimate typical duration of hospice services required for patients with pancreatic cancer. What is the **SINGLE MOST** appropriate epidemiological measure for the situation described above?

- A Case Fatality B Incidence C Median Survival D Mortality E Prevalence

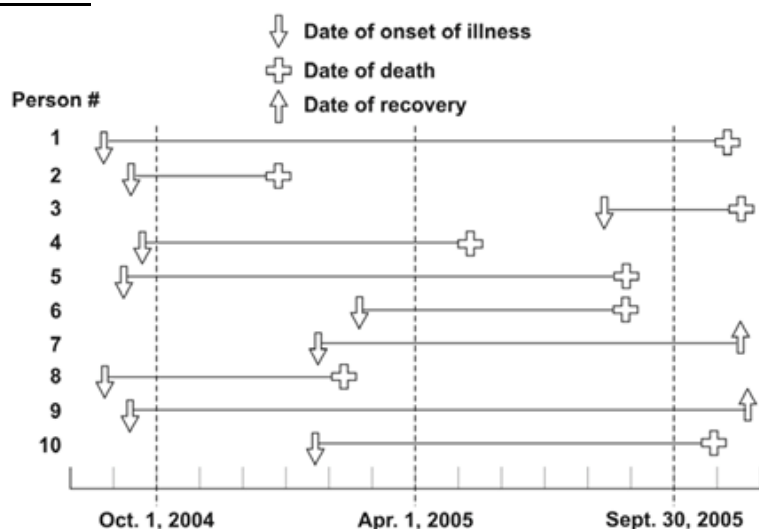
Q15: Please match the appropriate morbidity frequency measures with their appropriate calculations:

- A Incidence risk B Incidence rate C Period Prevalence D Point Prevalence

1. Number of cases of disease on a particular date / Size of population on that date
2. Number of new cases of disease during specified period / Size of population at start of the period
3. Number of cases of disease during specified period / Size of population during that period
4. Number of new cases of disease during specified period / Time each person was observed totaled for all persons

Q16: Table 1 represents 10 new cases of illness over about 15 months in a population of 20 persons. Each horizontal line represents one person. The down arrow indicates the date of onset of illness. The solid line represents the duration of illness. The up arrow and the cross represent the date of recovery and date of death, respectively.

Table 1:



Calculate the point prevalence on April 1, 2005.

Answer:

Q17: A statistical study is proposed to reach a summary conclusion regarding the results of several investigations which looked at prospective exposure to environmental tobacco smoker and risk of lung cancer. Which is the **SINGLE MOST** appropriate study design? Select **ONE** option only

- A Case Control Study
- B Cohort Study
- C Correlation Study
- D Descriptive Study
- E Meta-analysis

***Q18:** With regards to the hierarchy of evidence, please match up the appropriate study to the level of evidence:

Level of evidence

- | | |
|---|-------------------------------|
| 1 | A Mechanism based reasoning |
| 2 | B Systematic R/V of RCT |
| 3 | C Randomized controlled trial |
| 4 | D Non randomized cohort study |
| 5 | E Case controlled study |

Q19 : With regards to Type I and Type II errors, please complete the boxes with the appropriate error

		Truth	
Hypothesis Testing		The Null Hypothesis Is True	The Alternative Hypothesis Is True
Research	The Null Hypothesis Is True	Accurate	
	The Alternative Hypothesis Is True		Accurate

Q20 :

The following is a Forrest Plot showing risk of admission for patients with asthma on 2 different treatments. Which **ONE** of the following statements best describes the Forrest Plot?

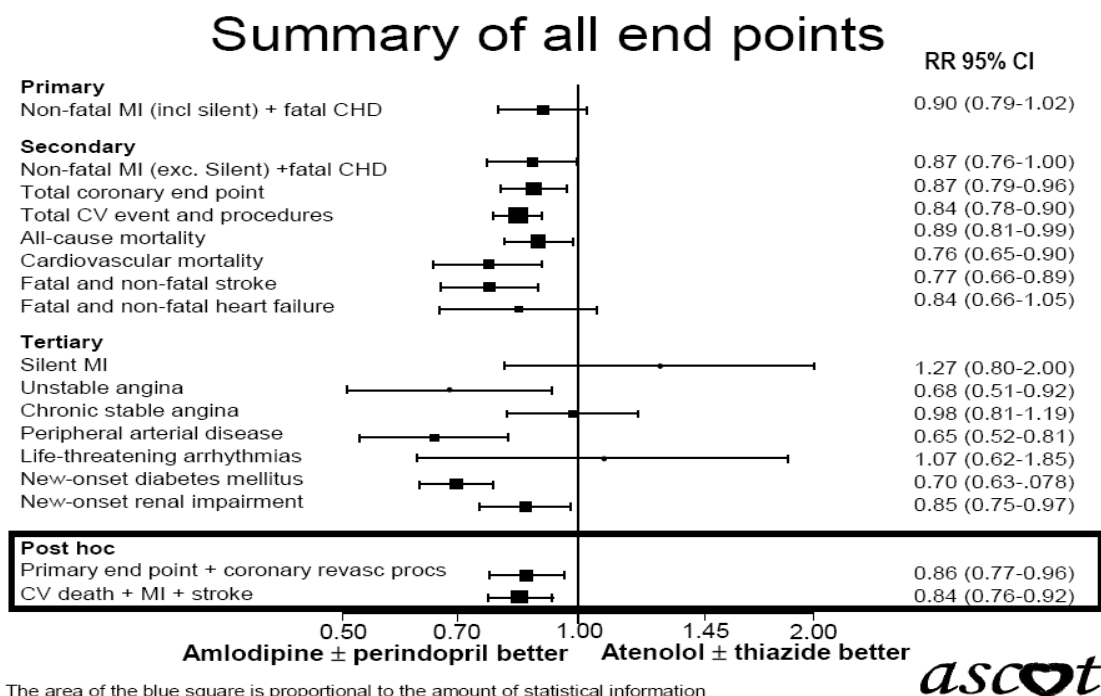
- A All the studies demonstrated that there were clinically significant improvements with LABA+ICS compared with LTRA+ICS
- B The pooled risk ratio showed there was no significant clinical difference between the 2 treatments
- C Overall being on LABA+ICS reduced the risk of admission by 17% compared to being on LTRA+ICS
- D The Ringdal 2003 trial did not demonstrate significant clinical difference between the 2 treatments
- E None of the studies demonstrated that there were clinically significant differences between the 2 treatments

Relative risk reduction

Meta-analysis of long-acting beta₂-agonists (LABA) versus leukotriene receptor antagonists (LTRA) as add-on therapy to inhaled corticosteroids (ICS) in chronic asthma

Study	Patients with ≥1 exacerbation needing corticosteroids [Total number in trial group]		Risk ratio [95% confidence interval]	Favours LABA + ICS Favours LTRA + ICS	
	LABA + ICS	LTRA + ICS		0.1 0.2 0.5 1 2 5	
Nelson 2000	3 [222]	10 [225]	0.30 [0.08, 1.09]		
Fish 2001	16 [476]	16 [472]	0.99 [0.50, 1.96]		
Bjermer 2003	107 [743]	118 [747]	0.91 [0.72, 1.16]		
Ringdal 2003	17 [404]	31 [401]	0.54 [0.31, 0.97]		
Ilowite 2004	102 [718]	123 [734]	0.85 [0.67, 1.08]		
		Pooled risk ratio:	0.83 [0.71, 0.97]		

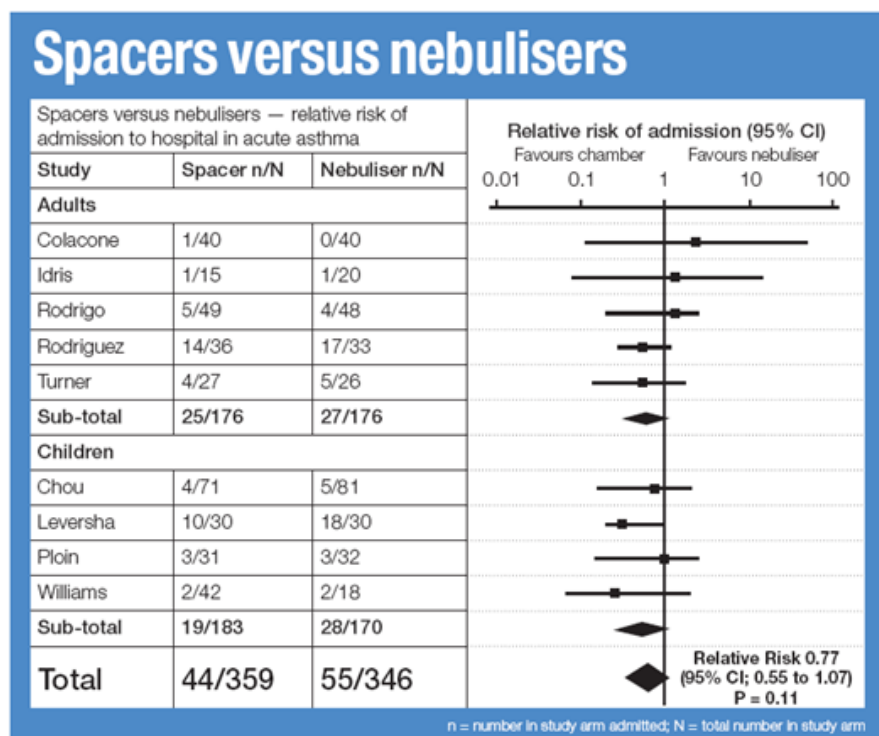
Q21: The following is a Forrest Plot of the ASCOT Trial



Which **ONE** of the following statements best describes the Forest plot for the ASCOT study?

- A amlodipine & perindopril reduced the onset of diabetes on average by 30%
- B amlodipine & perindopril significantly reduced the risk of non-fatal MI
- C atenolol & thiazide was better at preventing life threatening arrhythmias
- D amlodipine & perindopril reduced the onset of renal impairment on average by 25%
- E amlodipine & perindopril had no significant effect on all cause mortality

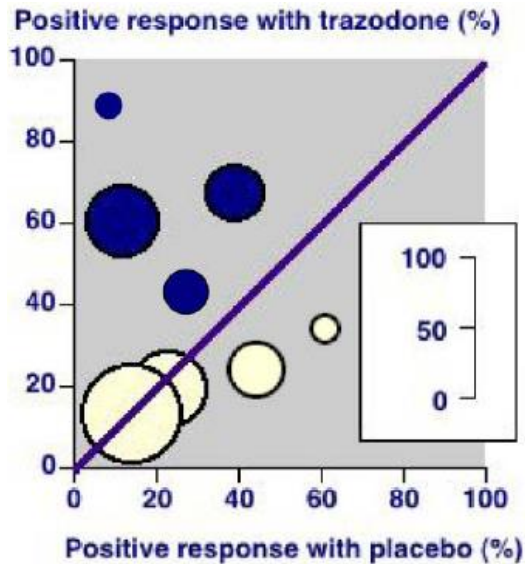
Q22 : The below Forrest Plot compares the risk of admission for acute asthma attacks using either spacers or nebulisers in children and adults.



Please explain the following:

1. What does the RR 0.77 signify?
2. What does the CI 0.55 to 1.07 signify?
3. What does the P=0.11 signify?

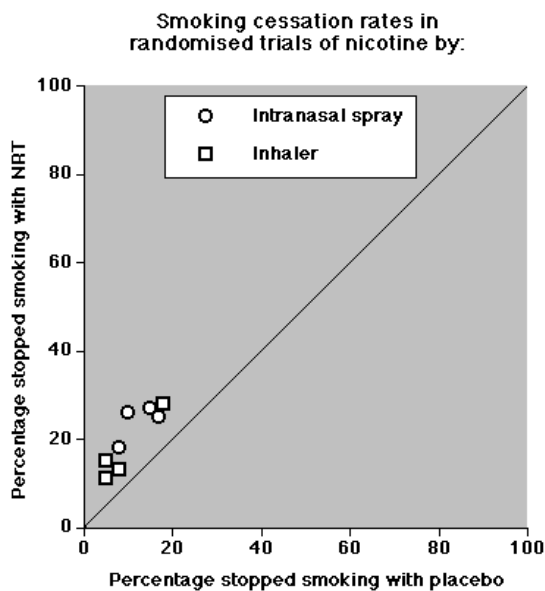
Q23 : The L'Abbe plot shows trials analyzing the effect of Trazodone for erectile dysfunction in psychogenic erectile dysfunction (dark symbols) and with physiological or mixed aetiology (light symbols).



Which ONE of the following statements is INCORRECT?

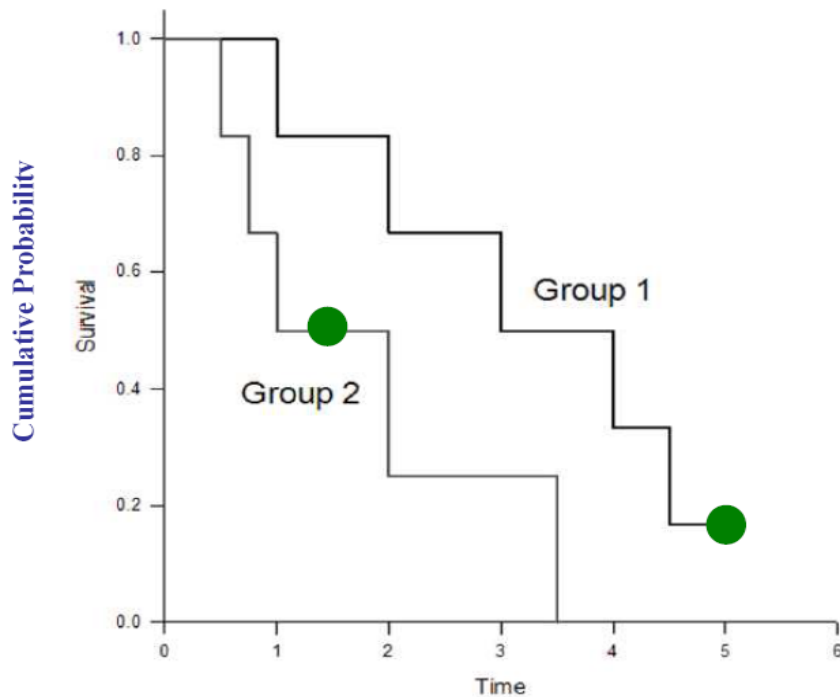
- A trazodone appears effective in the treatment of psychogenic ED
- B the size of the symbols are appropriate to the size of the trials
- C trazodone is no better than placebo in treating physiological ED
- D the trials demonstrate clinical homogeneity
- E the trials demonstrate clinical heterogeneity

Q24 : The L'Abbe plot shows trials analyzing the effect of NRT formulations and placebo in smoking cessation



Please comment on:

1. Trial comparability
2. Clinical effectiveness of NRT versus placebo

Q25**Survival Analysis**

The above Kaplan –Meier Plot displays the probability of cancer survival times in two groups of patients.

● - indicates a censored patient

Please answer the following questions:

1. How many subjects are there in each group?
2. What is a censored patient?
3. Up to the 1st year of the study – how many patients were alive in each group?
4. What is the approximate probability of being alive in each group at 3 years?
5. How many patients were alive at the end of the study at 5 years?