Public Health England

NHS

NHS Diabetic Eye Screening Programme

Grading definitions for referable disease

Public Health England leads the NHS Screening Programmes

About Public Health England

Public Health England exists to protect and improve the nation's health and wellbeing, and reduce health inequalities. We do this through world-class science, knowledge and intelligence, advocacy, partnerships and the delivery of specialist public health services. We are an executive agency of the Department of Health, and are a distinct delivery organisation with operational autonomy to advise and support government, local authorities and the NHS in a professionally independent manner.

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About PHE screening

Screening identifies apparently healthy people who may be at increased risk of a disease or condition, enabling earlier treatment or better informed decisions. National population screening programmes are implemented in the NHS on the advice of the UK National Screening Committee (UK NSC), which makes independent, evidence-based recommendations to ministers in the four UK countries. The Screening Quality Assurance Service ensures programmes are safe and effective by checking that national standards are met. PHE leads the NHS Screening Programmes and hosts the UK NSC secretariat.

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Classifying referable retinopathy

Feature based grading (FBG)

Graders identify individual features of diabetic retinopathy (DR) by selecting a given feature from the feature-based grading (FBG) form. This produces a grade which is determined by rules applied in the grading software. FBG forms for routine digital screening, digital surveillance and SLB surveillance are found in feature-based grading forms v1.4 on GOV.UK.

Questionable features

Grading should be conducted in line with national guidance. Equipment should meet national specifications and should be used in line with recognised procedures for grading. This includes avoiding excessive enhancement and enlargement of images beyond 1:1. A lesion should only be recorded if it is definitely present.

Microaneurysms should be differentiated from pigment spots by viewing in colour and red free and from artefacts by viewing on overlapping images where possible.

IRMA should not be recorded unless visible on colour images, without enlarging the image area, in addition to red free images.

Cotton wool spots

Isolated cotton wool spots (one or more) in the absence of any microaneurysm or haemorrhage should be counted as no DR (R0).

Any number of cotton wool spots (CWS) in the presence of other non-referable features of DR should be graded as background DR (R1).

Where CWS are detected, graders should ensure they have checked for features of referable DR – in particular IRMA and early venous beading.

Venous loops

A venous loop should no longer be referred and should be regarded as a feature of R1.

Photocoagulation scars

If there is no evidence of previous photocoagulation, P0 grade is assigned. If there is evidence of previous photocoagulation (focal/grid to macula or peripheral scatter) a P1 grade is assigned.

Definition of the macula

The macula is defined as that part of the retina which lies within a circle centred on the centre of the fovea whose radius is the distance between the centre of the fovea and the temporal margin of the disc.

Grading classification for pre-proliferative DR (R2)

The grading classification for R2 is:

- venous beading (venous beading from ischaemia in diabetic retinopathy does not occur in isolation)
- venous reduplication
- multiple blot haemorrhages (if uncertain, refer only in the presence of IRMA that are definitely seen)
- intraretinal microvascular abnormality (IRMA*)* (check that they can still be seen on the colour image, that has not been enlarged)

Venous beading

Patients with venous beading should be referred. Venous beading from ischaemia in diabetic retinopathy does not occur in isolation from multiple blot haemorrhages or IRMA.

Venous reduplication

Patients with venous reduplication should be referred.

Multiple blot haemorrhages (MBH)

Patients with multiple blot haemorrhages should be referred. If uncertain, refer only in the presence of IRMA that are definitely seen.

The image set MBH (previously known as MBH 3) in the macula and nasal photographs below shows the amount of haemorrhage present in the retina to warrant an R2

classification. An image which has this number of blot haemorrhages or more is referable.

Although the inherent difficulties of counting blot haemorrhages are recognised, most expert graders graded the MBH image set as having between 8 -10 blot haemorrhages across both images.

Dot and blot haemorrhages

These haemorrhages are located in the retina's inner nuclear and outer plexiform layers. They are restricted in a particular location and so take longer to clear than a superficial haemorrhage.

The difference between a dot and a blot is one of size. Provided the veins are not very dilated, blot haemorrhages are larger than the width of the smallest of the four branches of the central retinal vein as it crosses the edge of the disc.

Flame haemorrhages are superficial haemorrhages in the nerve fibre layer. Any haemorrhage that is flame-shaped or any MA should not be counted as a blot.

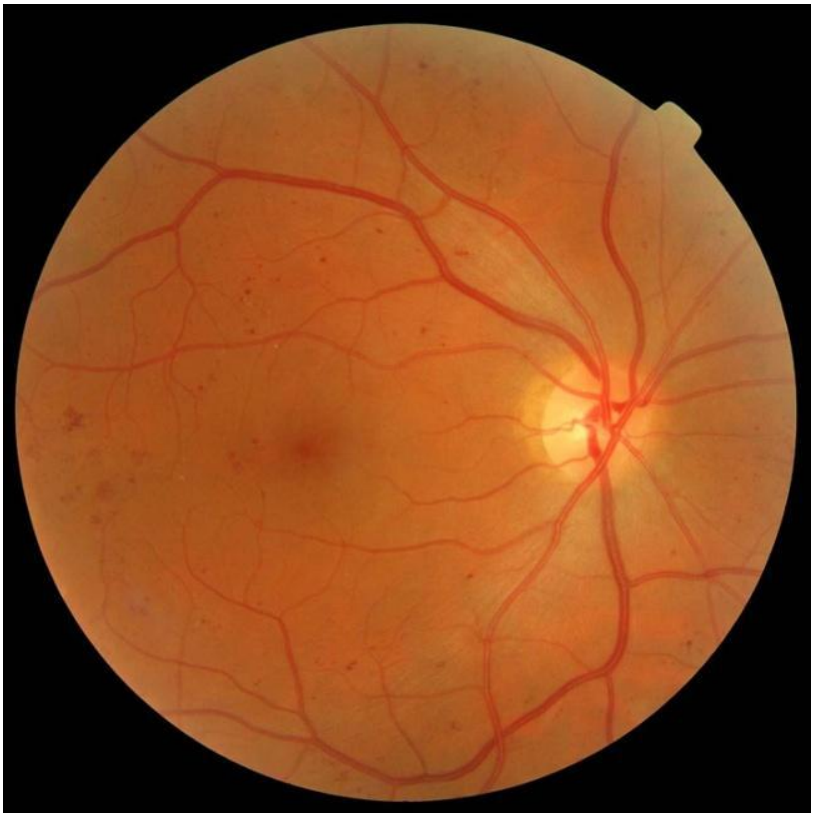


Photo MBH macula

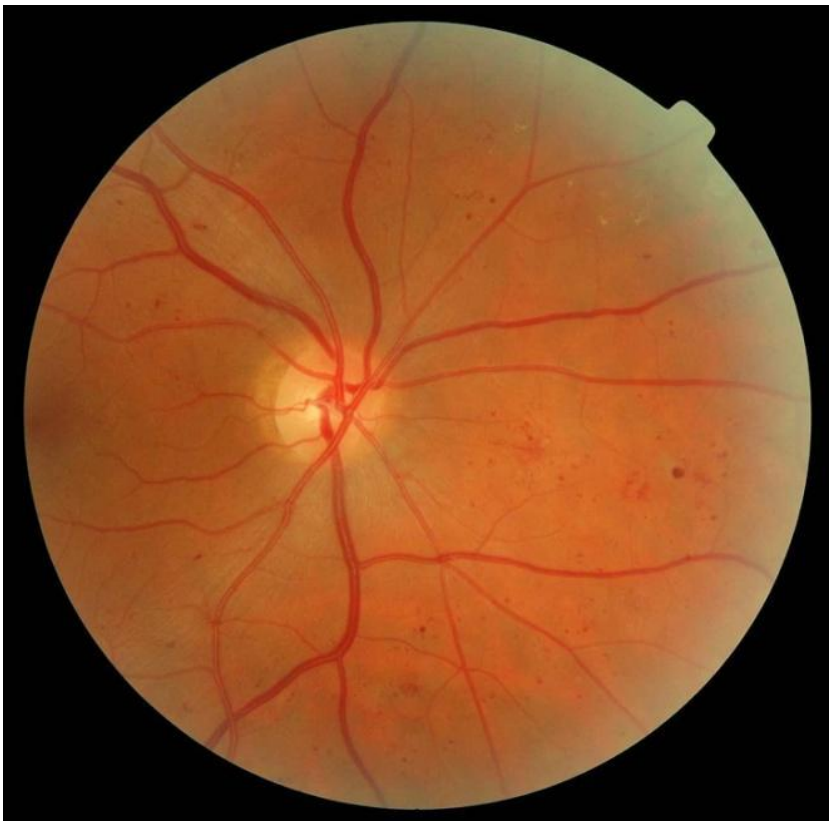


Photo MBH nasal

Intraretinal microvascular abnormality (IRMA)

Patients with IRMA should be referred. **Only IRMA that are definitely seen should be classified as R2.**

If an IRMA is found, the grader should return to the colour image. IRMA is considered present if the IRMA can still be seen on the colour image, that has not been enlarged, as well as on the red free.

If an IRMA can only be seen on a red free image and not on the colour image a referral should not be made (returned to annual screening).

The above assumes screen settings, colour balance, monitor, software and camera settings are optimal according to the recommendations of the NHS Diabetic Eye Screening Programme.

Sometimes collaterals from vein occlusions can look like IRMA. In cases where there is a localised patch of possible IRMA, the likelihood of a vein occlusion should be considered. If it is judged that small collaterals are present from an old vein occlusion rather than IRMA, this should not be given an R2 grade.

An example of one IRMA is shown in photograph example IRMA 1.
Examples of 2 IRMA are shown in photograph example IRMA 2, 3, 4, and 5.

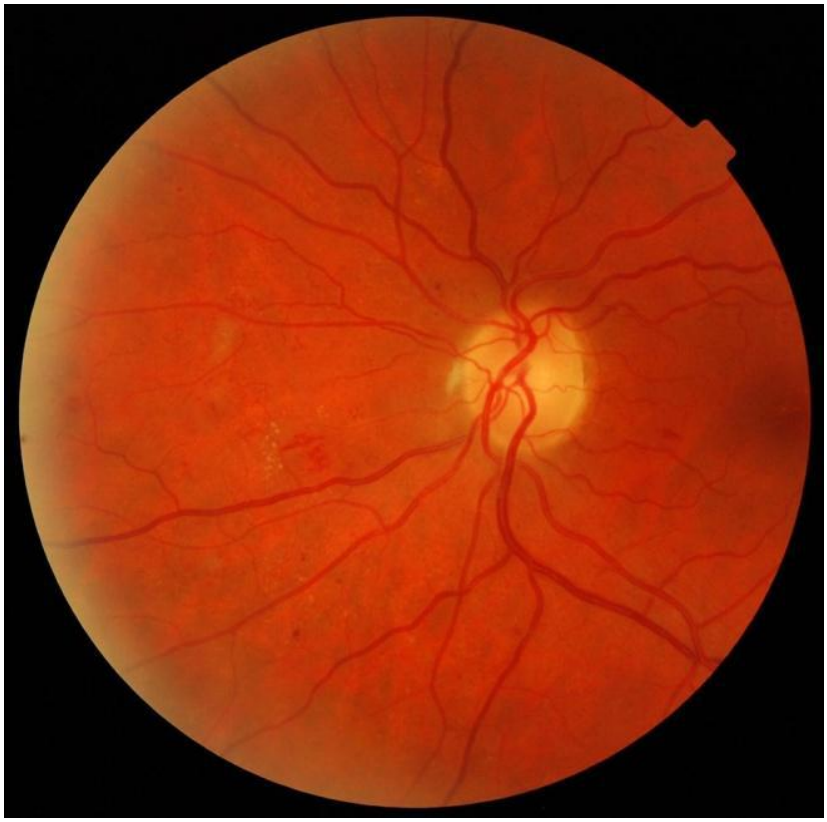


Photo IRMA 1

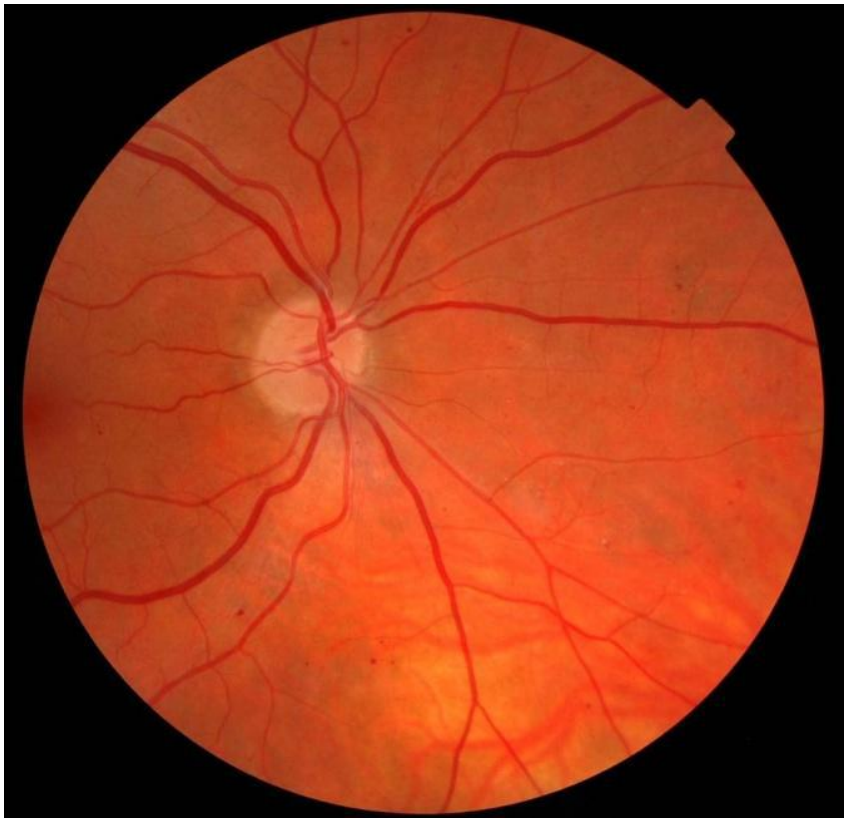


Photo IRMA 2

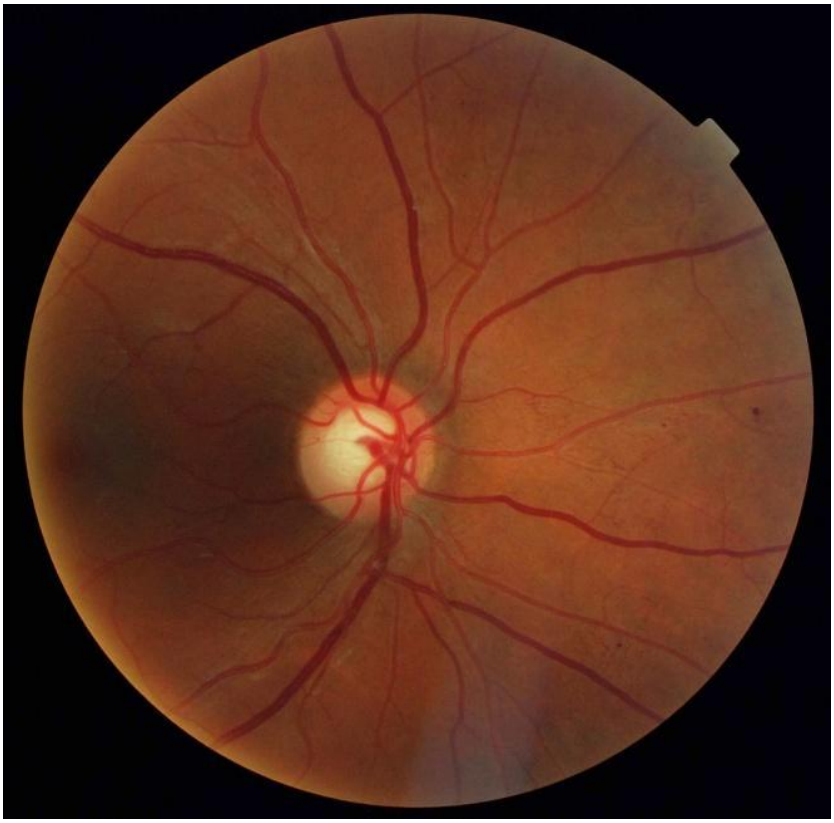


Photo IRMA 3

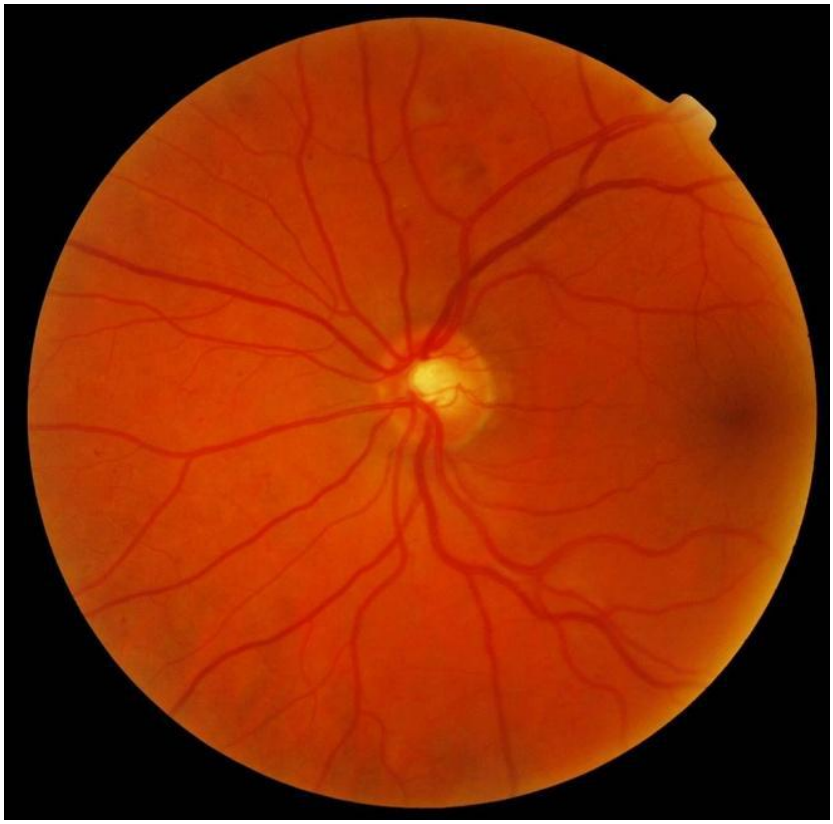


Photo IRMA 4

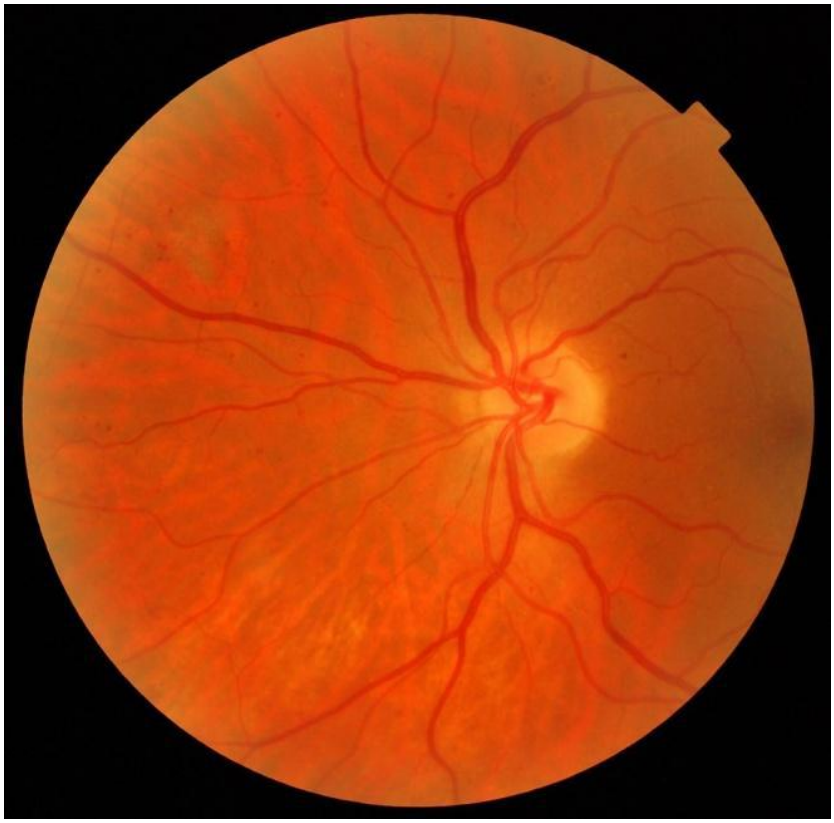


Photo IRMA 5

Grading classification for proliferative DR (R3)

The new classification consists of 2 categories – **R3A** (active proliferative retinopathy) and **R3S** (stable treated proliferative retinopathy).

This allows for urgent attention where disease is active and a robust monitoring pathway outside the hospital eye service for discharged patients once treatment has allowed the condition to stabilise.

R3A

The following will be classed as R3A (active):

- patients with newly presenting proliferative retinopathy
- patients where previous treatment has not been deemed stable by the treating ophthalmologist
- patients where new features indicating reactivation of proliferation, or potentially sight threatening change from fibrous proliferation, are seen with respect to a previously obtained reference image set.

R3S

The following will be classed as R3S (stable):

- evidence of peripheral retinal laser treatment **and** stable retina with respect to reference images taken at or shortly after discharge from the hospital eye service (HES)

A referral outcome grader (ROG) will always be responsible for the decision as to whether the presentation can be considered stable. They may make that decision based on photography and patient history when encountering patients who have moved from other screening services.

A referral should be made as R3A in any case where there is doubt.

Pathway

On discharge, the HES must either place a benchmark set of images on the screening service software, supply a benchmark set of images electronically for the service to import, or arrange for a set of benchmark images to be taken by the screening service within three months. These should be graded by the discharging clinician to ensure they represent a stable condition.

When such patients are screened subsequently, their images must be compared with the benchmark images taken on discharge before deciding the grade. Patients who are graded as R3S following discharge from the HES should be managed in the digital surveillance pathway. Patients with stable treated retinopathy currently in routine annual screening should be graded as R3S at their next routine annual screen, have benchmark images taken and transferred to digital surveillance pathway for their next and subsequent routine appointments.

The only R grades that will be allowed for such patients are R3A and R3S

The grading would be R3S if there are no significant changes from the baseline discharge images.

If there are significant changes then the patient would revert to R3A and be urgently referred back to the HES. Not all changes will be clinically urgent but the grading committee decided it is better to keep things simple and not introduce the concept of routine referral of R3.

‘Significant changes’ requiring urgent re-referral would include signs of active neovascularisation, including active new vessels, pre-retinal or vitreous haemorrhage.

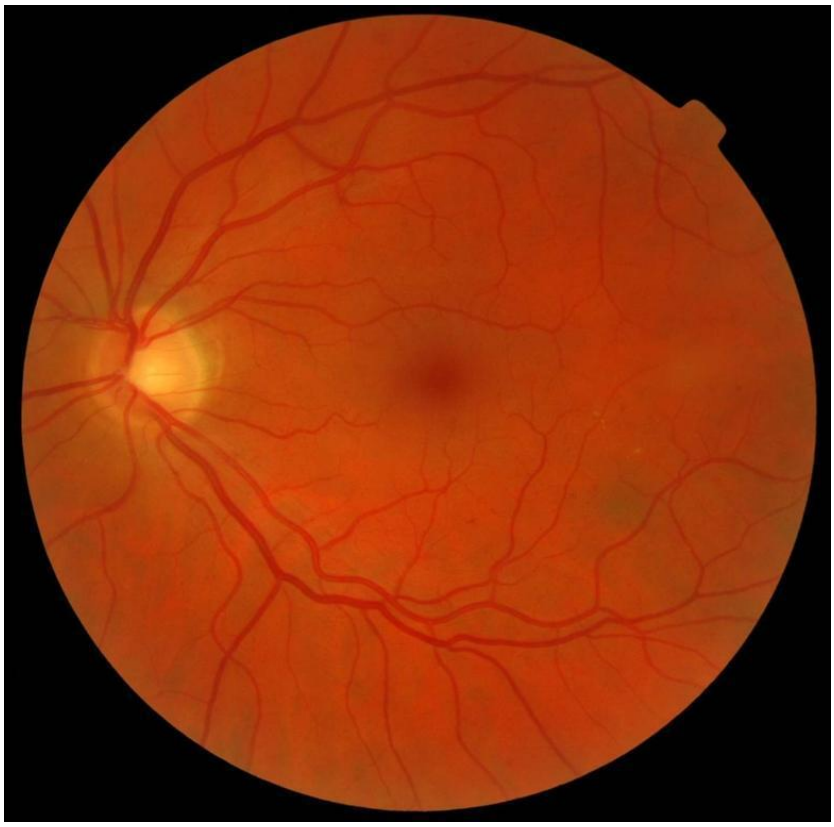
Grading classification for maculopathy – groups of exudates (M1)

A group of exudates is an area of exudates that is greater than or equal to half the disc area and this area is all within the macular area.

How to work out the area

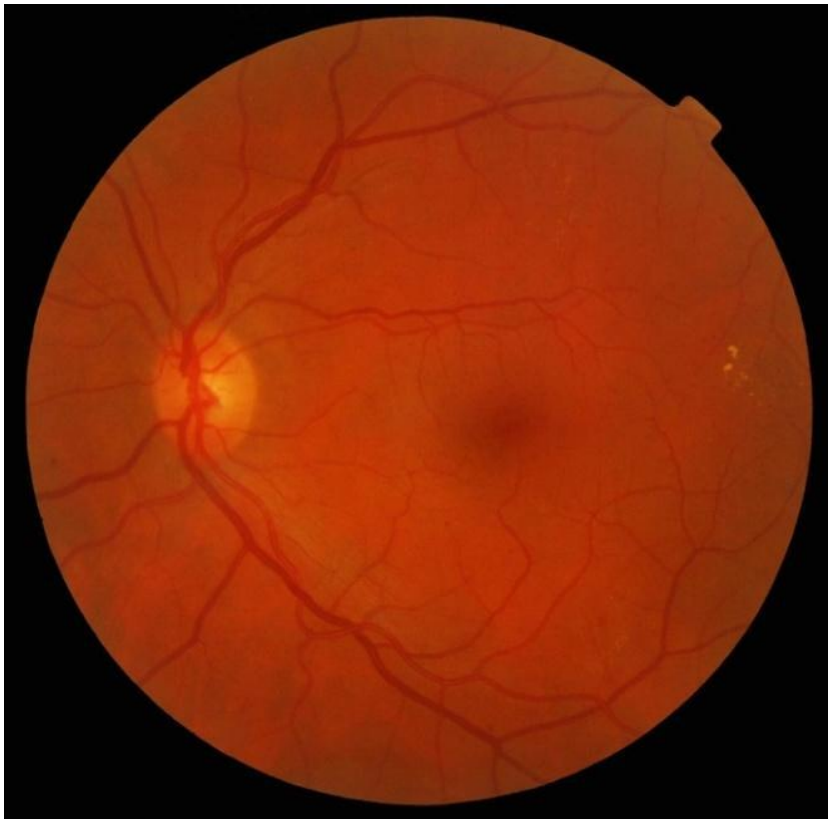
The outer points of the exudates are joined and compared to half the area of the optic disc.

Examples of referable groups of exudates are given below as well as example photographic images that are not referable.



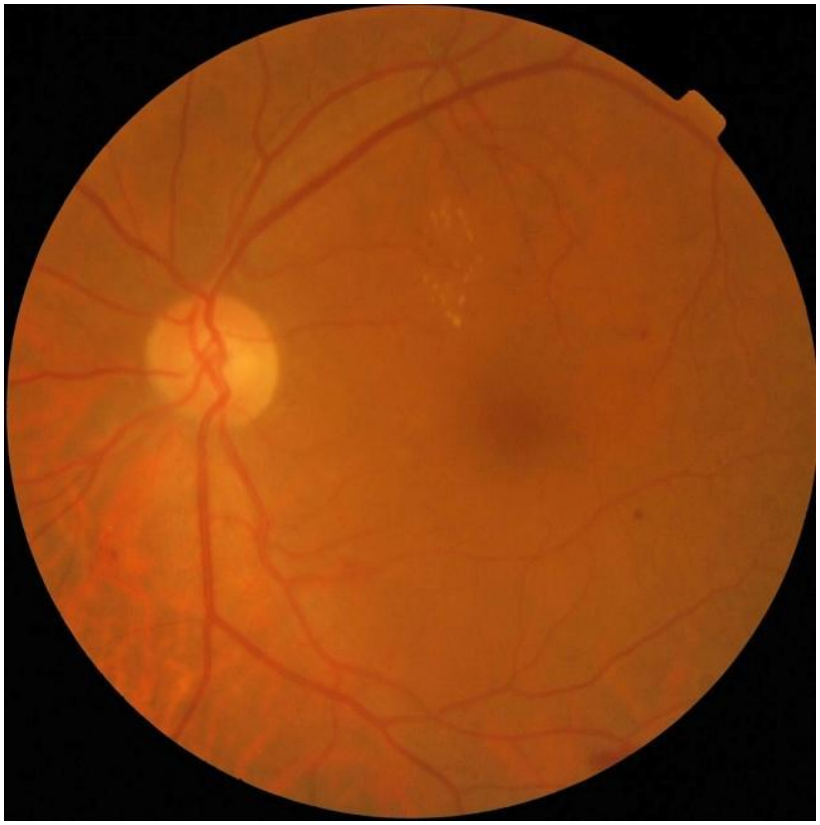
Example of an area of exudates that is less than half a disc area is given in photo GE 1 and would not be referred.

Photo GE 1



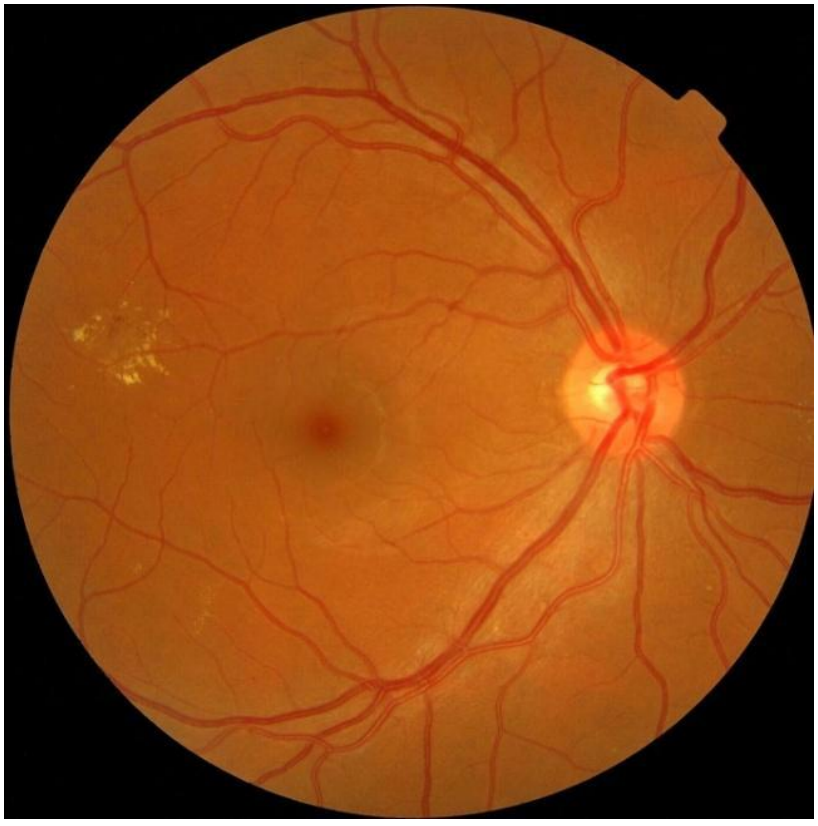
Example of an area of exudates that is less than half a disc area which is borderline in size but there is less than half a disc area within the macular area is given in photo GE 2 and would not be referred.

Photo GE 2



Example of an area of exudates that is greater than half a disc area is given in photo GE 3 and this would be referred.

Photo GE 3



Example of an area of exudates that is greater than half a disc area is given in photo GE 4 and this would be referred.

Photo GE 4

Classifying the macula where amblyopia and age-related macular degeneration (AMD) are known.

There will be cases when the VA is less than or equal to 6/12 and microaneurysms or haemorrhages present within one disc diameter of the centre of the fovea. If screener has documented known amblyopia, or there is AMD (which may also show exudates within the macula) to account for the poor VA:

- these images should be graded by the ROG grader and a decision made from the available information whether it is considered that the reduced vision is due to the amblyopia, the AMD or diabetic maculopathy
- if the ROG decides the reduced vision is due to the amblyopia or AMD, the maculopathy should be graded as M0 – local protocols should be followed for referral of non-DR lesions
- if the ROG decides that the reduced VA could be caused by diabetic maculopathy, the maculopathy should be graded as M1 and the patient should follow the nationally recommended pathway

ETDRS final Retinopathy Severity Scale[1]	ETDRS (Final) Grade	Lesions	Risk of progression to PDR in 1 year (ETDRS Interim)	ETDRS Screening / Clinic follow up intervals	English Screening Programme levels	Scottish Grading Classification
No apparent retinopathy	10 14 15	DR absent DR questionable			R0 Currently screen Annually	R0 Currently screen Annually
Mild NPDR	20	Micro aneurysms only		1 year	R1 Screen annually Background microaneurysm(s) Retinal haemorrhage(s) any exudate	R1 Screen annually Background dot haemorrhages microaneurysms, hard exudates cotton wool spots, blot haemorrhages superficial/ flame shaped haemorrhages
	35 a b c d e	One or more of the following: Venous loops > definite in 1 field SE, IRMA, or VB questionable Retinal haemorrhages present HE > definite in 1 field SE > definite in 1 field	Level 30 = 6.2%	4-6 months	R1 Screen annually Background microaneurysm(s) Retinal haemorrhage(s) any exudate	R1 Screen annually Background dot haemorrhages microaneurysms, hard exudates cotton wool spots, blot haemorrhages superficial/ flame shaped haemorrhages
Moderate NPDR	43 a b	H/Ma moderate in 4-5 fields or severe in 1 field or IRMA definite in 1-3 fields (ETDRS: Grade 0 = no evidence of IRMA Grade 1 = questionable IRMA Grade 2 = IRMA present < standard photo 8A Grade 3 = IRMA present > standard photo 8A but < standard photo 8B Grade 4 = IRMA > standard photo 8B)	Level 41 = 11.3%	3-6 months	R2 Refer to ophthalmologist Pre-proliferative multiple blot haemorrhages intraretinal microvascular abnormality (IRMA) venous beading venous reduplication It is recommended that venous loop is removed	R2 Background diabetic retinopathy BDR – observable Rescreen 6 months Four or more blot haemorrhages (i.e. _AH standard photograph 2a – in one hemi-field only
Moderately severe NPDR	47 a b c d	Both level 43 characteristics – H/Ma moderate in 4-5 fields or severe in 1 field and IRMA definite in 1-3 fields or any one of the following: IRMA in 4-5 fields HMA severe in 2-3 fields VB definite in 1 field	Level 45 = 20.7%	4 months	from the English Diabetic Eye Screening Programme referral criteria.	R3 Background diabetic retinopathy BDR – referable Any of the following features: Four or more blot haemorrhages (i.e. _AH standard photograph 2a – in both inferior and superior hemi-fields Venous beading standard photograph

[1] Fundus photographic risk factors for progression of diabetic retinopathy. ETDRS report number 12. Early Treatment Diabetic Retinopathy Study Research Group. Ophthalmology 1991; 98:823-33.