



Title	Colour Vision Testing for Diabetic Retinopathy: A Systematic Review of Diagnostic Accuracy and Economic Evaluation
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Aim

1) To determine the diagnostic performance of color vision testing (CVT) options to identify and/or monitor the progression of diabetic retinopathy (DR) and identify patient preferences related to incorporating CVT in the retinopathy screening program. 2) To determine what tests are currently used to detect and manage DR, and views on future research priorities. 3) To review previous economic studies of DR screening with CVT and develop a cost-effectiveness model to evaluate the potential efficiency of incorporating CVT into the current DR screening program.

Conclusions and results

Of the 25 studies reporting on CVT, 18 presented 2x2 diagnostic accuracy data. The quality of studies and reporting was generally poor. Automated or computerized CVTs reported variable sensitivities (63%-97%) and specificities (71-95%). One study reported good diagnostic accuracy estimates for combined computerized CVT and retinal photography in detecting sight-threatening DR, but this single study included few cases of retinopathy. Results for other types of CVTs (pseudoisochromatic plates, anomaloscopes, and color arrangement tests) were heterogeneous, but largely inadequate for DR screening; most performed little better than chance, having Youden indices (sensitivity + specificity – 100%) close to zero. We found no studies that addressed patient preferences relating to color vision screening for DR. Retinal photography is universally employed as the primary method for retinal screening by centers responding to a survey of current practice (none used CVT). The most frequently cited preference for future research was the use of ocular coherence tomography (OCT) to detect clinically significant macular edema. Our search of the economic evaluation literature revealed no studies describing the cost and effects of any type of CVT. The results of the economic evaluation suggested that adding CVT to the current national screening program could be cost effective if it adequately increases sensitivity and is relatively inexpensive. The base case analysis, based on

one small diagnostic accuracy study, indicated that the cost per QALY gained is 3337 pounds sterling (GBP) and GBP 6674 for type 1 and type 2, diabetes respectively. However, there is scant evidence on the diagnostic accuracy of combining CVT with retinal photography.

Recommendations

Not all color vision tests have been evaluated, and those that have were generally not considered in the context of retinal photography-based screening. The data are insufficient on any predictive/protective value of CVT. There is a lack of primary studies evaluating the efficiency of including CVT in DR screening. Evidence is insufficient to support the use of CVT alone as a screening method for retinopathy in patients with diabetes.

Methods

See Executive Summary link at www.hta.ac.uk/project/1665.asp.

Further research/reviews required

Survey respondents did not identify CVT as a research priority; around a third of respondents considered OCT to be a research priority. Any study to resolve outstanding uncertainties would have to evaluate the addition of CVT to retinal photography and be: prospective; generalizable to a screening population; independent of test developers; designed to account for lens yellowing, iris color, macular pigment density, and other clinical factors; and comply with STARD reporting guidelines.