

EASDEC 2015 MEETING  
SCREENING FOR DIABETIC RETINOPATHY IN THE  
CENTRAL REGION OF PORTUGAL: *ADDED VALUE  
OF AUTOMATED “DISEASE / NO DISEASE”  
GRADING*

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Luisa Ribeiro, Carlos Manta Oliveira, Catarina Neves, João Diogo Ramos, Hélder Ferreira, José Cunha-Vaz

**TAKEAWAY**

Oral Communication presenting results of screening for DR using Retmarker Screening in the Central Region of Portugal. Performance values detail sensitivity, specificity, inter and intra-grader agreement



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The 25<sup>th</sup> EASDec 2015 conference was held in Turin, 26th to 28th June 2015.

This yearly conference aims at promoting "the advancement of knowledge in all aspects of Diabetic Retinopathy", and in this edition the added value of automated grading using Retmarker technology was presented.

Screening for DR in The Central Region of Portugal was the topic of the communication from Dr. Luísa Ribeiro, which underlined the results obtained of **Sensitivity: 97.23%** and **Specificity: 70.35%**.

It was also shown that the sensitivity values are very similar to those obtained when evaluating the agreement between different human graders, 96.83%, or even for the intra-grader agreement: 98.92%.

## SCREENING FOR DIABETIC RETINOPATHY IN THE CENTRAL REGION OF PORTUGAL

### ADDED VALUE OF AUTOMATED “DISEASE/NO DISEASE” GRADING

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*EASDEC 2015 Meeting . Turim, June 26-28, 2015*

## Diabetic Retinopathy

Worldwide, diabetes is projected to affect 300 million people by 2025.

Diabetic retinopathy is a leading cause of visual impairment in working-age adults.

**10%** of the world population will likely develop **visual impairment secondary to diabetic retinopathy**

## Diabetic Retinopathy

Asymptomatic until advanced stages

It can occur at any age

**Need to screen and identify eyes that can be treated**

- Macular Edema
- Proliferative Retinopathy

**All diabetic patients**

## Diabetic Retinopathy

### Screening for DR

#### WHO Cardinal Principles for Screening

1. Condition should be an important health problem
2. An appropriate screening procedure
3. Treatment available and effective
4. Economic cost is justified

## Screening of DR

Some studies have found that photography is more sensitive in identifying **sight-threatening retinopathy** than clinical examination with ophthalmoscopy

2003

*Lin DY et al, Am J Ophthalmol 2002*  
*Larsen N et al, Invest Ophthalmol Vis Sc*

*Leese GP et al, Diabetes Med 2002*  
*Ahmed J et al, Diabetes Care 2006*

**Photographic screening programs** have great value, mostly when the access to ophthalmic care is limited

## Screening of DR

**An effective screening programme** can distinguish:

- who needs referral to an ophthalmologist for close follow-up and timely treatment
- from those who should only come for a later rescreening

## Diabetes in Portugal

**Prevalence** of Diabetes Mellitus is 13%  
(Age 20-79 years)

- More man (15.6%) than women (10.7%)
- Increase of DM Prevalence with age increase

**Incidence** of Diabetes Mellitus

In Portugal, there are 500-700 new cases of diabetes every year per 100.000 population

## Screening for DR in The Central Region of Portugal

### **Main Objective**

To describe the procedures of a **non-mydratiac DR screening program** in the Central Region of Portugal

and

The added value of the introduction  
of an automated “**disease/no disease**” analysis

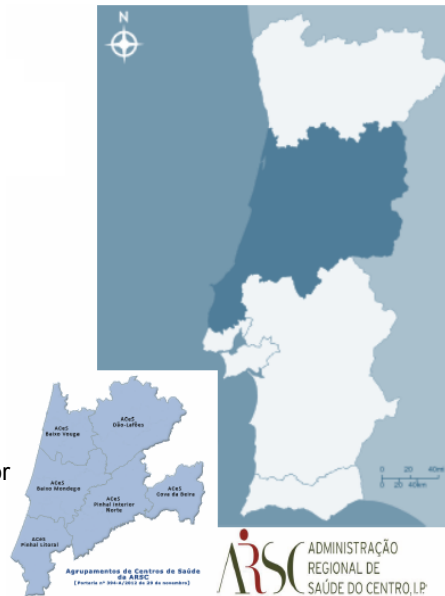
## Screening for DR in The Central Region of Portugal



The DR Screening Program is running since 2001.

Since 2011 it was introduced a central reading center and an automated software analysis.

**Target population**  
**All type 1 and type 2 diabetic patients**  
except those already treated / in treatment for DR



## Screening for DR in The Central Region of Portugal



- Each of the 5 geographic areas have a portable non-mydratic retinograph/camera and a technician
- The screening site changes location to cover all the geographic area
- Digital 45 degree fundus photography (2 fields/eye)
- Performed annually
- Refer for treatment
  - maculopathy (M)
  - proliferative diabetic retinopathy (PDR)

## Screening for DR in The Central Region of Portugal

### Methods

#### **First Phase of Grading – Automated Analysis**

Images from the DR screening program are analysed in a  
Central Reading Center (Coimbra Ophthalmology Reading Center - CORC)

#### **Second Phase of Grading – Human Grading**

Only applied to images of the previous identified “**disease**” cases

## Screening for DR in The Central Region of Portugal

**Automated Analysis** (RetmarkerSR; Retmarker SA, Coimbra, Portugal)  
of retinal photographs for DR screening

- 59.626 patients
- Taken between July 2011 and May 2015
- Fundus photo of fields 1 and 2
- In 5 geographic areas / local health centers

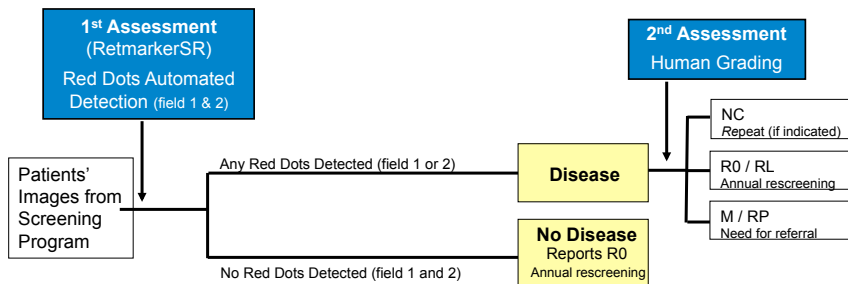
#### Two possible outputs

- “**Disease**” (referral for human grading)
- “**No disease**” (annual rescreening)



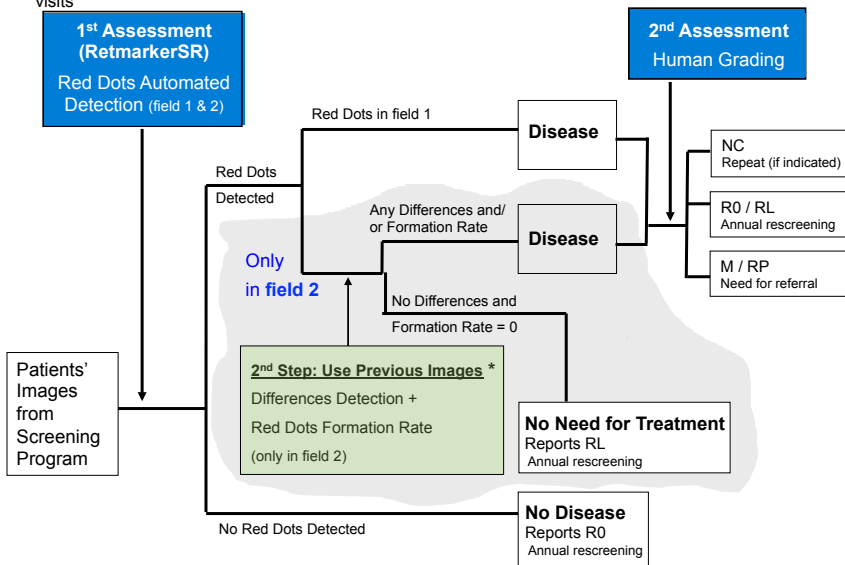
## Screening for DR in The Central Region of Portugal

### First Step of Automated Analysis



### 1st Assessment – RetmarkerSR Two-step approach (2<sup>nd</sup> visits workflow \*)

\* **Conditions:** Previous visit between 1 year and 2 years before; if not, uses the same schema as for 1<sup>st</sup> visits



## Human Grading

**Dados Utilente**  
 CS rastreio: LOUSA    Semana rastreio: 201314  
 Nº SNS: 270379141    Idade: 53    DM desde: 2006  
 AV OD: 10/10    AV OE: 9/10

**Classificação**

OD    OE

Classificável     Classificável

Não Classificável     Não Classificável

Repetir Exame     Repetir Exame

Não Aplicável     Não Aplicável

OD    OE



R0     R0

RL     RL

M     M

RP     RP

Rever    6/10

## Human Grading - Grading scale

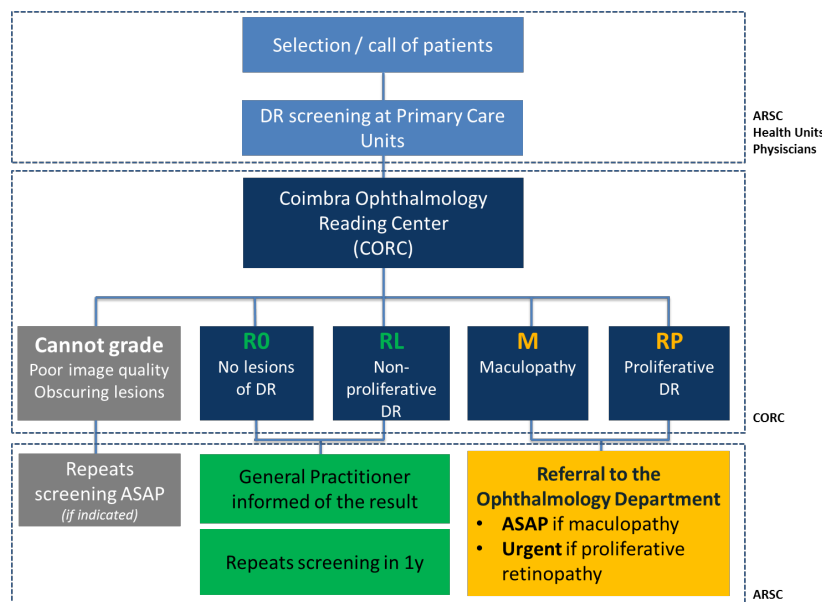
Grade	Description	General grading rules
<b>R0</b>	<b>No DR</b>	<ul style="list-style-type: none"> <li>No lesions of DR</li> </ul>
<b>RL</b>	<b>Non proliferative DR (without maculopathy)</b>	<ul style="list-style-type: none"> <li>Microaneurysm(s)</li> <li>Retinal hemorrhage(s)</li> <li>Any exudate <b>not within the definition of maculopathy</b></li> </ul>
<b>M</b>	<b>Maculopathy</b>	<ul style="list-style-type: none"> <li>Exudates within 1 disc diameter (1DD) centred on the fovea</li> <li>Microaneurysms and/or hemorrhages (&gt;5) within 1DD centred on the fovea, and / or</li> <li>Multiple deep, round or blot hemorrhages and larger venous abnormalities within 2DD centred on the fovea</li> </ul>
<b>RP</b>	<b>Proliferative DR</b>	<ul style="list-style-type: none"> <li>New vessels on the disc (NVD)</li> <li>New vessels elsewhere (NVE)</li> <li>Pre-retinal or vitreous hemorrhage</li> <li>Pre-retinal fibrosis + tractional retinal detachment</li> </ul>

## Human Grading - Grading scale

### Grading Results

Grade	Description	Follow-up
NC	Not classifiable	Repeat (if indicated)
R0	No DR	Annual rescreening
RL	Non-proliferative DR (without maculopathy)	Annual rescreening
M	Maculopathy	Referral ASAP – Tx available
RP	Proliferative DR	Urgent referral – Tx available

## Patient Care Pathway



## Screening for DR in The Central Region of Portugal

### Quality Control Automated Analysis of DR

#### Results

Automated grading of DR may safely reduce the burden of  
“**disease/no disease**” grading in DR screening programmes

- Sensitivity: 97.23%
- Specificity: 70.35%

## Screening for DR in The Central Region of Portugal

### Quality Control Human Grading of DR

#### **Inter Grader Agreement** (number of cases = 1864)

- Referral vs No referral – 96.83%
- All levels – 82.94%

#### **Intra Grader Agreement** (number of cases = 279)

- Referral vs No referral – 98.92%
- All levels – 91.04%

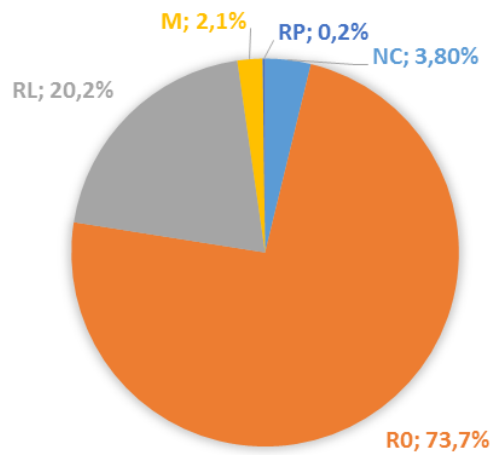
## DR Screening – Results

Jul 2011 – Mai 2015



	Eyes	NC	R0	RL	M	RP
<b>TOTAL</b>	119.253 (59.626 pts)	4.486 <b>3.8%</b>	87.944 <b>73.7%</b>	24.090 <b>20.2%</b>	<b>2.547</b> <b>2.1%</b>	<b>186</b> <b>0.2%</b>

### RESULTS



## Screening for DR in The Central Region of Portugal

### Main Conclusion

The implemented automated analysis with the RetmarkerSR, together with a simplified grading scale, identifies well DR vision-threatening complications while decreasing human burden and costs.

### Publications

Oliveira CM, Cristóvão LM, Ribeiro ML, Abreu JR. **Improved automated screening of diabetic retinopathy.** Ophthalmologica 2011;226(4):191-7.

Neves C, Oliveira CM, Ribeiro ML, Ferreira HJ, Cunha-Vaz J. **Prospective Evaluation of an Automated System to reduce Human Grading Burden in a Diabetic Retinopathy Screening Program.** In: ARVO, 2012. Fort Lauderdale, FL, USA. Invest Ophthalmol Vis Sci. 2012; 53: eAbstract2890.

Ribeiro L, Oliveira CN, Neves C, Ramos JD, Ferreira H, Cunha-Vaz J. **Screening for Diabetic Retinopathy in the Central Region of Portugal. Added value of automated “disease / no disease” grading.** Ophthalmologica 2015;233(2):96–103.