

# Accuracy of alcohol screening instruments in primary care: systematic review and meta-analysis

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# INTRODUCTION

- To increase identification of patients with unhealthy alcohol use
- Questionnaires administered by trained personnel e.g. G.P, nurse or midwife
- AUDIT, CAGE, SMAST, T-ACE, TWEAK, BMAST, AUDIT-C, AUDIT-3, FAST, SASQ and RAPS4
- Overall score assigned
- Cut-off score defines screening positive for an alcohol use disorder

# AUDIT-C

Questions	Scoring system				
	0	1	2	3	4
<b>How often do you have a drink containing alcohol?</b>	Never	Monthly or less	2-4 times per month	2-3 times per week	4+ times per week
<b>How many units of alcohol do you drink on a typical day when you are drinking?</b>	1-2	3-4	5-6	7-9	10+
<b>How often have you had six or more units if female, or 8 or more if male, on a single occasion in the last year?</b>	Never	Less than monthly	Monthly	Weekly	Daily or almost daily

Scoring: A total score of 4 or more in men and 3 or more in women indicates increased risk of hazardous drinking and need for further evaluation

Bush et al. The AUDIT alcohol consumption questions (AUDIT-C): an effective brief screening test for problem drinking. Archives Internal Medicine, 1998; 158: 1789-1795

## Rationale for the review

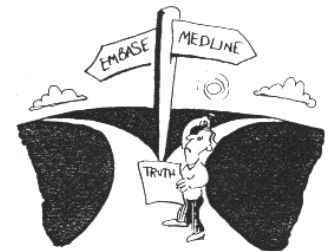
- Previous reviews (mainly) focused on evaluating a single screening tool
- Mostly qualitative vote-counting summary - no meta-analysis
- Differences in screening instrument performance suggested to vary between men and women
  
- No consensus on which tool is most accurate to use for a particular group within a setting
- More precise estimates required to make clearer recommendations

## Aims

- To compare the diagnostic accuracy of one brief alcohol questionnaire with another for identifying risk or hazardous drinking, or an alcohol use disorder in primary care.
- To investigate the following factors as potential sources of heterogeneity: sex, age and ethnicity.

## Methods: search and study selection

- **Comprehensive search** - no language restrictions
  - MEDLINE (1966 to present), EMBASE (1974 to present), PsycINFO (1980 to present), CINAHL (1966 to present), BIOSIS, MEDION, DARE and HTA (*The Cochrane Library* 2009, issue 3) and reference lists of articles
- **Eligibility criteria**
- **Designs**
  - Cross-sectional, cohort or RCT
- **Participants**
  - People of any age, gender, ethnicity and nationality attending primary care settings
- **Index tests**
  - Any brief alcohol questionnaire with 13 items or less
- **Target conditions**
  - Risk drinking or hazardous drinking defined as exceeding recommended benchmarks
  - Current alcohol abuse and/or dependency (alcohol use disorder)
- **Reference standards**
  - Structured interviews, to obtain quantity/frequency alcohol consumption or DSM or ICD-10 criteria



Research article

Open Access

## The development of QUADAS: a tool for the quality assessment of studies of diagnostic accuracy included in systematic reviews

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Patrick MM Bossuyt<sup>2</sup> and Jos Kleijnen<sup>1</sup>

**Table 2: The QUADAS tool**

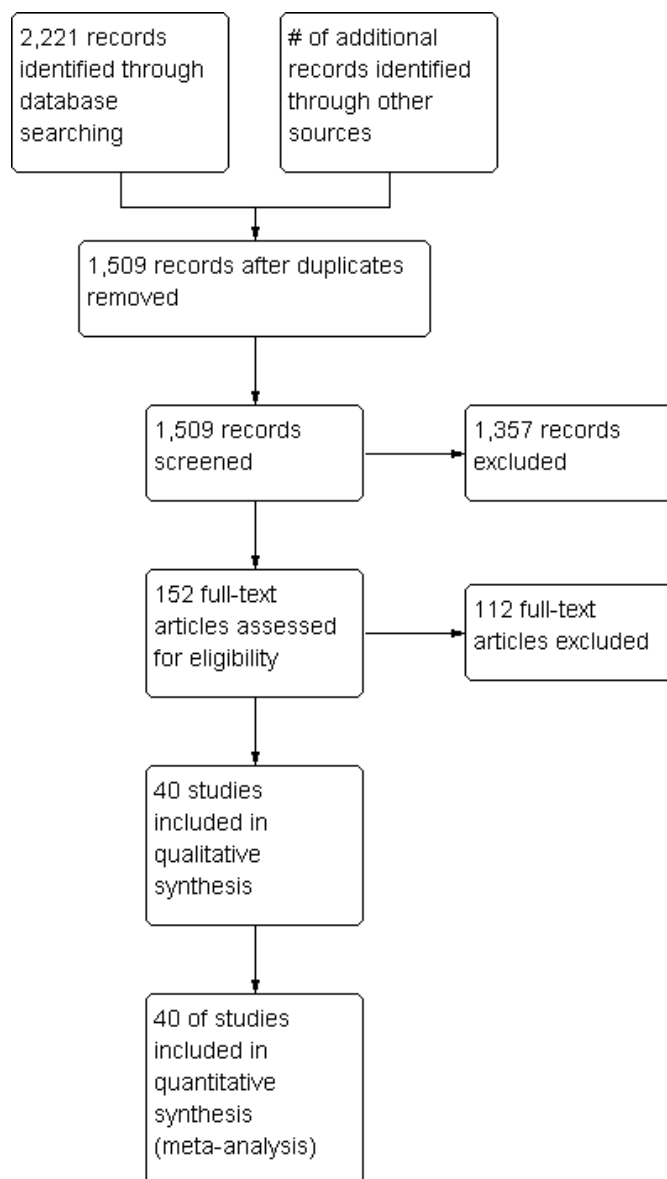
Item	Yes	No	Unclear
1. Was the spectrum of patients representative of the patients who will receive the test in practice?	( )	( )	( )
2. Were selection criteria clearly described?	( )	( )	( )
3. Is the reference standard likely to correctly classify the target condition?	( )	( )	( )
4. Is the time period between reference standard and index test short enough to be reasonably sure that the target condition did not change between the two tests?	( )	( )	( )
5. Did the whole sample or a random selection of the sample, receive verification using a reference standard of diagnosis?	( )	( )	( )
6. Did patients receive the same reference standard regardless of the index test result?	( )	( )	( )
7. Was the reference standard independent of the index test (i.e. the index test did not form part of the reference standard)?	( )	( )	( )
8. Was the execution of the index test described in sufficient detail to permit replication of the test?	( )	( )	( )
9. Was the execution of the reference standard described in sufficient detail to permit its replication?	( )	( )	( )
10. Were the index test results interpreted without knowledge of the results of the reference standard?	( )	( )	( )
11. Were the reference standard results interpreted without knowledge of the results of the index test?	( )	( )	( )
12. Were the same clinical data available when test results were interpreted as would be available when the test is used in practice?	( )	( )	( )
13. Were uninterpretable/ intermediate test results reported?	( )	( )	( )
14. Were withdrawals from the study explained?	( )	( )	( )

## Analysis

- **Descriptive**
- Summary estimates of sensitivity and specificity for each study by test and alcohol misuse category, using a recommended cut-off score and displayed using Forest plots (RevMan 5.1)
- **Meta-analysis**
- Minimum of 4 studies required
- Summary estimate of test accuracy, likelihood ratios (LRs) and diagnostic odds ratios (DOR) and summary ROC curve using hierarchical models (SAS)



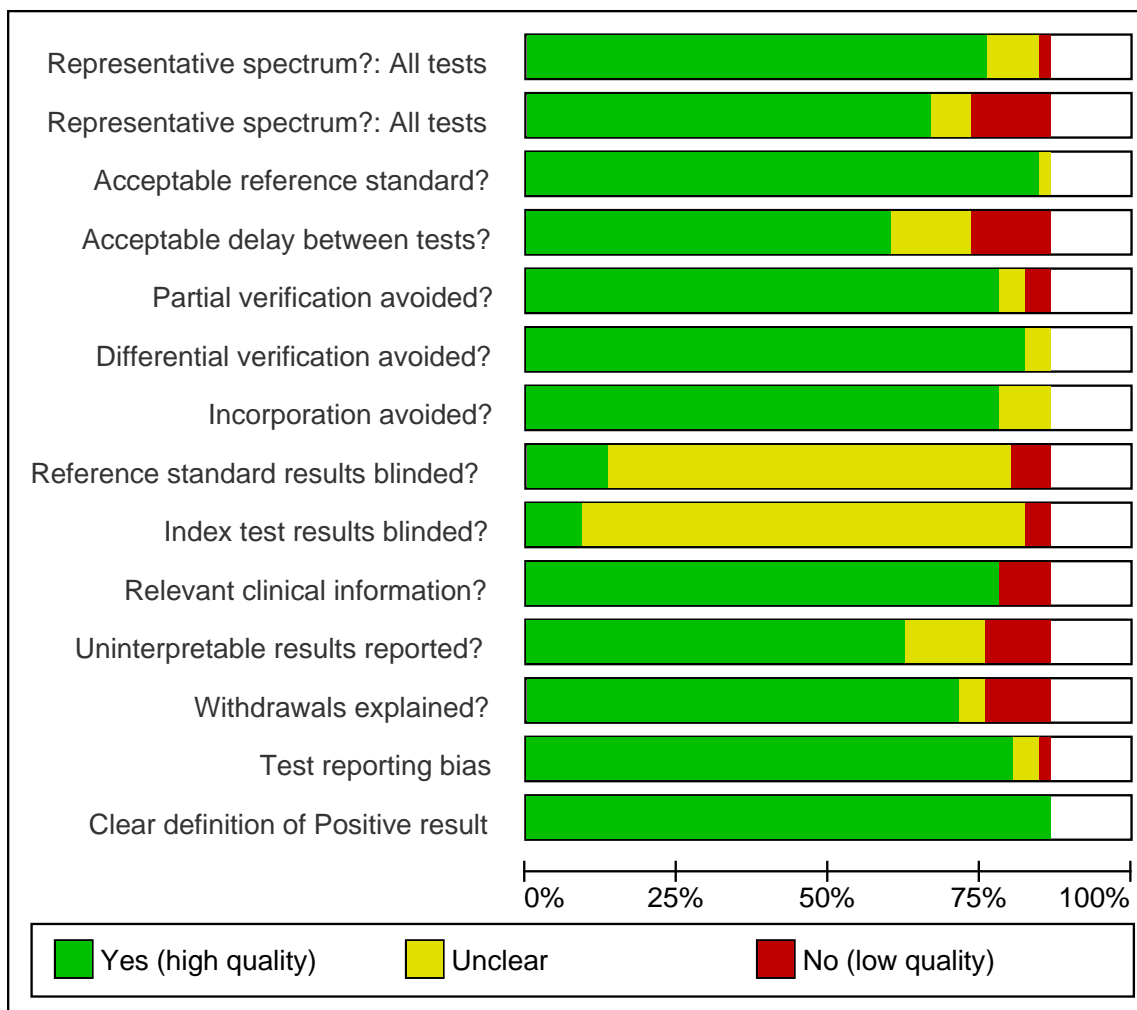
## Results: study selection



## Results

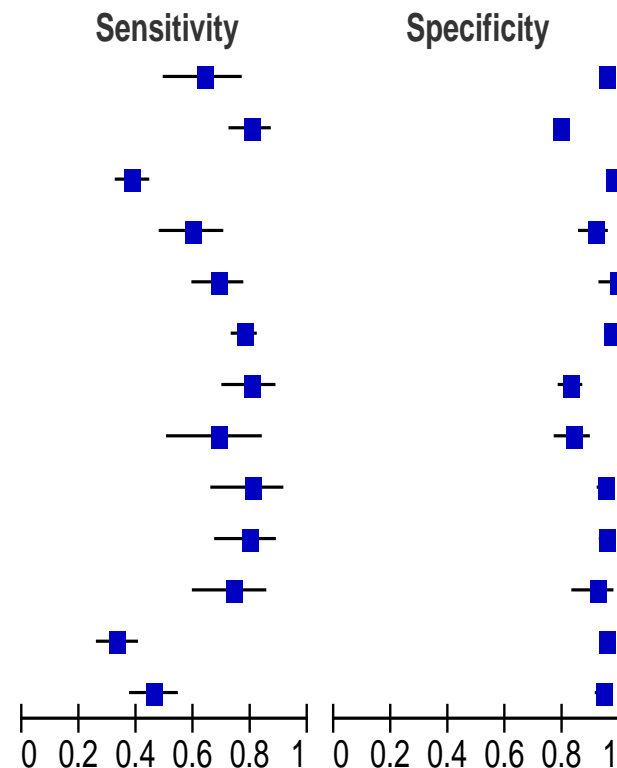
- **Identification of hazardous drinking**
- Twenty-four studies evaluated 13 different alcohol screening instruments
- AUDIT (16), AUDIT-C (11) and AUDIT-3 (6), SASQ (4), CAGE (3), AUDIT-PC (3) evaluated most frequently
- **Identification of alcohol abuse and/or dependency**
- Thirty-five studies evaluated 17 different alcohol screening instruments
- AUDIT (22), CAGE (17) AUDIT-C (6) and SASQ (4), TWEAK (3), evaluated most frequently

# Results: Risk of bias summary across all studies



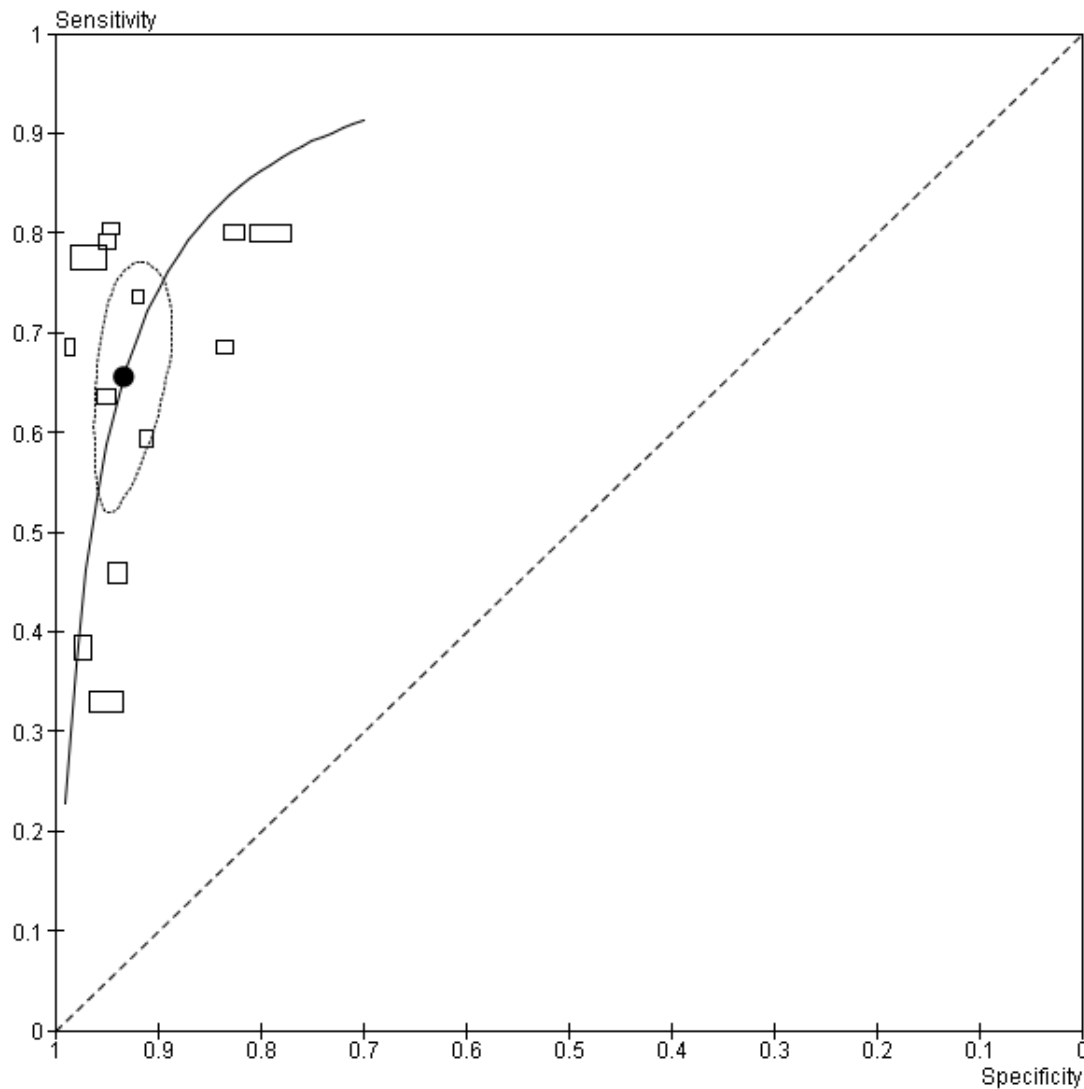
## AUDIT cutpoint 8 for identification of hazardous drinking

Study	TP	FP	FN	TN	Cut-off Value	Sensitivity	Specificity
Aalto 2006	35	42	20	797	8.0	0.64 [0.50, 0.76]	0.95 [0.93, 0.96]
Aalto 2009	112	359	28	1352	8.0	0.80 [0.72, 0.86]	0.79 [0.77, 0.81]
Bradley 2007	117	28	188	986	8.0	0.38 [0.33, 0.44]	0.97 [0.96, 0.98]
Bush 1998	51	14	35	143	8.0	0.59 [0.48, 0.70]	0.91 [0.85, 0.95]
Coulton 2006	83	1	38	72	8.0	0.69 [0.60, 0.77]	0.99 [0.93, 1.00]
Dybek 2006	327	217	95	6439	8.0	0.77 [0.73, 0.81]	0.97 [0.96, 0.97]
Gache 2005	68	69	17	326	8.0	0.80 [0.70, 0.88]	0.83 [0.78, 0.86]
Giang 2005	24	28	11	142	8.0	0.69 [0.51, 0.83]	0.84 [0.77, 0.89]
Gomez 2005	37	25	9	429	8.0	0.80 [0.66, 0.91]	0.94 [0.92, 0.96]
Gomez 2006	53	27	14	508	8.0	0.79 [0.67, 0.88]	0.95 [0.93, 0.97]
Gual 2002a	39	6	14	68	8.0	0.74 [0.60, 0.85]	0.92 [0.83, 0.97]
Rumpf 2002	63	168	128	3192	8.0	0.33 [0.26, 0.40]	0.95 [0.94, 0.96]
Seale 2006	72	28	85	431	8.0	0.46 [0.38, 0.54]	0.94 [0.91, 0.96]



13 studies, N = 17,660

## AUDIT cutpoint 8 for identification of hazardous drinking



Bivariate model

Sensitivity

0.66 (0.56, 0.74)

Specificity

0.93 (0.90, 0.96)

LR+

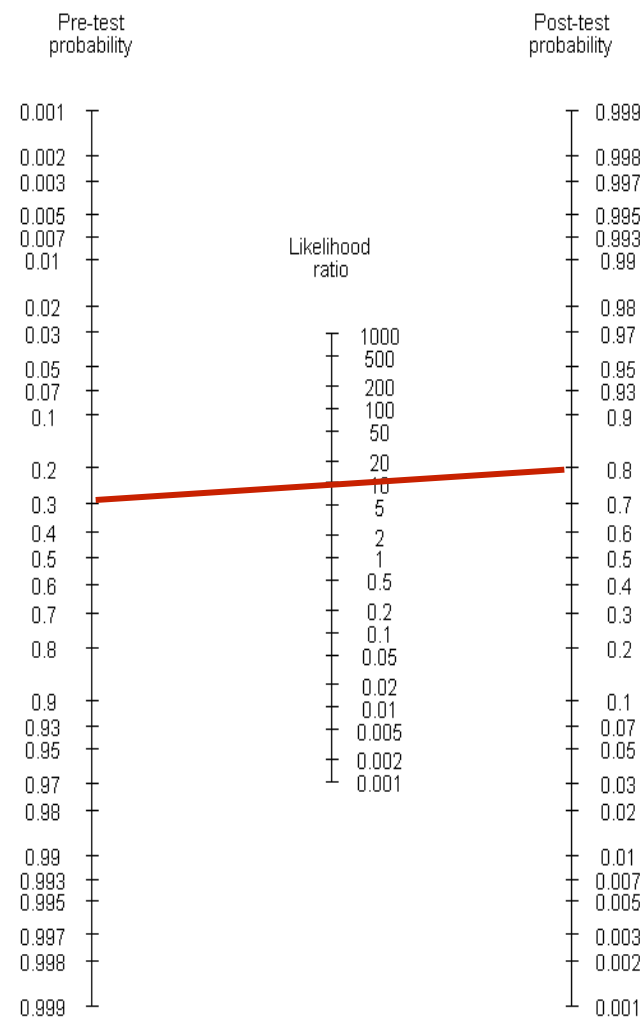
9.8 (6.9, 14.0)

LR-

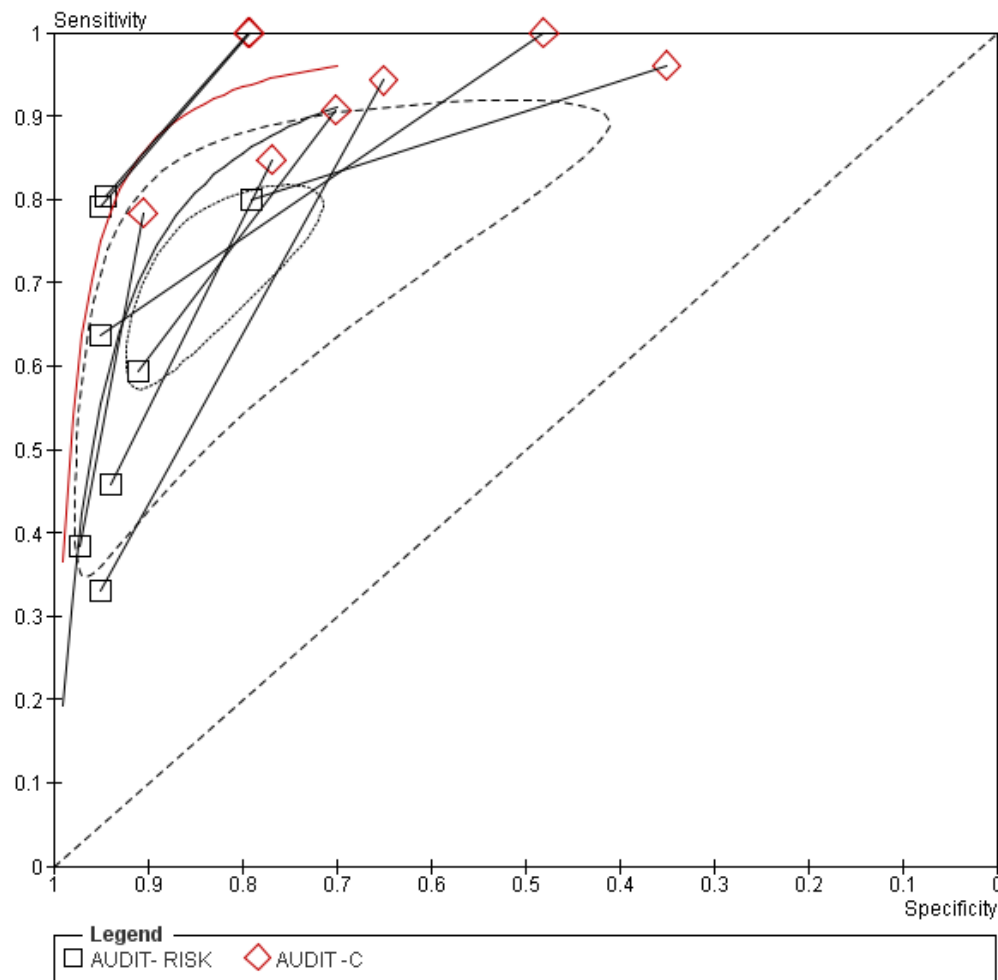
0.37 (0.29, 0.47)

## Positive likelihood ratio (LR+)

- The ratio of the probability of test positive result in diseased patients to the probability of test positive result in non-diseased patients
- How many times more likely a **positive AUDIT** score is found in hazardous drinkers than non-hazardous drinkers
- Use pre-test probability to calculate post-test probability = 0.81
- $\text{pretest odds} = \frac{\text{pretest prob}}{1 - \text{pretest prob}}$
- $\text{posttest odds} = \text{pretest odds} * \text{LR+}$   
(in case of test+)
- $\text{posttest odds} = \text{pretest odds} * \text{LR-}$   
(in case of test-)
- $\text{posttest probability} = \frac{\text{posttest odds}}{1 + \text{posttest odds}}$



## Direct comparison AUDIT 8 and AUDIT-C 4 for identification of hazardous drinking



AUDIT-C vs AUDIT

**Relative sensitivity**

1.63 (1.34, 1.99)

**Relative specificity**

0.79 (0.70, 0.89)

**RDOR**

1.27 (0.98, 1.6)

## Direct comparison AUDIT 8 and CAGE 2 for identification of abuse and/or dependence

CAGE vs AUDIT

Relative sensitivity

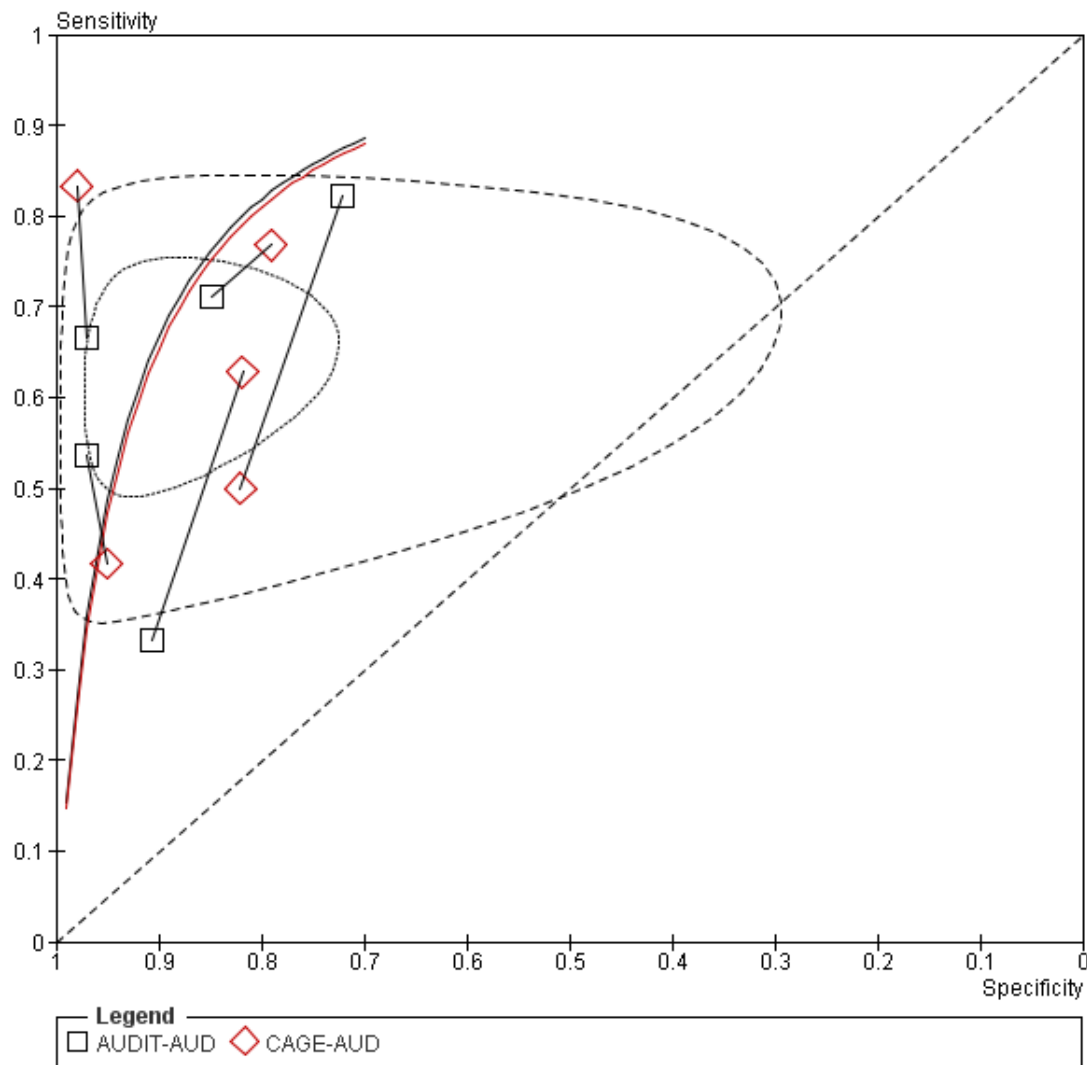
0.84 (0.72, 0.98)

Relative specificity

1.0 (0.98, 1.03)

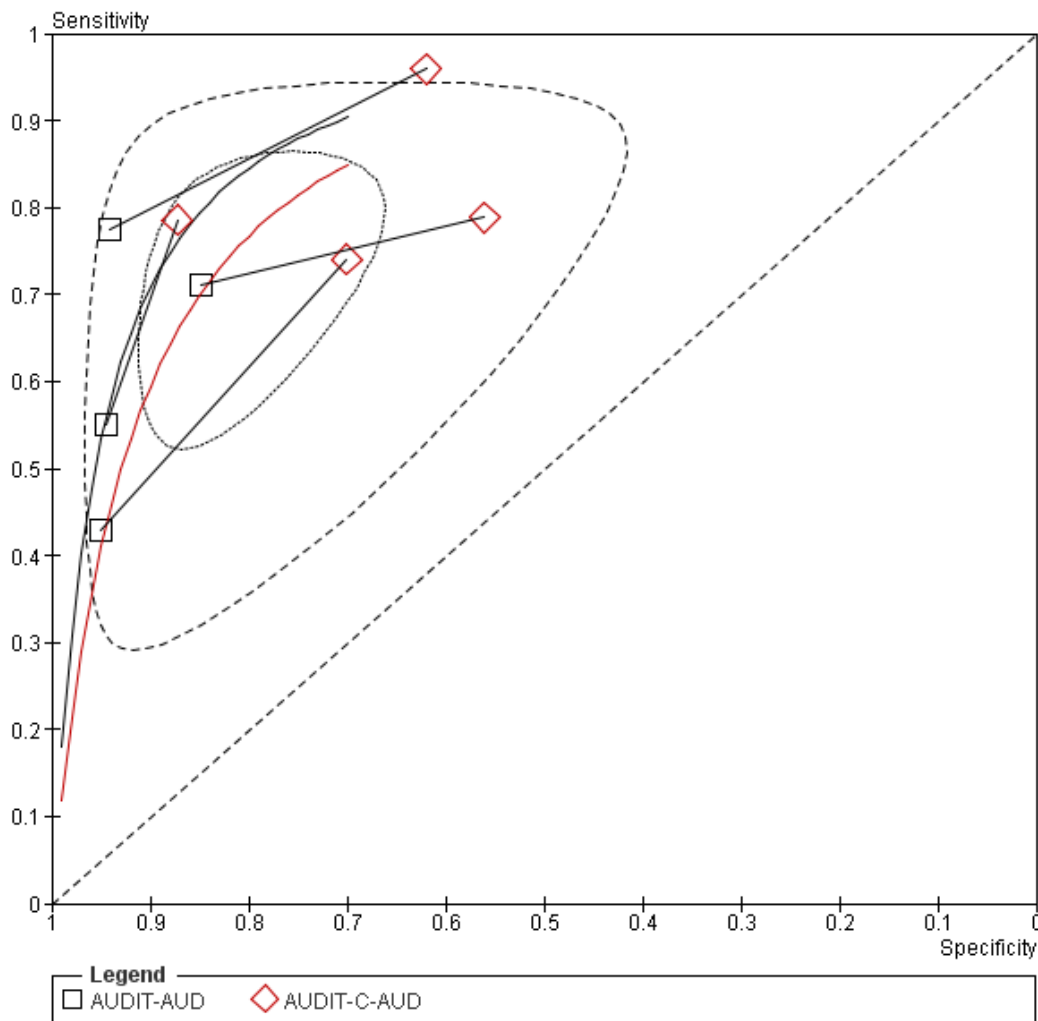
RDOR

0.63 (0.39, 1.02)





## Direct comparison AUDIT 8 and AUDIT C 4 for identification of abuse or dependence



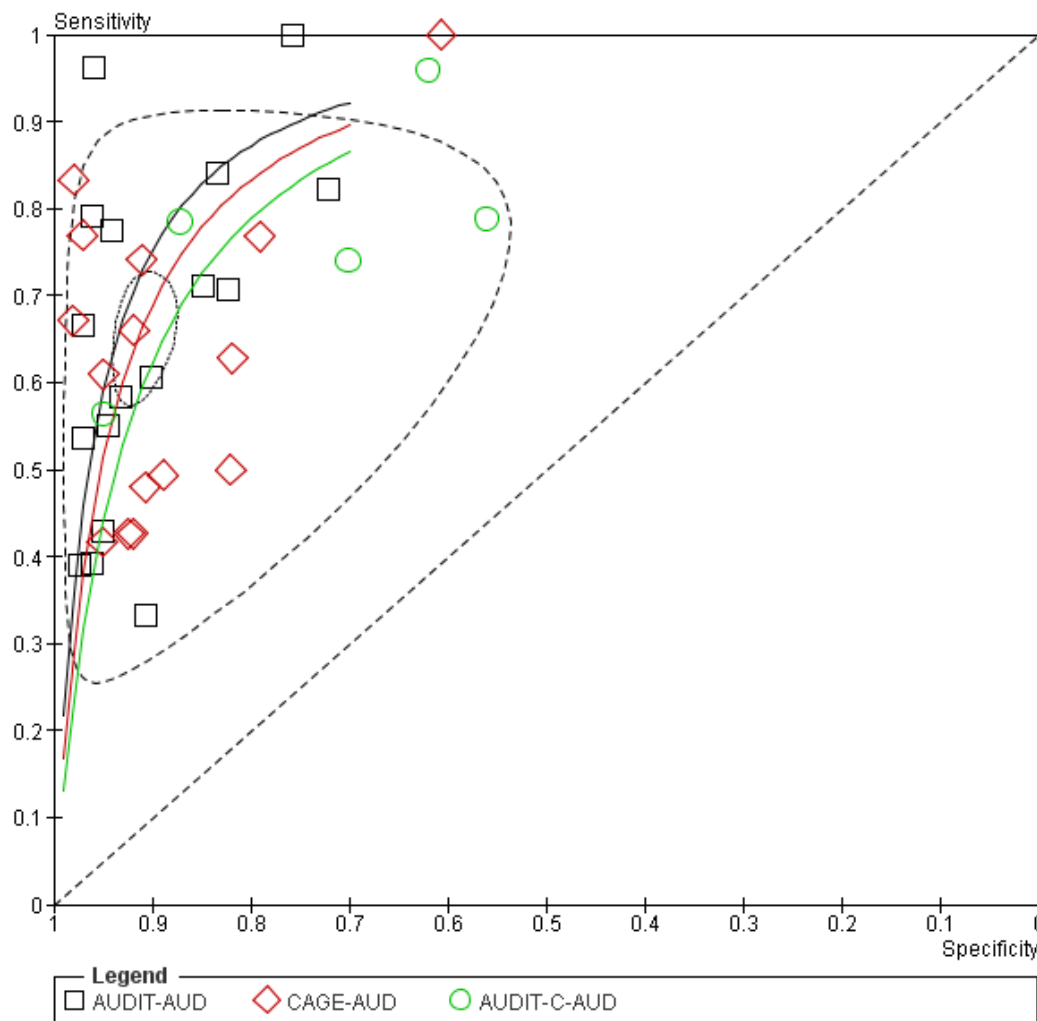
**AUDIT-C vs AUDIT**

**Relative sensitivity**  
1.4 (1.2, 1.6)

**Relative specificity**  
0.73 (0.64, 0.85)

**RDOR**  
0.42 (0.30, 0.59)

# Indirect comparison AUDIT 8, CAGE 2 and AUDIT C 4 for identification of abuse or dependence



N = 39

AUDIT-C vs AUDIT  
RDOR

0.40 (0.28, 0.56)

CAGE vs AUDIT  
RDOR

0.63 (0.43, 0.92)

## Best cut points to identify hazardous drinking

AUDIT Men	cutpoint	TPR	TNR	FPR	Youden's J
	4	0.966	0.6526	0.3474	0.6186
	5	0.9007	0.7884	0.2116	0.6891
	6	0.888	0.7976	0.2024	0.6856
	7	0.8338	0.8414	0.1586	0.6752
	8	0.7373	0.9011	0.0989	0.6384
AUDIT women	4	0.9433	0.8097	0.9103	0.753
	5	0.8443	0.9232	0.0768	0.7675
	6	0.7468	0.9522	0.0478	0.699
	7	0.6821	0.9539	0.0461	0.636
	8	0.5199	0.9681	0.0319	0.488

Youden index (sen+spec-1)

## Best cut points to identify abuse or dependency

AUDIT Men	cutoff	TPR	TNR	FPF	Youden's J
	4	0.9412	0.6013	0.3987	0.5425
	5	0.8871	0.7699	0.2301	0.657
	6	0.8477	0.802	0.198	0.697
	7	0.7838	0.8556	0.1444	0.6394
	8	0.7316	0.8789	0.1211	0.6105
<b>AUDIT women</b>	4	0.8668	0.8526	0.1474	0.7194
	5	0.8176	0.9332	0.0668	0.7508
	6	0.7033	0.9542	0.0458	0.6575
	7	0.6721	0.9705	0.0295	0.6426
<b>AUDIT-C</b>	3	0.8949	0.6612	0.3388	0.5561
	4	0.7858	0.7833	0.2167	0.5691
	5	0.6967	0.8596	0.1404	0.5563
<b>CAGE</b>	1	0.8294	0.7968	0.2032	0.6262
	2	0.6186	0.9163	0.0837	0.5349
	3	0.3802	0.9704	0.0296	0.3506
	4	0.139	0.999	0.001	0.138

## Conclusions

- Results suggest lower thresholds than commonly recommended would classify a greater proportion of subjects more accurately
- Lack of data for performance of these tests in women – lack of UK data
- Verification of lower thresholds for screening positive in men and women in UK primary care population warranted

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