Screening for presence or absence of diabetic retinopathy: a meta-analysis

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CRD summary
The review concluded that outreach screening for diabetic retinopathy was an effective alternative to on-site specialist examination and had potential to increase screening coverage of high risk patients without missing disease. The review did not report separate data for outreach screening or include outreach screening as a covariate in meta-analyses, so these conclusions should be viewed with caution.

Authors' objectives
To assess the effects of mydriasis and the medical qualifications of retinal photographers on the accuracy of screening for diabetic retinopathy.

Searching
MEDLINE, EMBASE, CINAHL, The Cochrane Library, Rural and Remote Health Database (RURAL) and Indigenous Australia (Informit) databases were searched from inception to June 2009. Search terms were reported and included methodological terms for test accuracy studies. The bibliographies of clinical guidelines and literature reviews were screened for further studies. Language restrictions were not reported.

Study selection
Studies that assessed the accuracy of photography or examination-based retinopathy screening (in patients with diabetes or diabetic retinopathy) were eligible for inclusion. Studies measured sensitivity and specificity for the detection of diabetic retinopathy, sight-threatening diabetic retinopathy or macular oedema using either seven-field mydriatic photography or dilated fundus examination (by an ophthalmologist or equivalent specialist) as the reference standard. Studies of automated analysis methods were excluded.

Approximately half of the included studies were conducted in Europe; most of the others were conducted in the USA or Canada. Study settings were primary healthcare, diabetes clinics or hospitals. The mean age of study participants was 58 years (range 48 to 68.8 years). The mean proportion of male participants was 55.2% (range 31% to 98.4%). The mean duration of diabetes was 10.9 years (range 3.7 to 17.7 years).

Screening methods assessed were: digital photography; film photography; direct examination; Polaroid photography; various combinations of camera types or camera plus examination and scanning laser ophthalmoscope. Most assessments used pharmacological mydriasis in some or all participants. For the camera methods, single-field photography was most common and images were most frequently taken by a photographer or technician and interpreted by an ophthalmologist. Most assessments used dilated fundus examination as the reference standard.

Two reviewers independently screened studies for inclusion; disagreements were resolved by consensus or by consultation with an ophthalmologist.

Assessment of study quality
The authors did not state that they assessed study validity.

Data extraction
Data were extracted for each study and the screening test assessed. Test items extracted were sensitivity and specificity (with 95% confidence intervals, CIs), use of mydriasis and specialist status of the photographer (where camera methods were used). Due to variation in methods and reporting across studies, the unit of analysis was patients rather than eyes. Reported sensitivity and specificity values were applied to the number of patients in order to generate per patient 2x2 tables (numbers of true positive, false negative, false positive and true negative test results).

Data extraction was performed by two authors after piloting and modification of protocols.

Methods of synthesis
In order to accommodate heterogeneity between studies and between tests within studies, a three-level random-intercepts logistic regression model (using 20 numerical quadrature points) was used to generate pooled estimates of sensitivity and specificity with 95% confidence intervals. Odds ratios that compared sensitivity and specificity across subgroups (mildriatic status, medical qualifications of the photographer and combinations of both) were calculated by including relevant covariates in the regression models.

**Results of the review**

Forty-three studies were identified that measured the sensitivity and specificity of diabetic retinopathy screening. Twenty-three studies were excluded because there were too few studies with the same definition of diabetic retinopathy to allow statistical analysis. Twenty studies that defined a positive screening test as "any retinopathy" were included in the review. These studies included approximately 4,000 participants (range 14 to 773) and reported 40 data sets.

The overall estimate of sensitivity was 82.5% (95% CI, 75.6% to 87.9%) and the overall estimate of specificity was 88.4% (95% CI, 84.5% to 91.4%).

Variations in mydriatic status alone did not significantly affect sensitivity or specificity. Variation in the medical qualifications of photographers did not significantly affect sensitivity. Specificity was significantly higher for screening methods that used a photographer with a specialist medical of eye qualification; the odds ratio of a negative screening test when retinopathy was not evident on the reference standard was 3.86 (95% CI, 1.78 to 8.37).

**Authors' conclusions**

Outreach screening is an effective alternative to on-site specialist examination. It has potential to increase screening coverage of high risk patients with diabetic retinopathy in remote and resource-poor settings without the risk of missing diabetic retinopathy.

**CRD commentary**

The review stated a clear research question and defined appropriate inclusion criteria. Several sources were searched for relevant studies. The search strategy included methodological terms for test accuracy studies which can result in relevant studies being missed. The review process included measures to minimise error and/or bias. No assessment of the methodological quality of included studies was provided so it was not possible to determine the reliability of reported data.

The analytical approach was reasonable but more optimal models tailored to the analysis of test accuracy studies may have been preferable. Including direct examination data and data from camera screening tests in the same meta-analyses was questionable.

The authors’ conclusions relate to the value of outreach screening rather than to the specific subgroups considered in their analysis. Some studies included in the review were reported as outreach screening, but data were not reported separately for these studies and outreach screening was not considered as a covariate in the meta-analyses.

**Implications of the review for practice and research**

**Practice:** The authors did not specify any recommendations for practice.

**Research:** The authors stated that future studies should use consistent classification systems for diabetic retinopathy to facilitate more detailed analyses than the presence or absence of retinopathy analysis currently possible.

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**Bibliographic details**


**PubMedID**
Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.