

## REVIEW ARTICLE

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## Updates in the English Diabetic Eye Screening Programme

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The English Diabetic Eye Screening Programme (DESP)—first set up in 2003 has proved very successful and is believed to be a key contributor to the reduction in DR-related blindness [1, 2]. Despite this success, there are limitations to the Programme. It is predicted that people diagnosed with diabetes, particularly type 2, will reach record high levels in the next decade and together with the increased cost of technology and personnel required to run each programme, sustaining and keeping DESP cost-effective in the long term is going to be challenging. Additionally, with increasing pressures on Hospital Eye Services (HES) to provide intravitreal anti-VEGF, steroid therapies, laser treatment and vitrectomies, there is a definite need to make changes to the DESP. This review article describes the three main changes that have recently been implemented within DESP to try to address these challenges. These include the introduction of 2-yearly screening of certain low-risk groups, the refinement of the R2 grade into low-risk (R2L) and high-risk (R2H) categories and the introduction of the Optical Coherence Tomography (OCT) surveillance pathway within DESP.

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## INTRODUCTION

Since the advent of the English NHS Diabetic Eye Screening Programme (DESP) [1] in 2003, every individual diagnosed with type 1 or type 2 diabetes in England has been invited annually for eye screening to detect diabetic retinopathy (DR) and maculopathy changes on the retina. This programme is based on the rationale that these changes can be identified before they become symptomatic and allow timely treatment. At each visit, in the English Programme, following dilation of the pupils with 1% tropicamide drops, two 45° field colour retinal images, centred on the optic disc and the fovea, are taken in each eye [1]. These images then undergo primary and secondary grading by trained graders with an arbitration process for any disagreements. There are slight differences across the 4 Nations of the UK regarding screening protocols [3].

The roll-out of the DESP over the subsequent decade proved very successful and is believed to be a key contributor to the reduction in DR-related blindness. Diabetic retinopathy, for the first time in five decades, was no longer the commonest cause of blindness in the working age population in England and Wales [2].

Despite this achievement, even with a high uptake rate and in excess of 4 million individuals registered (at the end of Q4 2023/24) with the DESP in England, there are limitations of the Programme. There is a continuing increase in people diagnosed with diabetes, particularly type 2, which will reach record high levels in the next decade. In addition, there is an increased cost of technology and personnel required for the programme. As such, sustaining and keeping DESP cost-effective in the long term is going to be challenging.

With limited resources and capacity of screening venues, trained screener-graders, increased pressures in the HES due to improved treatment options with intravitreal anti-VEGF, steroid

therapies, laser treatments and potentially increased vitrectomies and the need to keep more patients within surveillance pathways within DESP, there is a definite need to make changes to the DESP. Recent changes have been made to the English DESP in order to address the identified challenges.

## CHANGES TO UK DESP

**Three main changes have recently been implemented with DESP to try to address these challenges**

- 1) Increasing the interval to 2-yearly screening of certain low-risk groups.
- 2) Refinement of the R2 grade into low risk (R2L) and high risk (R2H) categories, so that only higher risk groups are referred to the HES for review.
- 3) The introduction of the Optical Coherence Tomography (OCT) pathway within DESP will allow further refinement of the diabetic maculopathy grade (M1) so that only OCT-positive patients are referred to the HES for review.

## Extended intervals for eye screening

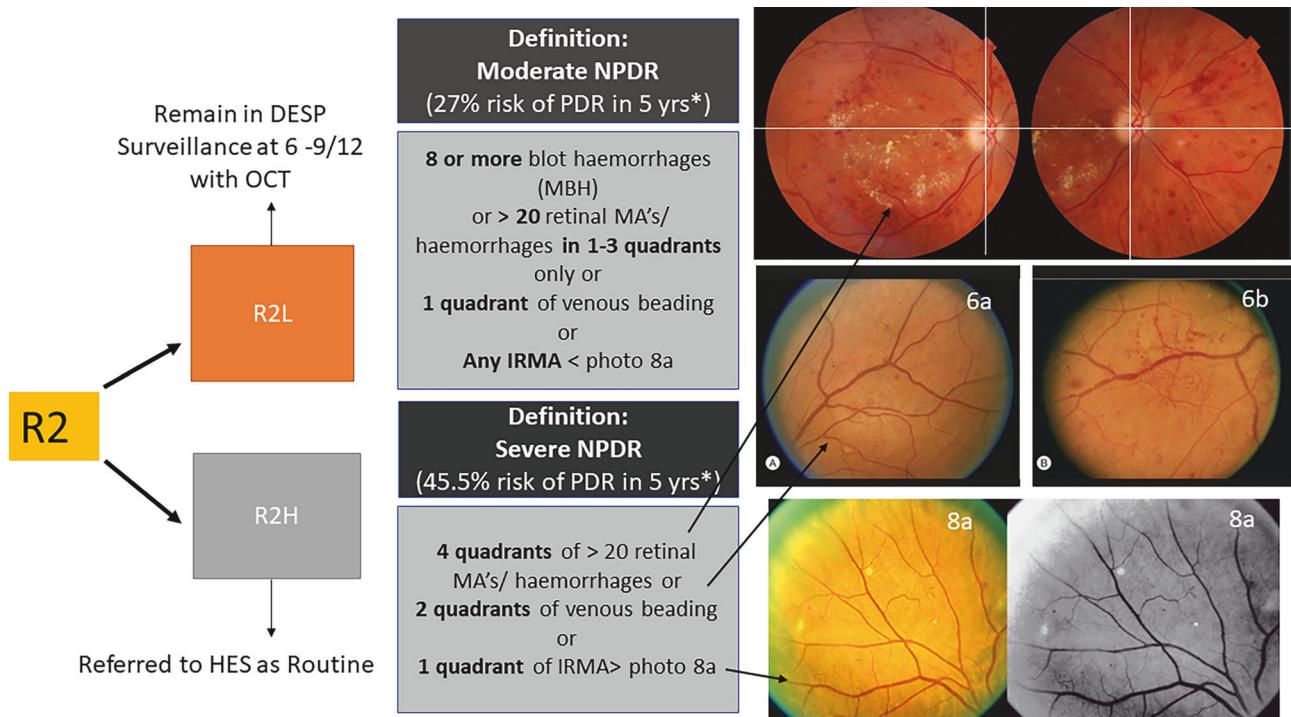
Up until 2023, the screening interval for DR has remained annual, despite research showing that certain low-risk groups can safely be screened less frequently [3]. Other programmes, such as breast and cervical cancer screening, routinely invite women every 3 to 5 years [4].

Following the most recent upgrade of the diabetic eye screening software in 2024, DESPs across England have introduced a 2-yearly screening interval for low-risk groups who have

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Table 1. Previous and Updated DESP Grading System.

Old Grading System	New Grading System
<b>R0</b> - No diabetic retinopathy	<b>R0</b> - No diabetic retinopathy
<b>R1- Background retinopathy</b> (presence of at least one microaneurysm)	<b>R1- Background retinopathy</b> (presence of at least one microaneurysm)
<b>R2-pre-proliferative retinopathy</b> with the presence of:	<b>R2L- Low Risk R2</b> (See Fig. 1 & Table 2 for definition)
<ul style="list-style-type: none"> <li>any venous beading or</li> <li>multiple deep, round or blot haemorrhages in 4 quadrants or</li> <li>any IRMA formation visible on the colour fundus image.</li> </ul>	<b>R2H- High Risk R2</b> (See Fig. 1 & Table 2 for definition)
<b>R3a - Proliferative retinopathy</b> with the presence of:	<b>R3a - Proliferative retinopathy</b> with the presence of any new vessels on disc (NVD) or
<ul style="list-style-type: none"> <li>any new vessels on disc (NVD) or</li> <li>any new vessels elsewhere (NVE) or</li> <li>pre-retinal or vitreous haemorrhage or</li> <li>pre-retinal fibrosis ± tractional retinal detachment</li> </ul>	<ul style="list-style-type: none"> <li>or new vessels elsewhere (NVE) or</li> <li>pre-retinal or vitreous haemorrhage or pre-retinal fibrosis ± tractional retinal detachment</li> </ul>
<b>R3s- Stable treated proliferative retinopathy</b> with the presence of PRP laser scars.	<b>R3s- Stable treated proliferative retinopathy</b> with the presence of PRP laser scars.
<b>M0- Non-referable maculopathy</b>	<b>M0- Non-referable maculopathy</b>
•No maculopathy or any microaneurysm or haemorrhage within 1DD of centre of the fovea if associated with VA better than 6/12	•No maculopathy or any microaneurysm or haemorrhage within 1DD of centre of the fovea if associated with VA better than 6/12
<b>M1-Referable maculopathy</b> , which includes any of the following:	<b>M1 - (Referable maculopathy</b> as previously but subdivided by OCT configuration- see Table 3 and Fig. 3)
<ul style="list-style-type: none"> <li>any exudate within 1 disc diameter (DD) of the centre of the fovea,</li> <li>any circinate or group of exudates within the macula &gt; ½ disc area</li> <li>Any retinal thickening within 1DD of the centre of the fovea (if stereo available)</li> <li>Any microaneurysm or haemorrhage within 1DD of the centre of the fovea, only if associated with a best VA of worse than or equal to 6/12 (if no stereo)</li> </ul>	<ul style="list-style-type: none"> <li>• OCT negative</li> <li>• OCT borderline</li> <li>• OCT positive (referral to HES)</li> </ul>



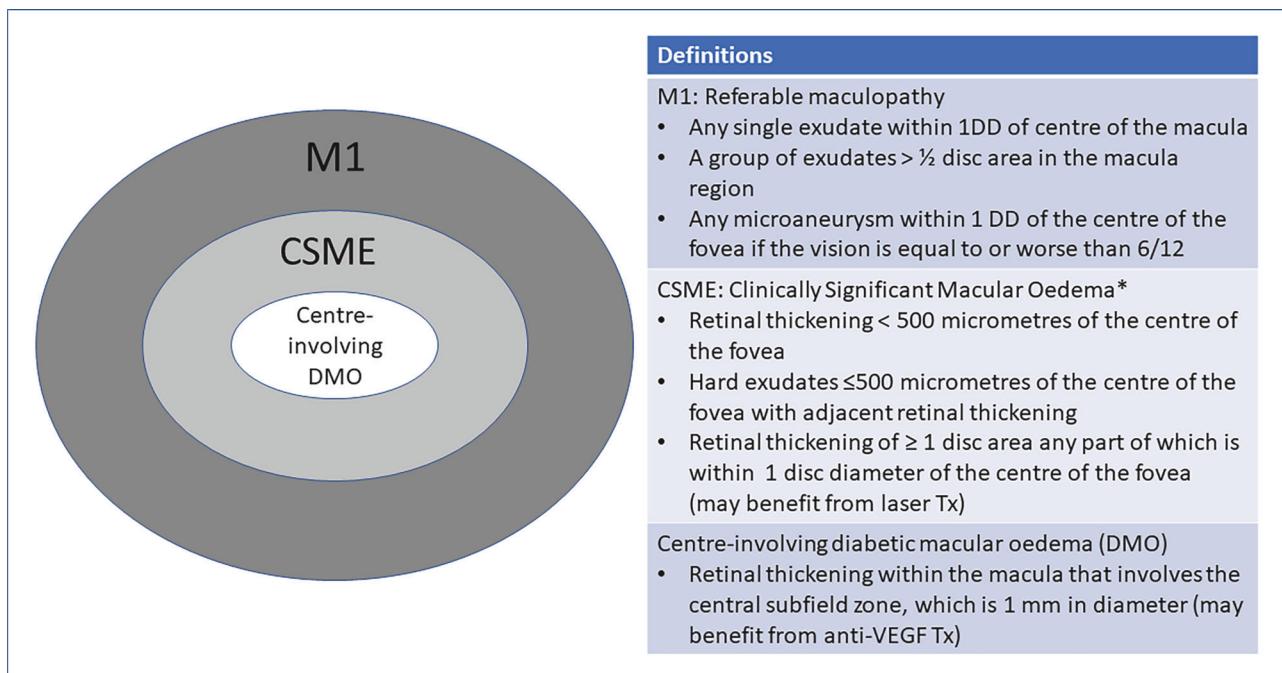
**Fig. 1 Showing the subdivision of the R2 grade into the new low and high-risk categories (R2L and R2H).** Note that these correlate with the ETDRS definitions of moderate and severe non-proliferative diabetic retinopathy [11]. Photograph 8a also denotes the lower severity of IRMA required for the R2H grade. \*Risks of Progression to PDR over 5 years as taken from Lee et al. [12].

had a negative screen (R0M0) on two consecutive occasions. As such, not all individuals with 'no retinopathy' or 'maculopathy' are invited all at once: programmes are staggering the introduction over two years. The rationale for this change was based on an audit commissioned by the National Screening Committee (NSC)

of nearly 350,000 patients from seven UK geographically dispersed DESPs. The results showed low rates of progression to sight-threatening retinopathy (and more serious proliferative diabetic retinopathy) among those without DR at two successive screening episodes at least 12 months apart (with approximately 0.7%

**Table 2.** The Definitions of the Low- and High-risk R2 grade based on ETDRS studies.

<b>Lower risk (R2 L) is defined as the presence of ANY of the following features:</b>	
• 8 or more blot haemorrhages across the two digital 45° photographs	
• More than 20 intraretinal haemorrhages or microaneurysms located in 1,2 or 3 (but not all 4) of the four quadrants of the retina	
• Venous beading in 1 quadrant	
• Any quantity of IRMA less than ETDRS Standard photograph 8a* (see image below)	
Higher risk (R2H) is defined as the presence of ANY of the following features: 4-2-1 rule	
• More than 20 intraretinal haemorrhages or microaneurysms in EACH of the four quadrants of the retina (see image below).	
• Venous beading present in two or more quadrants	
• Moderate IRMA equal to or worse than the Airlie House ETDRS Standard photograph 8a in one or more quadrants*	
Please see Fig. 1 for examples of images.	
* ETDRS Standard photograph 8a standard photograph shows multiple patches of moderate IRMA, and it is the severity and quantity of IRMA present within 1 quadrant that should be assessed to determine if there are equal to or greater levels of IRMA present within 1 quadrant. Only IRMAs that are definitely seen on colour imaging should be classified as R2.	



**Fig. 2 Diagram to show the relationship between the definitions of maculopathy.** The M1 category is an umbrella term encompassing all diabetic maculopathy as graded within the UKDES, and within this category, cases of clinically significant macular oedema, as defined by the ETDRS [16], may benefit from focal or grid laser treatment. A subset of these clinically significant cases, if centre-involving with visual impairment, may benefit from anti-VEGF treatment as recommended by NICE [13]. The inner 2 circles would both be included as part of the 'OCT positive' grade described below. (CSME= clinically significant macular oedema; M1= maculopathy grade 1; Tx= treatment).

developing referable DR over 2 years) [3]. The safety of this extended interval was also demonstrated by the Individualised Screening for diabetic retinopathy (ISDR) study group from Liverpool [5].

More recently, a DESP with higher levels of ethnic diversity has raised concerns that particular groups may be disadvantaged by these extended intervals [6]. Their study showed that biennial screening would have delayed detection of some sight-threatening retinopathy by one year, especially among those of Black ethnic origin, South Asian groups and younger individuals, leading to potential healthcare inequalities. They criticised the previous NSC audit as being retrospective and not explicitly quantifying the effects on certain ethnic groups. It is important that Programmes are aware of this potential inequality and that the National Programme takes steps to monitor this to reduce any adverse impact.

There are some high-risk groups, including pregnant women and those with type 1 diabetes who have been started on a hybrid closed loop (HCL) system, who will be exempt from the 2-yearly

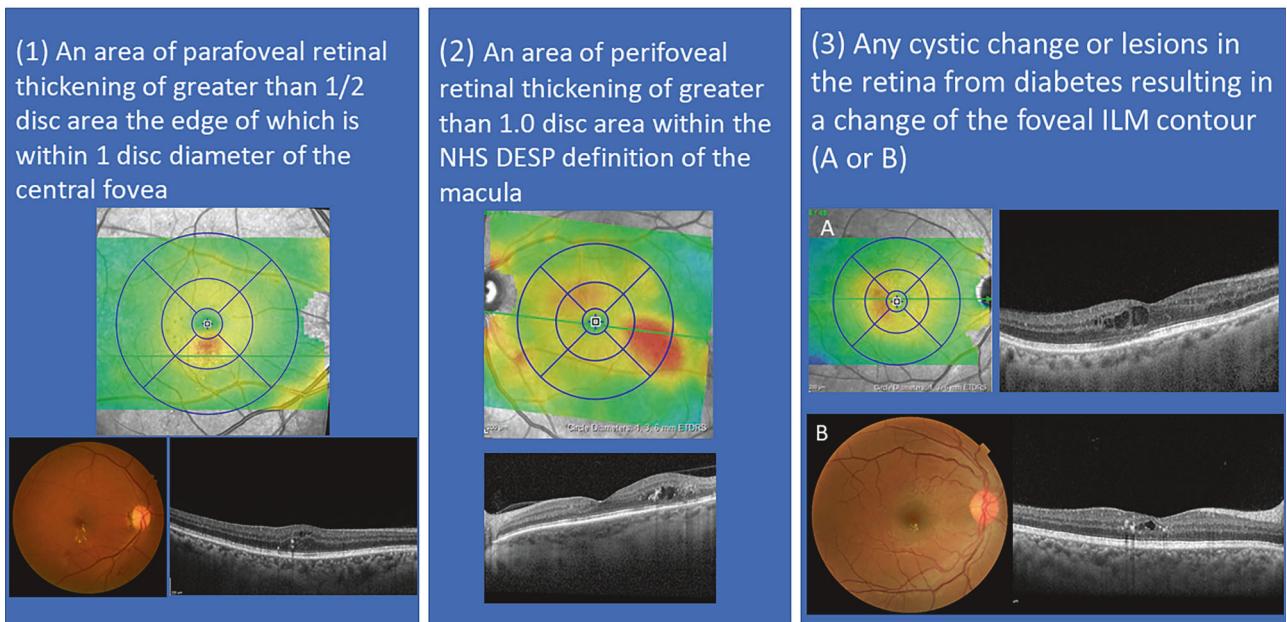
screening intervals [7]. Pregnant women will remain on an increased frequency recall seen in the first trimester and again at 28 weeks (and only at 16 weeks if there is retinopathy present at the first screen) in accordance with NICE guidance [8]. All persons with type 1 diabetes who are started on an insulin pump will continue on an annual rescreen for the first year (as long as they remain free of any retinopathy) in view of the increased risk of worsening retinopathy with rapidly reducing HbA1c [9]. Although the risk may be the same for all drugs, causing a sudden drop in systemic control, this pathway has not yet been implemented or recommended for those starting GLP-1 receptor agonists.

**Refinement if the R2 grade into low and high-risk categories**  
 The second main change is related to the refinement of the R2 grade or pre-proliferative retinopathy, which traditionally has been a very broad grading category. Other grades in the UK Diabetic Eye Screening Programme, such as R0 (no retinopathy), R1 (background or mild non-proliferative diabetic retinopathy)

**Table 3.** Optical coherence tomography (OCT) grading criteria in diabetic eye screening (DES) surveillance clinics [14].

OCT negative
• This is defined as the absence of features required to meet the OCT positive or borderline criteria. This can include the presence of microaneurysms.
OCT borderline
• The presence of intraretinal cysts with no change in the foveal contour within the macular region, and/or an area of retinal thickening less than 1-disc area within the DESP definition of the macula but outside 1DD from the centre of the fovea
OCT positive
• The presence of any of the following (see Fig. 3 for examples): • A change in the foveal contour caused by the presence of intraretinal cysts. • An area of retinal thickening greater than 1/2-disc area, the edge of which is within 1 DD of the central fovea • An area of retinal thickening greater than 1-disc area within the DESP definition of the macula.

## OCT positive -3 definitions (Routine Referral to HES)



**Fig. 3** Showing examples of OCT images graded as 'OCT positive' and referred routinely to the Hospital Eye Services. In cases of high-risk maculopathy with extensive thickening and loss of vision, more urgent referral is recommended.

and R3a (active proliferative retinopathy) and R3s (stable treated proliferative retinopathy) have remained unchanged (see Table 1). The R2 grade has now been further subdivided into low and high-risk groups (see Fig. 1) [10]. Those receiving a low risk R2 or R2L grade (see Table 2 below for definitions) in the worse eye will remain under review in the DESP (6–9 months) within a separate surveillance pathway rather than being referred to the HES. Individuals, however, will initially be invited within 3 months for further peripheral imaging (recommended to have 5–7 images per eye) in addition to an OCT examination. Table 1 summarises the old and new DESP grading system.

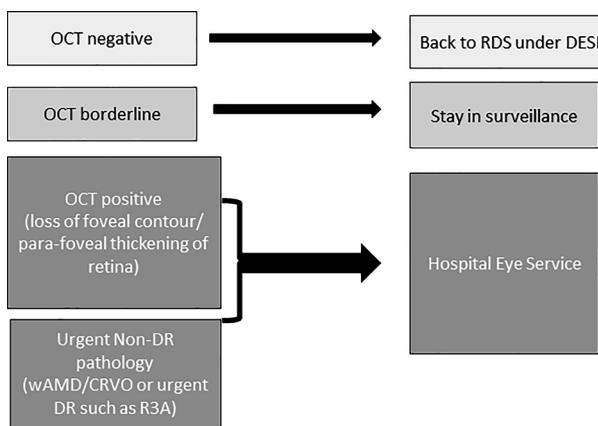
In the revised grading system, persons with a high-risk R2 or R2H grade (see Table 2 below for definition) in the worse eye are considered to have a level of retinopathy reaching the definition of severe non-proliferative retinopathy (essentially following the 4-2-1 rule from the ETDRS) [10, 11]. From a more recent study, these eyes have a risk of 45.5% of progressing to proliferative retinopathy within 5 years [12] and should be referred routinely to the Hospital Eye Service for further review, as they are deemed to have levels of retinopathy closer to requiring treatment.

The grading criteria for the low and high-risk R2 groups [9] have been largely based on the criteria for moderate and severe non-proliferative diabetic retinopathy from the ETDRS studies [11].

### The introduction of Optical Coherence Tomography (OCT) pathways within DESP

The final change described here is the refinement of the M1 grade with the implementation of the OCT pathway within DESP. Traditionally, the M1 term or grade for 'referable diabetic maculopathy' has always been a very broad category including anything from a single exudate within 1 disc diameter (DD) from the centre of the fovea to extensive macular exudates with central retinal thickening requiring anti-VEGF treatment (see Fig. 2). Previously many DESPs were mandated to refer all patients with an M1 grade to the Hospital Eye Service which often caused more pressure on already over-stretched eye clinics. Now, with the advent of OCT clinics being introduced within DESP, this will allow the further refinement of the M1 grade.

In order to refine the M1 classification, all individuals graded with an M1 grade in either eye will automatically be referred to an OCT pathway within digital surveillance within DESP. This OCT scan can take place on the initial visit or at a further attendance, but should ideally take place within 3 months if the OCT is not carried out on the day. If, however, there is a Retinopathy grade of R2H or R3a in the same eye, this will override the M1 grade, and referral to the HES will take place instead. A new grading scheme has also been derived, taking into account the OCT configuration



**Fig. 4 Diagram to show the outcome of the OCT grades from the surveillance clinic within DESP.** Note that the OCT positive cases are referred routinely to the Hospital Eye Services, unless more urgent pathology is identified.

[13]. This has now been incorporated as part of the OCT feature-based grading form within the DESP software.

The OCT images should be taken on either a spectral domain or Swept Source (SS) OCT machine and graded by trained graders, ideally with two-level grading and arbitration.

The grades have been divided into OCT negative, OCT borderline and OCT positive (see Table 3 and Fig. 3) [14]. The OCT negative group can be discharged back to the annual routine digital screening. The OCT borderline group will remain in the OCT surveillance pathway to be reviewed 6–9 months. The latter, OCT-positive group, along with other urgent, non-DR pathology (such as neovascular AMD if identified from the scan), would be referred into HES either routinely or urgently, respectively, for further review (see Fig. 4), although there is some flexibility with input from the Clinical Lead of the local DESP.

Cases of higher-risk maculopathy, which is defined as macular exudation (circinate) greater than 1/2 disc area within 1 disc diameter (DD) of the fovea, and where there is a drop in visual acuity in this eye to 6/12, can be referred directly to the HES to avoid delay in treatment.

This sub-classification of the M1 maculopathy grade has allowed only the higher-risk cases to be referred to the HES for further review and possible treatment. Those with non-centre-involving CSMO should be considered for focal/ laser treatment according to ETDRS criteria [12], although those with good visual acuity may wish to be observed in the first instance in view of the Protocol V study [15].

Those with centre-involving retinal thickening on OCT examination should be referred to HES for consideration of treatment with intravitreal injections of anti-VEGs or steroids.

## CONCLUSION

With the implementation of 2-yearly screening for those with no retinopathy or maculopathy, this will create the much-needed capacity within DESP services to manage the increased workload, with the low-risk R2 and M1 cases staying under surveillance clinics. We should not, however, underestimate the amount of training and work required to develop this pathway within DESP. Many centres have already implemented some degree of OCT surveillance, but to date, there has been no quality assurance or formal training introduced, and it has been left to individual programmes to implement and monitor this pathway internally. There is a definite need to develop appropriate training and certification for OCT grading, including the introduction of monthly tests and training sets for ongoing quality assurance. This, together

with the increased grading time required for each patient, has to be factored into the pathway and challenges going forward.

For Ophthalmology services, they should see some much-needed increased capacity within their services as they will no longer have to review the lower risk R2M1 cases. This, however, means that all those referred will have more advanced levels of retinopathy and/or maculopathy. These higher risk referrals will need to be seen in a timely manner, in face-to-face clinics, to consider possible laser treatment or pharmacotherapy with anti-VEGF or steroids to reduce the risk of sight loss.

## SUMMARY

What is known about this topic

- The introduction of DESP has significantly reduced the rates of blindness due to diabetic retinopathy.
- Currently, digital fundus images are graded by trained graders and given a retinopathy and maculopathy status to determine outcome.

What this study adds

- It introduces the main changes within DESP which includes the introduction of 2 yearly screening for certain low risk groups.
- The R2 grade has now been split into low and high risk groups to reduce referrals to the Hospital Eye Service.
- The introduction of OCT scans into DESP for all maculopathy cases will also serve to reduce the number of referrals into ophthalmology, hopefully increasing the much needed capacity to help with treatments for sight-threatening diabetic eye disease.

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## COMPETING INTERESTS

The author declares no competing interests.

## ADDITIONAL INFORMATION

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