

Diagnostic Test Accuracy Meta-Analysis Worksheet

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Diagnostic tests generally comprise of a measure which splits individuals into healthy or diseased. To assess accuracy, a diagnostic test is compared to the “gold standard” test which is assumed to provide the true diagnosis of individuals. There are two parameters which are often used to assess the accuracy of diagnostic tests. Sensitivity is the proportion of patients with the disease correctly diagnosed by the test. Specificity is the proportion of patients without the disease correctly diagnosed by the test. For those new to this topic, an interactive primer on the evaluation of diagnostic test accuracy can be found here: <https://crsu.shinyapps.io/diagprimer/>.

A meta-analysis of diagnostic test accuracy (DTA) studies synthesises both sensitivity and specificity from multiple studies to evaluate the performance of a diagnostic test. The results are often presented either around a mean point or as a summary receiver operating curve (ROC). *Diagnostic Test Accuracy Meta-Analysis (DTA MA)* is a web-based App for conducting meta-analysis of diagnostic test accuracy studies. The App produces summary ROC plots, and pooled estimates for sensitivity and specificity together with uncertainty in their estimation. The App can also be used to aid sensitivity analyses by excluding studies.

After completing this worksheet, you should be able to:

- Use the *DTA MA* app to perform a meta-analysis of diagnostic test accuracy studies, obtain pooled estimates of sensitivity and specificity and interpret the results
- Use the *DTA MA* app to produce and download a summary ROC plot
- Use the *DTA MA* app to examine the influence of studies when they are included and excluded in a sensitivity analysis

The app can be accessed from: https://crsu.shinyapps.io/dta_ma/

The default dataset is a subset of data from a study on unhealthy alcohol use and alcohol use disorders (Kriston et al. *Ann Intern Med.* 2008; 149: 879). The dataset consists of fourteen studies assessing the use of the AUDIT-C (Alcohol Use Disorders Identification Test-Consumption) questionnaire for identifying patients with an unhealthy alcohol use problem.

Start by viewing the data in the ‘Load Data’ tab and then use the AUDIT-C dataset to complete the following questions:

1. Click on the ‘Load Data’ page and select the ‘Data for Analysis’ tab. Check you understand the data that is loaded and ready for analysis. (Optional: Calculate sensitivity by hand for Aalto and check your result using the ‘Study-level Outcomes’ tab on the ‘Meta-Analysis’ page).
2. a) Use the ‘Study-level Outcomes’ tab on the ‘Meta-Analysis’ page to complete the following table:

Author	Year	Sensitivity	Specificity
Aertgeerts02	2002		
Bradley03	2003		
Bush	1998		

Gordon	2001		
Rumpf	2002		
Tuunanen	2007		

- b) Across all studies:
 - i) Which studies have the largest and smallest values for sensitivity?
 - ii) Which studies have the largest and smallest values for specificity?
- 3. Use the 'ROC Curve' tab on the 'Meta-Analysis' page to produce a plot which shows the HSROC curve (this stands for hierarchical summary receiver operatic characteristics curve and is a pooled curve taking all the data points into account and including random effects to allow for between study heterogeneity), summary estimate, 95% confidence region and individual study estimates. Change the title to "AUDIT-C Meta-Analysis". (Optional: Download the plot and place into a Word document).
- 4. a) Use the 'Statistics' tab on the 'Meta-Analysis' page to complete the following table:

Parameter	Estimate	2.5%	97.5%
Sensitivity			
Specificity			
False Positive Rate			
DOR			

- b) Interpret the sensitivity, specificity and false-positive rate
- c) Interpret the diagnostic odds ratio
- 5. Use the 'Sensitivity Analysis' page to exclude the trials with the largest values of sensitivity and specificity:
 - a) Use the 'ROC Curve' tab to produce a plot which shows the data points, summary estimate, 95% confidence region and 95% predictive region. Change the title to "Sensitivity Analysis". (Optional: Download the plot and place in a Word document)
 - b) How do the estimates of sensitivity and specificity change compared to the analysis with all studies?
- 6. Use the 'Sensitivity Analysis' page to compare the earliest seven studies with the most recent seven studies:
 - a) Is there a difference between the estimates of sensitivity?
 - b) Is there a difference between the estimates of specificity?
- 7. a) From the 'Study-level Outcomes' tab of the 'Meta-Analysis' page download the study-level outcomes table to Excel and add a new study to the meta-analysis
 - b) In the 'Load Data' tab upload this new dataset
 - c) Assess the impact of adding a new study using the 'Sensitivity Analysis' page
- 8. Try loading your own data into the app using the 'Load Data' page and producing the same tables and plots as above.