

Scoring the quality of diagnostic accuracy studies: an example using QUADAS

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Background

- Quality scores are a convenient method to incorporate quality into a systematic review.
- The main problem with quality scores is determining how to weight each item. There is no objective way of doing this and different methods are likely to produce different scores.
- We are not aware of any work which has looked at different weightings for the same quality assessment tool in the area of diagnostic accuracy studies.

Objective

- To use different methods of weighting QUADAS' items to produce five quality scores, and to examine the effects of incorporating these into a systematic review.

Methods

- Scoring schemes:** We developed five schemes for weighting QUADAS to produce different quality scores. These are summarised in Table 1.

QUADAS item	Scoring scheme				
	1: Equal	2: Equal with not clear	3: Type of item	4: Evidence based	5: Subjective
1. Was the spectrum of patients representative of the patients who will receive the test in practice?	1	2	3	3	10
2. Were selection criteria clearly described?	1	1	1	1	2
3. Is the reference standard likely to correctly classify the target condition?	1	2	3	2	10
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?	1	2	3	1	6
5. Did the whole sample or a random selection of the sample, receive verification using a reference standard of diagnosis?	1	2	3	3	9
6. Did patients receive the same reference standard regardless of the index test result?	1	2	3	2	7
7. Was the reference standard independent of the index test (i.e. the index test did not form part of the reference standard)?	1	3	3	1	7
8. Was the execution of the index test described in sufficient detail to permit replication of the test?	1	2	2	1	3
9. Was the execution of the reference standard described in sufficient detail to permit its replication?	1	3	2	1	2
10. Were the index test results interpreted without knowledge of the results of the reference standard?	1	2	3	3	8
11. Were the reference standard results interpreted without knowledge of the results of the index test?	1	2	3	3	8
12. Were the same clinical data available when test results were interpreted as would be available when the test is used in practice?	1	2	3	3	8
13. Were uninterpretable/intermediate test results reported?	1	2	1	1	4
14. Were withdrawals from the study explained?	1	2	1	1	3
Maximum score	14	28	23	26	85

All scoring given above refer to the score which studies which answered 'yes' to each question should be given. Studies which answered 'no' or 'not clear' were scored 0 for each scoring system with the exception of system 2 in which studies that scored 'not clear' were given 1.

Table 1: QUADAS' and weighting for each item using each of the different scoring schemes

- Data set:** 28 studies on ultrasound for the diagnosis of vesico-ureteral reflux in children. The studies can be split into standard (12 studies) and contrast-enhanced (16 studies) ultrasound.

- Methods for investigating the effects of the quality scores on test performance:**

- We used four different methods to investigate the effects of quality scores on test performance.
- Each method was performed separately for the standard and contrast-enhanced ultrasound studies:

a. **Ranking of studies:** we ranked studies according to quality score

b. **Difference in estimated diagnostic accuracy between high and low quality studies:** We stratified studies into 'high' and 'low' quality studies. Studies with scores higher than the median score were classified as 'high' quality, studies with the median quality score or lower were classified as 'low' quality. Relative diagnostic odds ratios (RDORs) comparing results from high and low quality studies were estimated.

c. **Quality score as a possible source of heterogeneity:** the SROC model was extended to include 'quality score' as a covariate.

Results

a. Ranking of studies

Study details	Ranking of study				
	Score 1	Score 2	Score 3	Score 4	Score 5
Standard ultrasound					
Trave (1997) ²	1	1	1	1	1
Foresman (2001) ³	2	2	2	2	2
Mahant (2002) ⁴	3	3	3	3	3
Muensterer (2002) ⁵	4	4	4=	5=	5
Evans (1999) ⁵	5=	5=	8	7=	9
Tan (1988) ⁷	5=	8=	4=	7=	7=
Morin (1999) ⁸	5=	5=	6	7=	7=
Salih (1994) ⁹	8=	11=	7	4	4
Baroncini (1986) ¹⁰	8=	7	9	5=	6
Oostenbrink (2000) ¹¹	8=	8=	11=	7=	10
Verber (1988) ¹²	8=	8=	10	11	11
Mage (1989) ¹³	12	11=	11=	12	12
Contrast enhanced ultrasound					
Frutos (2000) ¹⁴	1=	1=	1=	2=	1=
Rohden (1995) ¹⁵	1=	1=	1=	2=	1=
Radmayr (2002) ¹⁶	3	3=	3	4	3=
Schneider (1984) ¹⁷	4=	3=	4	5=	7
McEwing (2002) ¹⁸	4=	5=	5=	5=	6
Mentzel (2002) ¹⁹	4=	5=	7	8	8
Bergius (1989) ²⁰	7=	9=	5=	1	3=
Uhl (2003) ²¹	7=	8	8	7	5
Piaggio (2003) ²²	7=	5=	9	9=	10
Siampis (1996) ²³	10	9=	11=	11	11
Nakamura (2002) ²⁴	11=	12	10	9=	9
Valentini (2001) ²⁵	11=	13=	11=	12=	12=
Haberlick (1997) ²⁶	11=	11	13	12=	12=
Berrocal (2001) ²⁷	14=	13=	14	14=	14
Kessler (1982) ²⁸	14=	15	15=	14=	16
Alzen (1994) ²⁹	16	16	15=	16	15

Table 2: ranking of studies according to each different quality score

b. Difference in estimated diagnostic accuracy between high and low quality studies

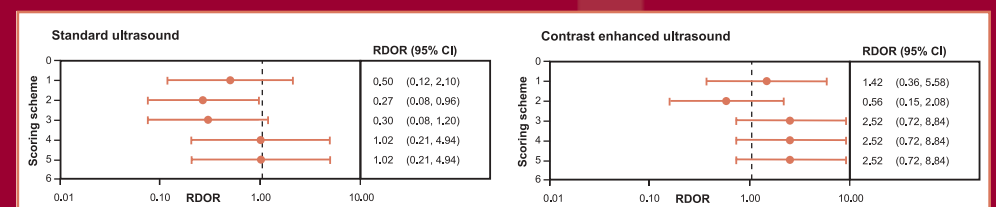


Figure 1: Forest plots showing the RDOR in 'high' quality studies compared to 'low' quality studies for each of the five quality scoring schemes

c. Quality score as a possible source of heterogeneity:

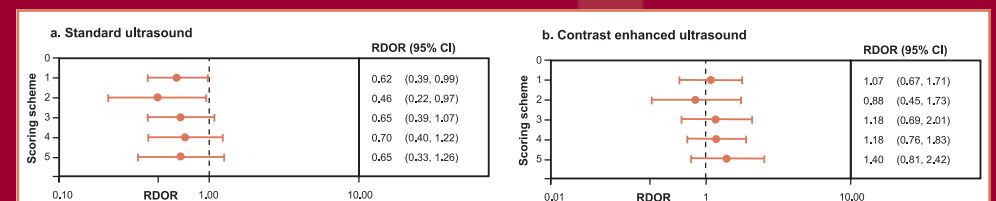


Figure 2: Forest plots showing the RDOR for a 10 point increase in quality for each of the 5 quality scoring schemes

Conclusions

- Using different methods of weighting quality items produces different quality scores
- Incorporating these different quality scores into the results of a review can produce conflicting results
- Quality scores should not be used to summarise the results of the quality assessment
- This work has limitations due to the small number of included studies

References

- Whiting P, Rutjes A, Reitsma J, Bossuyt P, Kleijnen J. The development of QUADAS: a tool for the quality assessment of studies of diagnostic accuracy included in systematic reviews. *BMC Medical Research Methodology* 2003;3:25. Available from: <http://www.biomedcentral.com/1471-2288/3/25>