



Risk of bias in assessing Risk of Bias

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Risk of bias in assessing Risk of Bias.

Griffiths *et al.*¹ have used the Cochrane Risk of Bias tool in the first thorough review of the complex data surrounding the use of colour in helping with reading. Unfortunately for them, recent evidence indicates that the tool is not up to the job. Under double-masked conditions, agreement between judges using the Risk of Bias tool is so poor as to suggest that assessments of this kind have questionable validity². In an attempt to be constructive, I should like to offer steps that can be taken to improve Cochrane reviews, and the assessment of bias in particular. (1) Judges need to be drawn from all the relevant disciplines; (2) Readers need to be told the degree of agreement between judges, and those instances where agreement is poor need to be identified and the final decision justified; (3) Readers need to be told the pre-existing standpoint of the judges and (4) the judges should include those with opposing standpoints, declared. The last two are particularly important in controversial fields where professional opinion is split, otherwise any criticism is simply seen as one side taking a poke at the other. Without these simple precautions any review using the Risk of Bias tool is regrettably no more than a set of untraceable opinions of uncertain validity, dressed up to look like science. In the present review: (1) the disciplines were biased towards ophthalmology, with no representation from neurology or education; (2) there was evident disagreement between judges, but the reader is given no information as to the nature or extent of this disagreement; (3/4) the generally sceptical standpoint of the senior author, can be judged from his blog visualstresssceptic.blogspot.com/ and his previous publications.

The authors take as their subject of interest the effect of coloured filters on reading. It may seem counter-intuitive, but reading is in fact difficult to define. The authors appear to be using a definition in which measures of reading include comprehension of connected prose. This seems reasonable until one considers that in order to measure reading speed or accuracy one needs to take some account of the participants' pre-existing linguistic and semantic knowledge, their ability to remember what they have read, their interest in doing so, and so on. It will be readily appreciated that, against this background, effects of small changes in, for example, refractive error, would be difficult to measure. If one were to fail to show an effect of an inappropriate refraction on reading speed or accuracy using a conventional reading test, one would not be justified in concluding that refraction had no effect on reading. Instead one would use a more sensitive test, one that measured the visual aspects of reading and kept the variance due to comprehension to a minimum. The acuity chart is a case in point. So is the Wilkins Rate of Reading Test (WRRT).

The WRRT is sensitive to the effects on reading speed of refractive errors and prisms for decompensated heterophoria,^{3,4} and it can identify the individuals who will subsequently choose to use coloured overlays in the long term,⁵ so it has validity in the context of refraction, heterophoria and use of coloured filters. It may be subject to placebo effects, but where these have been deliberately introduced via instructional set, little effect has been measurable.⁶ It may be subject to Hawthorn effects (which are a combination of the effects of expectation on the part of both the participants and the experimenters). But any experimenter effects are likely to be small, given that both experimenters who are sceptical of the use of overlays⁷ and those who are less so⁸ have obtained similar improvement in reading speed with overlays. So it is some surprise that the authors categorise the use of the WRRT as an instance of external bias. Curiously, they do so only when the study in question reveals a beneficial effect of overlays on reading, not when it fails to do so. Both the study by Henderson *et al.*⁷ and that by Ritchie *et al.*⁹ used the WRRT, but the external bias was not

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3 categorised as high for these studies. Indeed the study by Henderson *et al.*⁷ showed
4 improvements in reading speed with overlays, improvements that are ignored.
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7 There are several issues to disentangle: does the use of overlays result in immediate
8 benefits in reducing symptoms and improving reading speed, and does their use result in
9 longer term improvement in scholastic attainment? Currently there is little evidence for
10 improvements in scholastic attainment, but this does not mean that the various immediate
11 benefits in symptoms and reading speed are unimportant.

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13 The review is marred by several errors of fact. For example, the authors criticise the
14 reliability of the WRRIT in the context of the statistic that 5% of children read more than 25%
15 more quickly with an overlay. Unfortunately, they have omitted to allow for the fact that the
16 above statistic is based upon each child reading two passages with overlays and two
17 passages without. The reliability is higher than appears from the data that the authors use,
18 which is based on reading only one passage. The test is usually given four times, once with
19 the overlay, once without, again without, and finally once again with the overlay. The
20 practitioner can then get some idea of the reliability of their measurements and any practice
21 effects.
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24 As might be expected in a review of this extent, there are several incorrect citations.
25 Some are important. For example, the authors assert that psychophysical tests using
26 gratings have not been shown to demonstrate an improvement with colour. In fact they
27 have, in a paper by Monger *et al.*¹⁰ that they cite elsewhere.
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30 In the General Discussion the authors make many sweeping generalisations that the
31 reader is obliged to take on trust because the evidence is not cited. For example, the
32 assertion "Improvements have been reported with prescribed overlays/lenses, but similar
33 improvements are also found with placebo colours" is not supported. There is no such thing
34 as a perfect study, and every one of the cited studies, including those few showing no effect
35 of colour, have flaws and biases. The biases in the studies showing no effect are reported as
36 being lower, but in my view are just as great. The wastepaper basket method of simply
37 designating studies as having a high risk of bias and then ignoring their findings needs to be
38 replaced by a more nuanced approach.
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41 Are the beneficial effects of coloured filters indeed simply a reflection of placebo or
42 experimenter effects? Within the limited resources available, there have been many
43 attempts to find out. It would be nice to be certain, but large scale randomised controlled
44 trials are extremely expensive and funding has not been forthcoming. Given that overlays
45 cost very little and coloured lenses are paid for by the patient who has the chance to judge
46 their value, one wonders whether limited resources might perhaps be better spent assessing
47 treatments that are elective, but unlike tints, are invasive and irreversible, for example
48 refractive surgery¹¹. If, in less benighted times, the NHS were to provide a funding
49 mechanism to pay for precision ophthalmic tints, different considerations would obviously
50 apply; a randomised controlled trial would nowadays be required to justify the public
51 expenditure. There is agreement about a need for improvement and standardisation in
52 diagnosing visual stress and recent imaging studies^{12,13,14,15} and a Delphi study (submitted)
53 may come in useful. In the meantime, a proportionate approach for this non-invasive
54 intervention continues to be a trial with inexpensive coloured overlays. In this way, the child,
55 parent, and teacher have several months to decide for themselves whether there is a
56 benefit.
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Disclosure

Arnold Wilkins has undertaken consultancy for the following firms: Crossbow Education, iooSales and Cerium Visual Technologies. When employed by the Medical Research Council, he invented the Intuitive Colorimeter, Intuitive Overlays, Rate of Reading Test and (with Bruce Evans) the Pattern Glare Test. Under the MRC *Awards to Inventors* scheme he receives a proportion of royalties on sales of the Colorimeter and the Rate of Reading Test. No royalties are payable on overlays or lenses.

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