Diagnostic Studies

Dr Ben Bloom
Objectives

• To be able to critically appraise a diagnostic paper
• To become familiar with key questions to ask in appraising a diagnostic paper
• To be aware of the typical questions asked AND answers wanted for the FCEM exam
Ideal characteristics of a diagnostic test

• Correctly identify patients with the disease = True positive
• Minimise patients without the disease who test positive = False positive

• Correctly identify patients without the disease = True negative
• Minimise patients with the disease who test negative = False negative
Screening test

• Applied when a disease has a low prevalence and high morbidity/mortality
  • E.g. ca cervix/breast
  • E.g. PE/ACS in the ED

• Examples of screening tests?
Diagnostic standards

• Reference standard
  • Definition of *having the disease* in the paper

• Gold standard
  • Universally accepted definition of having the disease

• The two may be different
  • E.g. positive result on compression ultrasound Doppler vs contrast venography
  • E.g. CTPA vs pulmonary venography
  • E.g. ‘major adverse cardiac event’ vs ‘universal definition of MI’
  • E.g. ‘diagnosed by ED physician’ vs ‘DSM-V definition’
How does prevalence affect sensitivity?

- *It doesn’t:*
- \( \text{Prevalence} = \frac{a + c}{a + b + c + d} \)
- \( \text{Sensitivity} = \frac{a}{a+c} \)

- Higher prevalence means \( (a+c) \) as a whole is relatively larger

- So in sensitivity:
  - the top number (numerator) goes up
  - the bottom number (denominator) also goes up
- so the fraction remains the same
How does prevalence affect specificity?

- *It doesn’t:*
- *Prevalence* = \( \frac{a + c}{a + b + c + d} \)
- *Specificity* = \( \frac{d}{b + d} \)

- Higher prevalence means \( (b+d) \) as a whole is relatively smaller

- So in specificity:
  - the top number (numerator) goes down
  - the bottom number (denominator) also goes down

- so the fraction remains the same
How does prevalence affect PPV?

• As prevalence increases, PPV increases:
• \( \text{Prevalence} = \frac{a + c}{a + b + c + d} \)
• \( \text{PPV} = \frac{a}{a+b} \)

• Higher prevalence means \( a \) is higher and \( b \) is lower

• So in PPV:
  • the top number (numerator) goes up
  • the bottom number (denominator) goes down

• so the fraction gets bigger
How does prevalence affect NPV?

• **As prevalence increases, NPV decreases:**

  • Prevalence = \( a + c / a + b + c + d \)
  
  • \( NPV = d/(c+d) \)

• Higher prevalence means \( d \) is lower and \( c \) is higher

• So in NPV:
  
  • the top number (numerator) goes down
  
  • the bottom number (denominator) goes up

• so the fraction gets smaller
### Table 2: Test characteristics and ROC curve results for each clinical scoring system

<table>
<thead>
<tr>
<th>Clinical score</th>
<th>AUC</th>
<th>p Value compared with physician</th>
<th>Cut-off value</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Positive predictive value</th>
<th>Negative predictive value</th>
<th>Positive likelihood ratio</th>
<th>Negative likelihood ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>RIPASA</td>
<td>0.67 (0.6 to 0.74)</td>
<td>0.11</td>
<td>7.5</td>
<td>0.78 (0.68 to 0.86)</td>
<td>0.36 (0.29 to 0.44)</td>
<td>0.39 (0.32 to 0.47)</td>
<td>0.76 (0.66 to 0.84)</td>
<td>1.3 (1.1 to 1.5)</td>
<td>0.5 (0.4 to 0.8)</td>
</tr>
<tr>
<td>6.5</td>
<td></td>
<td></td>
<td>5.9</td>
<td>0.88 (0.82 to 0.95)</td>
<td>0.22 (0.16 to 0.28)</td>
<td>0.36 (0.29 to 0.42)</td>
<td>0.8 (0.69 to 0.91)</td>
<td>1.1 (1.0 to 1.2)</td>
<td>0.4 (0.2 to 0.9)</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td>4</td>
<td>0.99 (0.94 to 1)</td>
<td>0.04 (0.02 to 0.09)</td>
<td>0.35 (0.29 to 0.41)</td>
<td>0.89 (0.82 to 1)</td>
<td>1 (1.0 to 1.1)</td>
<td>0.2 (0.0 to 2.2)</td>
</tr>
<tr>
<td>Alvarado</td>
<td>0.72 (0.66 to 0.78)</td>
<td>0.93</td>
<td>7</td>
<td>0.61 (0.51 to 0.71)</td>
<td>0.74 (0.67 to 0.8)</td>
<td>0.53 (0.43 to 0.62)</td>
<td>0.79 (0.73 to 0.85)</td>
<td>2.2 (1.7 to 3.0)</td>
<td>0.6 (0.4 to 0.7)</td>
</tr>
<tr>
<td>Modified Alvarado</td>
<td>0.7 (0.64 to 0.77)</td>
<td>0.54</td>
<td>4</td>
<td>0.94 (0.89 to 0.99)</td>
<td>0.23 (0.17 to 0.29)</td>
<td>0.37 (0.31 to 0.43)</td>
<td>0.88 (0.79 to 0.97)</td>
<td>1.2 (1.1 to 1.3)</td>
<td>0.3 (0.1 to 0.6)</td>
</tr>
<tr>
<td>Physician estimate</td>
<td>0.72 (0.66 to 0.78)</td>
<td>N/A</td>
<td>60%</td>
<td>0.88 (0.82 to 0.95)</td>
<td>0.34 (0.27 to 0.4)</td>
<td>0.39 (0.33 to 0.46)</td>
<td>0.86 (0.77 to 0.94)</td>
<td>1.3 (1.2 to 1.5)</td>
<td>0.3 (0.2 to 0.6)</td>
</tr>
</tbody>
</table>

Results are presented as point estimates with 95% CIs in parentheses. Each scoring system’s ROC curve’s AUC was compared by the $\chi^2$ test based on the asymptotic $\chi^2$ distribution of the Wald statistic. Cut-off values are listed with their corresponding test characteristics.

### Alvarado Score

#### Symptoms

- **Anorexia**: NO
- **Nausea / Vomiting**: NO
- **Migratory RLQ Pain**: NO

#### Signs

- **RLQ Tenderness**: NO
- **RLQ Rebound Pain**: NO
- **Temperature > 37.3 °C**: NO

#### Lab Values

- **WBC > 10,000 c/mm³**: NO
- **Shift to the left of neutrophils**: NO

#### Score 0

**Appendicitis unlikely**

---

**Patient characteristics**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>0.5</td>
</tr>
<tr>
<td>Male</td>
<td>1.0</td>
</tr>
<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>&lt;40 years</td>
<td>1.0</td>
</tr>
<tr>
<td>&gt;40 years</td>
<td>0.5</td>
</tr>
<tr>
<td>Symptoms</td>
<td></td>
</tr>
<tr>
<td>RIF pain</td>
<td>0.5</td>
</tr>
<tr>
<td>Pain migration to RIF</td>
<td>0.5</td>
</tr>
<tr>
<td>Anorexia</td>
<td>1.0</td>
</tr>
<tr>
<td>Nausea and vomiting</td>
<td>1.0</td>
</tr>
<tr>
<td>Duration of symptoms</td>
<td></td>
</tr>
<tr>
<td>&lt;48 h</td>
<td>1.0</td>
</tr>
<tr>
<td>&gt;48 h</td>
<td>0.5</td>
</tr>
<tr>
<td>Signs</td>
<td></td>
</tr>
<tr>
<td>RIF tenderness</td>
<td>1.0</td>
</tr>
<tr>
<td>Guarding</td>
<td>2.0</td>
</tr>
<tr>
<td>Rebound tenderness</td>
<td>1.0</td>
</tr>
<tr>
<td>Rovsing’s Sign</td>
<td>2.0</td>
</tr>
<tr>
<td>Fever &gt;37 °C, &lt;39 °C</td>
<td>1.0</td>
</tr>
<tr>
<td>Investigations</td>
<td></td>
</tr>
<tr>
<td>Raised WCC</td>
<td>1.0</td>
</tr>
<tr>
<td>Negative urinalysis</td>
<td>1.0</td>
</tr>
<tr>
<td>Total</td>
<td>16.5</td>
</tr>
</tbody>
</table>

WCC: White cell count; RIPASA: Raja Isteri Pengira Anak Saleha Appendicitis; RIF: Right Iliac fossa
Likelihood ratios

• $LR^+ = \frac{\text{sens}}{1-\text{spec}}$
  • How much more likely is a positive test to be found in a patient with the disease compared to without

• $LR^- = \frac{1-\text{sens}}{\text{spec}}$
  • How much more likely is a negative test to be found in a patient with the disease compared to a patient without the disease
Little bit of probability

• Pre-test probability
  • Probability that a patient will have the disease
  • =prevalence

• Post test probability
  • Probability that a patient has the disease if they have a positive diagnostic test

• These are Bayesian probability formulae – don’t need to know
Receiver operating characteristic curves

• A plot of Sensitivity (y) against 1-specificity (x)
• The diagonal line from 0,0 to 1,1 is the line of no effect
• A perfect test hugs the y-axis before going across the top (i.e. sensitivity and specificity =1)
• The area under the curve ranges from 0.5 to 1
• 1 = perfect test
• In this study
  • AUC plaque = 0.88
  • AUC stenosis = 0.82
  • AUC TIMI score = 0.63
Bias

• **Selection bias**
  - The selection of subjects into your sample or their allocation to treatment group produces a sample that is not representative of the population, or treatment groups that are systematically different. Random selection and random allocation are the keys to avoiding this bias.

• **Measurement bias**
  - Measurement of outcomes is inaccurate. This may be due to inaccuracy in the measurement instrument or bias in the expectations of study participants, carers or researchers. The latter may be addressed by blinding participants, carers or researchers.

• **Analysis bias**
  - The protection against bias created by randomisation will only be maintained if all participants remain in the group to which they were allocated and complete follow up. Participant who change groups, withdraw from the study or are lost to follow up may be systematically different from those who complete the study. Analysis bias can be reduced by maximising follow up and carrying out an intention to treat analysis.
Validity

• Internal validity = robustness of study (IMRAD)
• External validity = The extent to which results of a study can be extrapolated to wider population (generalisability)

What would you have done differently?
Inter-observer error (reliability)

• Does the test give the same results when interpreted by different people?
• Measurement of reliability needs to take into account agreement due to chance
• Usually measured by Kappa (Value or Coefficient)
• $0= \text{chance}$
• $1= \text{perfect agreement}$
Structured Approach

• Title
• Introduction – 3 paragraphs
• Methods
  • Study design: PICOT
  • Statistics
• Results – baseline results, primary outcomes, secondary outcomes
• Analysis
• Discussion (Conclusion)
• Authors
• References
Diagnostic paper checklist

- Population examined
  - Is the sample examined in the research representative of patients to whom you would apply the test?

- Reference standard applied to all patients

- Test under investigation applied to all patients

- Inter-rater reliability assessment if relevant (kappa)

- Two tests are independent of each other

- Comparison between the two tests is blind

- Results given as sens, spec, PPV, NPV, LR+, LR-, ROC, AUROC

- May also get pre- and post- test probability and odds

- Applicability – external validity – generalisability –
  - are your patients similar to the ones reported in the study
  - Could you do this test in your ED
  - Who would do it and who would interpret it
  - Will results of test affect management of patient
  - Affordability
# Diagnostic paper checklist – STARD - 1

<table>
<thead>
<tr>
<th>Section &amp; Topic</th>
<th>No</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TITLE OR ABSTRACT</strong></td>
<td>1</td>
<td>Identification as a study of diagnostic accuracy using at least one measure of accuracy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(such as sensitivity, specificity, predictive values, or AUC)</td>
</tr>
<tr>
<td><strong>ABSTRACT</strong></td>
<td>2</td>
<td>Structured summary of study design, methods, results, and conclusions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(for specific guidance, see STARD for Abstracts)</td>
</tr>
<tr>
<td><strong>INTRODUCTION</strong></td>
<td>3</td>
<td>Scientific and clinical background, including the intended use and clinical role of the</td>
</tr>
<tr>
<td></td>
<td></td>
<td>index test</td>
</tr>
<tr>
<td><strong>METHODS</strong></td>
<td>4</td>
<td>Study objectives and hypotheses</td>
</tr>
<tr>
<td><strong>Study design</strong></td>
<td>5</td>
<td>Whether data collection was planned before the index test and reference standard</td>
</tr>
<tr>
<td></td>
<td></td>
<td>were performed (prospective study) or after (retrospective study)</td>
</tr>
<tr>
<td><strong>Participants</strong></td>
<td>6</td>
<td>Eligibility criteria</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>On what basis potentially eligible participants were identified</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(such as symptoms, results from previous tests, inclusion in registry)</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Where and when potentially eligible participants were identified (setting, location and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>dates)</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Whether participants formed a consecutive, random or convenience series</td>
</tr>
<tr>
<td><strong>Test methods</strong></td>
<td>10a</td>
<td>Index test, in sufficient detail to allow replication</td>
</tr>
<tr>
<td></td>
<td>10b</td>
<td>Reference standard, in sufficient detail to allow replication</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>Rationale for choosing the reference standard (if alternatives exist)</td>
</tr>
<tr>
<td></td>
<td>12a</td>
<td>Definition of and rationale for test positivity cut-offs or result categories of the</td>
</tr>
<tr>
<td></td>
<td></td>
<td>index test, distinguishing pre-specified from exploratory</td>
</tr>
<tr>
<td></td>
<td>12b</td>
<td>Definition of and rationale for test positivity cut-offs or result categories of the</td>
</tr>
<tr>
<td></td>
<td></td>
<td>reference standard, distinguishing pre-specified from exploratory</td>
</tr>
<tr>
<td></td>
<td>13a</td>
<td>Whether clinical information and reference standard results were available to the</td>
</tr>
<tr>
<td></td>
<td></td>
<td>performers/readers of the index test</td>
</tr>
<tr>
<td></td>
<td>13b</td>
<td>Whether clinical information and index test results were available to the assessors of</td>
</tr>
<tr>
<td></td>
<td></td>
<td>the reference standard</td>
</tr>
<tr>
<td><strong>Analysis</strong></td>
<td>14</td>
<td>Methods for estimating or comparing measures of diagnostic accuracy</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>How indeterminate index test or reference standard results were handled</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>How missing data on the index test and reference standard were handled</td>
</tr>
<tr>
<td></td>
<td>17</td>
<td>Any analyses of variability in diagnostic accuracy, distinguishing pre-specified from</td>
</tr>
<tr>
<td></td>
<td></td>
<td>exploratory</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>Intended sample size and how it was determined</td>
</tr>
</tbody>
</table>
# Diagnostic paper checklist – STARD 2

## RESULTS

<table>
<thead>
<tr>
<th>Participant</th>
<th>19</th>
<th>Flow of participants, using a diagram</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20</td>
<td>Baseline demographic and clinical characteristics of participants</td>
</tr>
<tr>
<td>21a</td>
<td></td>
<td>Distribution of severity of disease in those with the target condition</td>
</tr>
<tr>
<td>21b</td>
<td></td>
<td>Distribution of alternative diagnoses in those without the target condition</td>
</tr>
<tr>
<td>22</td>
<td></td>
<td>Time interval and any clinical interventions between index test and reference standard</td>
</tr>
<tr>
<td>Test results</td>
<td>23</td>
<td>Cross tabulation of the index test results (or their distribution) by the results of the reference standard</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>Estimates of diagnostic accuracy and their precision (such as 95% confidence intervals)</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>Any adverse events from performing the index test or the reference standard</td>
</tr>
</tbody>
</table>

## DISCUSSION

| 26          | Study limitations, including sources of potential bias, statistical uncertainty, and generalisability |
| 27          | Implications for practice, including the intended use and clinical role of the index test |

## OTHER INFORMATION

| 28          | Registration number and name of registry |
| 29          | Where the full study protocol can be accessed |
| 30          | Sources of funding and other support; role of funders |
Prospective evaluation of the ability of clinical scoring systems and physician-determined likelihood of appendicitis to obviate the need for CT

Question 1

- Provide a no more than 200 word summary of this paper. Only the first 200 words will be considered – short bullet points are acceptable.

Maximum of 8 points available
Question 1 - what’s expected?

• Use all 200 words
• One side A4
• Stand alone summary
• Not appraising the paper
• Consider it your own abstract
• Use structured approach
• Use bullet points
Summary details

• Type of study
• Population
• Test
• Reference standard
• Blinding
• Results- Sens/spec/ PP/ NPV
• Conclusion(s)
Q1 Summary
Type of study

• prospective, observational study
Q1 Summary
Population

• convenience sample ED patients
• for whom a CT was ordered to evaluate for appendicitis
Q1 Summary
Diagnostic test in question

• Page 2 para 3

• Alvarado score
• Modified Alvarado score
• RIPASA score
• Physician-determined likelihood of appendicitis
Q1 Summary
Reference / gold standard

• Top of page 3

• Surgical findings
• pathology reports
• CT findings
• Clinical follow-up

One mark
Q1 Summary
Blinding

• No blinding

One mark
Q1 Summary
Results

• RIPASA cut off 7.5
  • sens 0.78 (0.68 to 0.86) spec 0.36 (0.29 to 0.44)

• Alvarado cut off 7
  • sens 0.61 (0.51 to 0.71) 0.74 spec (0.67 to 0.8)

• Modified Alvarado cut off 7
  • sens 0.47 (0.37 to 0.57) spec 0.81 (0.75 to 0.86)

• Physician estimate
  • sens 0.88 (0.82 to 0.95) spec 0.34 (0.27 to 0.4)
In summary, our results do not support using either the high or low thresholds of clinical scoring systems for the diagnostic evaluation of patients with possible appendicitis when a physician has already determined that medical imaging is clinically warranted.

(verbatim)

One mark
Question 2

• List six features of the study design in this paper that enhance the quality of the study. (6 points)
Q2 – what’s required

• Strengths of DESIGN- NOT the paper!
• This is all about methodology!
• Explain the buzz words
• Forget the routine stuff- e.g. ethics
• Time to refer to your checklist
Diagnostic Papers

• Has the test in question been compared to the gold standard?
• Is the test independent to the reference standard?
• Have all had both tests?
Is the test interpretation blinded?

• Person interpreting diagnostic test blinded to reference standard?
• Vice versa
• Review Bias - Awareness either way
Q2 Answers

- Prospective design
- Test applied to relevant group of patients whom we would see in the ED and who there is uncertainty about.
- Diagnostic test of interest carries out on all patients
Q2 Answers cont..

• Appropriate reference (gold) standard
• Gold standard applied to all patients
• Appropriate sample size ‘power calculation’
• Double blinded- both those reporting the diagnostic test under evaluation and those applying the reference standard
Question 3a

• You see a patient with abdominal pain. Which performance measure (sensitivity, specificity etc) and which score is most useful in advising the patient about their chances of having appendicitis? (1 mark)

• Explain why you think this performance measure is most useful. (1 mark)

• What would you tell the patient about their chances of having appendicitis? (2 marks)
Q3 What’s wanted?

• How you can or cannot apply statistical results to individual patients
• How can we use research outcomes in clinical life?
• A brief explanation of this
Q3 Answer

- RIPASA cut off 5
- Negative Predictive Value

One mark

- NPV tells you the probability of the disease in those with a negative test so can advise an individual using this result

One mark
Q3 Answer cont...

• Tell the patient
• Negative result gives a 11% chance of having appendicitis
• BUT could be as high as 18% or as low as 1%—remember 95% CI...

Two marks
Question 4

• Table 2 gives the likelihood ratios of a positive and a negative test
  • Define a likelihood ratio? (1 mark)
  • What does LR + 2.4 mean? (1 mark)
  • Give one advantage of likelihood ratios over sensitivity, specificity, negative predictive value and positive predictive value? (1 mark)
Q4 What’s wanted?

• What are LR and why do we use them
• Understanding of ball park values of LR
Q4a Answer

• How much more likely is a positive test to be found in a patient with the disease compared to a patient without the disease

• LR >1 increase the probability the target disorder is present

• LR < 1 decrease the probability
Q4b - answer

- A positive result (appendicitis) is 2.4 times more likely to be found in a patient with appendicitis than a patient without it = literal
- OR
- Patient with a positive result is 2.4 times more likely to have the disease than you thought they were prior to the test
Q4c Answer

• Advantage of LR is they are applicable to patients in any population they are not altered by disease prevalence whereas NPV / PPV vary with prevalence and CANNOT be applied to different populations
Question 5a

• The specificity of the modified Alvarado score with a cut off of 7 when applied after physician estimated a likelihood of appendicitis of >60% is 0.9 (95% CI 0.86-0.94)
  • What does that mean? (1 mark)
Q5a answer

• The point estimate of the specificity is 0.9
• That means that the proportion of patients without appendicitis who have a negative test is 0.9, which means that the proportion of patients with a positive test but who do not have appendicitis is 0.1 i.e. the false positive rate is 0.1 i.e. there is a 10% chance of a false positive
• But this is only a point estimate – the range within which we can be 95% confident or sure that the true value of the specificity lies, is 0.86 to 0.94, so there may be as much as 14% false positive rate, or as little as 6% false positive rate
• This means that this test is fairly good at ‘ruling in’ appendicitis
Question 5b

• The mean age of the sample in years (range, SD) was 33 (12–88, 15.2) in the included group and 39 (12–95, 18.2) in the eligible not included group (p<0.0001)

• Why was this information reported

• What does p<0.0001 mean

• Give one advantage of CI over p-value
Q5b - What’s required?

- Understanding of confidence intervals (CI)
- Interpretation of probability and hypothesis testing
- Why we have both- what’s ‘best’
Q5b answer

• Only 26% of eligible patients were enrolled
• Why 74% were not enrolled was explained by the chief recruiters being physicians
• There could be an effect on the results because of a selection bias – the 26% may be materially different to the 74%
• The inclusion of information demonstrating the similarities or differences is an attempt to quantify the bias
• That this information was included is a good thing – this shows a candid approach to methodological or process flaws in the paper
Q5b answer

• P<0.0001 means that there is a 1/10000 chance that the difference reported between the two groups appeared by chance, or that there is a 1/10000 chance that the null hypothesis is true – this is such a low chance that we reject the null hypothesis and accept the alternative hypothesis i.e. that there is a difference
Q5b answer

• CI give magnitude and direction to the estimate whereas p values only give a probability of whether the null hypothesis is true i.e. yes/no

• CI therefore quantify the difference – which may be statistically significant but clinically meaningless

• Eg the mean age in the included group is 33 (12-88) and in the eligible not included group it is 39 (12-95), which is statistically significant but is it truly clinically significant?

• We assume that the samples are normally distributed (why?) and a difference in mean of 6 years seems unlikely to affect symptom or blood test characteristics
Question 6

• Having read this paper, give six reasons why you would or would not implement risk scoring for appendicitis in the ED. (6 marks)
Q6- what’s wanted

• A time to critique
• Weaknesses, limitations, validity, applicability and importance in EM
• Points relevant throughout all sections of paper
• Do not make any unquantified statements
• Explain each reason
• Back to the checklist
• Don’t copy their own limitations section if you can help it
• Imagine yourself as the researcher – would you have done it differently? Would you have been able to do it differently?
Will it change your practice?

• Importance?
• Applicability?
  • Different to your population?
  • Different setting?
• 4 Bs of implementation
  • Barriers- any harm
  • Beliefs
  • Burden of disease- incidence
  • Budgets
Summary

• Read the question carefully
• Think carefully how each answer is worded
• Look at the marks for each section
• Prepare standard phrases to demonstrate your understanding of statistical terms
• Don’t get bogged down in the stats and paper
• Practice- use resources available