Using data for continuous improvement in grading accuracy

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National Grading Resources Advisory Group

Improving Grading Quality in Diabetic Eye Screening

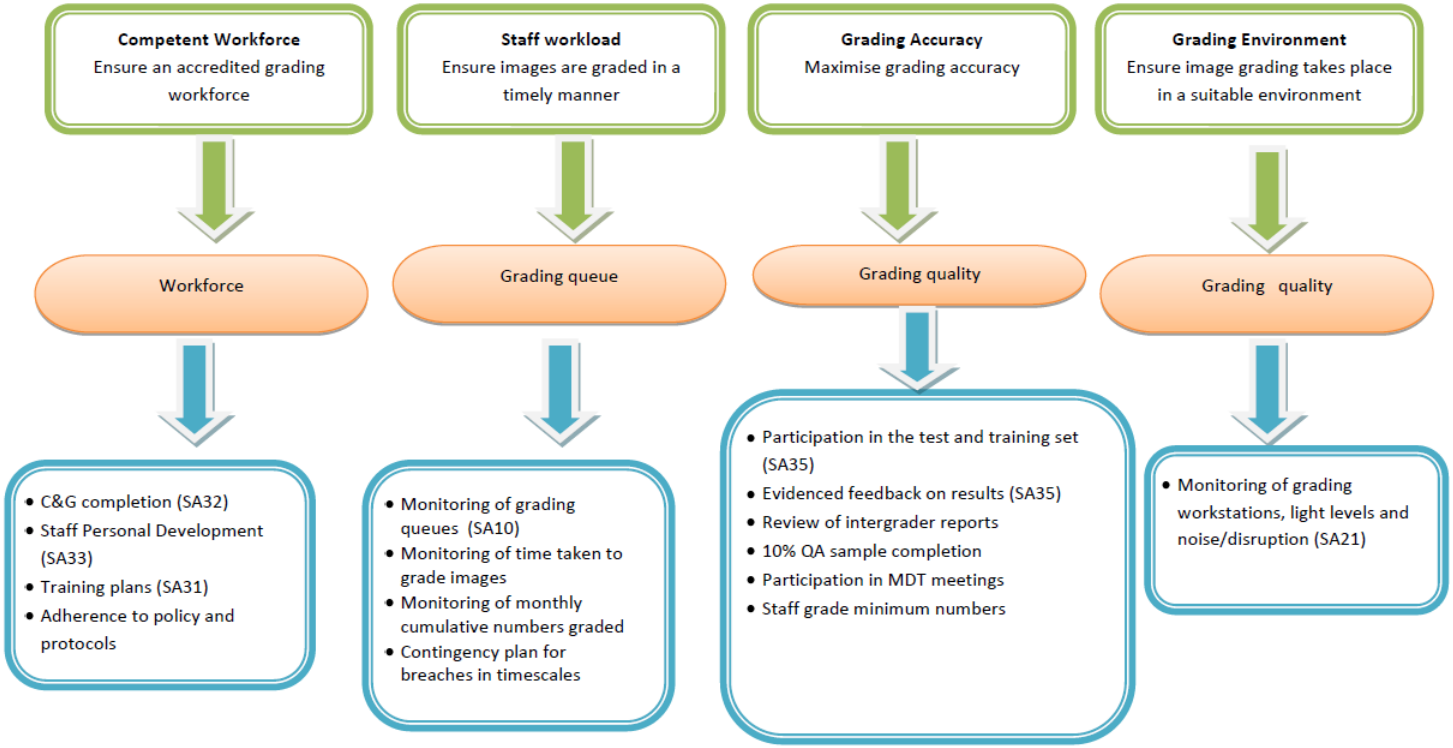
- Training & Accreditation
- Continuous Professional Development
- Internal Quality Assurance

What national guidance is available?

Process Three: Grading

Objective: Ensure a high quality service of reliable image grading results for patients

QA standards:
Objective 5: To ensure grading is accurate
Objective 14: To ensure that screening and grading of retinal images are provided by a trained and competent workforce
Objective 15: To ensure optimum workload for **all** graders in order to maintain expertise



http://diabeticeye.screening.nhs.uk/internal-qa

EQA visit document
Objective Measurement of Grading

- Regular MDTs with teaching
- Minimum no. images graded
- Time spent grading
- T&T results and feedback
- 1 in 10 R0M0 review
- Review & feedback of intergrader reports

- *UG rate*
- *Audit of ‘misses’, sight loss etc*
- *Reports to programme board*

Improve Grading Accuracy through *Feedback*

Individual graders

- Set standards
- Individual reports
- One to one review
- Grade or lesion training
- Buddy grader

All programme

- Set standards
- Group report for bench marking
- Group MDT sessions
- Grade or lesion training

Regular review at local programme level

DDESP Annual Report data

	2013/14	2013/12	2012/11	2011/10
Any retinopathy	**30.3%**	**30.5%**	**30.1%**	**31.4%**
Referable Retinopathy	**5.1%**	**5.9%**	**5.1%**	**4.5%**
Ungradable	**1.7%**	**5.3%**	**5.7%**	**4.9%**

DDESP Annual Report data

Number of Grades Performed

Year	Primary	Secondary	%	Arbitration	%
2013/14	**31220**	**10462**	**33.5%**	**785**	**2.5%**
2012/13*	**21530**	**7871**	**36.5%**	**3979**	**18.4%**
2012/11	**27219**	**10228**	**37.5%**	**2230**	**8.1%**
2010/11	**26127**	**11223**	**42.9%**	**2543**	**9.7%**

* 9 months data

3-6 monthly Programme Performance Review

	Target or Standard	Dorset Jan – Jun 2014 RDS
Patients screened as Ungradable	2.5-6.3% <3.0%	1.9 %
1st, 2nd & Arbitration grading rates for all patients screened	1st -100% 2nd - 35-50% Arbitration - <10% with target <5%	RDS only 1st 100%, 2nd 36.7% Arbitration 11.3% RDS & DS Arbitration 10.4%

IQA: Software Grading Reports

- Grading numbers per grader
- Time spent grading
- Arbitration rate & agreement rate
- R0M0 1 in 10 agreement
- Grading accuracy & kappa score >0.8
- Ungradable rate

Standards for Accredited Graders in Dorset

Test & Training tests	Minimum: 10 sets per year & score >80% on 8 of 10
Grading numbers	> 500 per year for optometrists & >1000 for graders
Grading Accuracy on Intergrader agreement	GA ≥80% with kappa score ≥0.8
1 in 10 R0M0 QA	≥90%
Arbitration rate on primary grading	< 10% with final grade agreement >50%

Individual Grader Review

- Feedback to all
- No single result correctly identifies below standard grading
- Low score in one test / report – look for other evidence
- Be honest and open
- Give constructive feedback

- Provide anonymised data on all graders

Grading Accuracy:
inter grader agreement

Table b: Grader M

Total agreement:		526/562
Proportion agreement:		93.59%
Cohen's Kappa:		0.865
Confidence interval:		0.823 to 0.908

Grader Number 0

Final Grade	R0M0	R1M0	R3SM0	R1M1	R3SM1	R2M0	R2M1	R3AM0	R3AM1	U	Total
R0M0	72	9	0	1	0	0	0	0	0	11	93
R1M0	6	386	0	1	0	0	0	0	0	1	394
R3SM0	0	0	2	0	0	0	0	1	0	0	3
R1M1	0	2	0	28	0	0	0	0	1	0	31
R3SM1	0	0	1	0	4	0	0	0	0	0	5
R2M0	0	0	0	0	0	3	1	0	0	0	4
R2M1	0	0	0	1	0	0	7	0	0	0	8
R3AM0	0	0	0	0	0	0	0	0	0	0	0
R3AM1	0	0	0	0	0	0	0	0	1	0	1
U	0	0	0	0	0	0	0	0	0	23	23
Total	78	397	3	31	4	3	8	1	2	35	562

What does the kappa score mean?

Grading Accuracy Data

Kappa score

- Based on the proportion agreement %
- Takes into account the ‘case mix’
- Target ≥ 0.8

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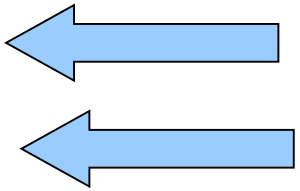

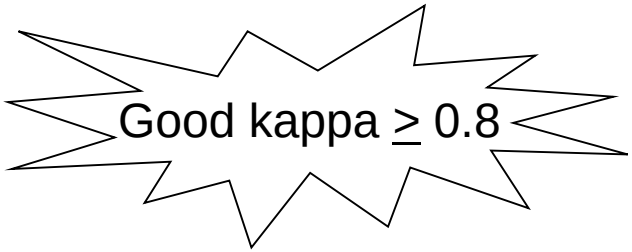

Grader Number	0									
Final Grade	**R0M0**	**R1M0**	**R3SM0**	**R1M1**	**R3SM1**	**R2M0**	**R2M1**	**R3AM0**	**R3AM1**	**U**	**Total**
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R1M1	0	2	0	28	0	0	0	0	1	0	31
R3SM1	0	0	1	0	4	0	0	0	0	0	5
R2M0	0	0	0	0	0	3	1	0	0	0	4
R2M1	0	0	0	1	0	0	7	0	0	0	8
R3AM0	0	0	0	0	0	0	0	0	0	0	0
R3AM1	0	0	0	0	0	0	0	0	1	0	1
U	0	0	0	0	0	0	0	0	0	23	23
Total	78	397	3	31	4	3	8	1	2	35	562

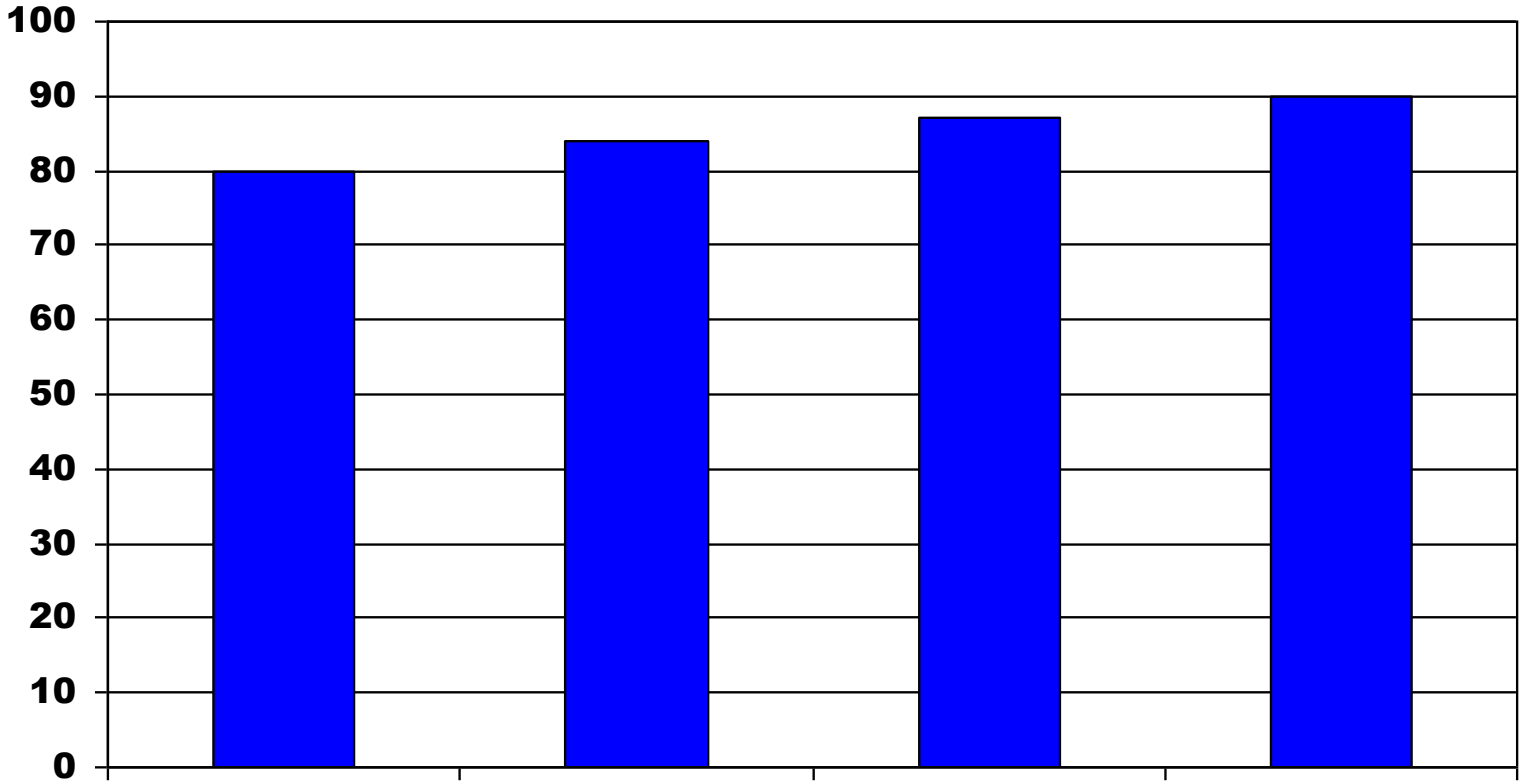
How do Test & Training Sets help assess grading accuracy?

Test & Training Sets

- All test cases have 3 out of 3 Grading College agreement (2012)
- Clear cut cases
- Demonstrate grader can grade accurately in a test

NB New software for better images soon

Dorset Diabetic Eye Screening Programme
Average Test and Training System Score since 2010



Number of graders	42	34	35	35

Test & Training Sets *but*

- Provides only correct score
- R1/R0 error same score as R3/R0
- No set standards
- 80% (8 of 40 wrong) but miss R3 cases
- Is it training or testing?
- Is it robust to detect sub-standard grading?
- It’s not real life grading

What do I want from external QA test?

- Robust, fair test for graders
- Participation is straight forward
- Provide good feedback
- Reassurance of good grading accuracy
- Detect sub – standard grading
- Pin point grading problems
- Bench mark grading accuracy across programme – local & national

Ask the statistician!

- How many cases need to be graded to detect sub-standard grading?
- Use data from 7 test sets from 2012/13
- Since 1.4.12, all TAT cases graded by grading college

Sensitivity

Sensitivity – ability of the test to **correctly** identify a positive case

$$\frac{\text{Positive cases correctly detected}}{\text{Positive cases detected + Positive cases missed}} \times 100$$

Low sensitivity: cases missed

Specificity

Specificity – ability of the test to **correctly** identify people who do not have the condition

Negative cases correctly graded

All negative cases (including false positive cases) x 100

Low specificity means high false positives

Review of T&T results 2012/13:

7 complete test sets

Graders assessed on ability to detect correct outcome not actual DR grade ie Any DR= all grades except R0M0; Referable retinopathy= R2, R3 or M1; and fast track=R3

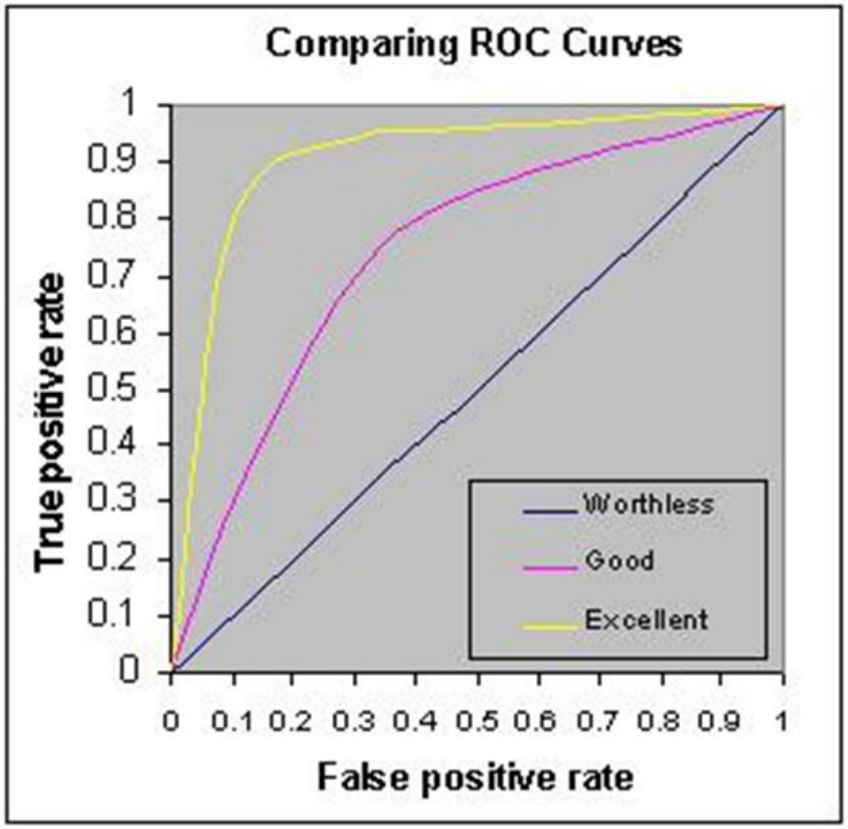
Trainee graders excluded

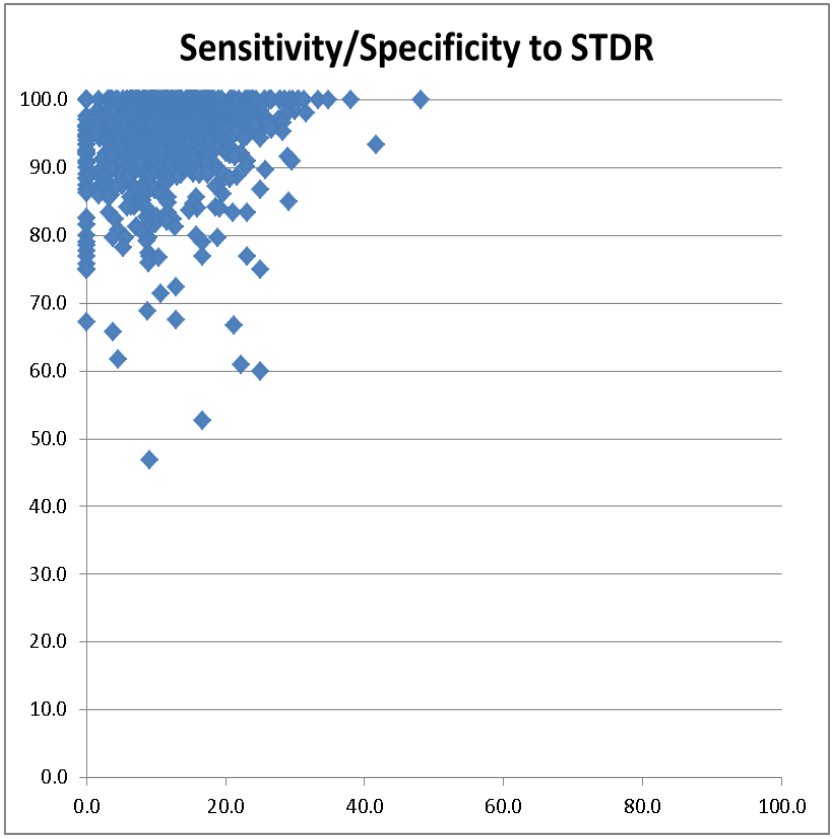
Level of DR	Image-sets completed	Image-sets with correct level of DR	Overall Sensitivity	Overall Specificity
Any DR	**104,575**	**102,181**	**97.7%**	**95%**
Referable DR	**60,386**	**60,155***	**95.1%**	**88%**
Fast track DR	**16,870**	**12,208****	**72.4%**	**72%**

*99.6% image-sets had at least any DR identified so would go to second disease grading in a live programme setting

**99.9% had at least any DR and 93.5% had at least referable DR identified

Test characteristics: STDR





Plot of test results for 1215 Graders

Statistician asks us!

- What is the target sensitivity for good grading accuracy?
- What is the threshold sensitivity for sub-standard grading?
- What proportion of poor graders do you want to detect?
- What will you tolerate in categorising sub-standard grading when it is just chance?

1	2	3	4	5	6	7
P value	**Power**	**Cut off sensitivity level in T&T**	**Target Sensitivity**	**Per cent of cases with Referable DR**	**Required size of test set**	**Comments**
1%	**80%**	**80%**	**95%**	**30%**	**218**	**Starting point**
1%	**70%**	**80%**	**95%**	**40%**	**146**	
1%	**80%**	**80%**	**95%**	**40%**	**164**	
1%	***90%***	***80%***	***95%***	***40%***	***191***	***Best option***
1%	**90%**	**80%**	**95%**	**30%**	**254**	
1%	**90%**	**85%**	**95%**	**30%**	**479**	

Test and Training Scheme

Participation

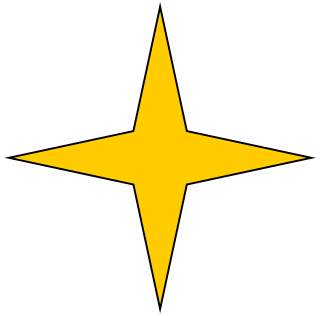
- 6 tests per year

- From 1.4.14, 10 tests per rolling 12 months

TAT: Participation 2013/14 & 2014

Year 2013 / 2014 - 1336 full disease graders registered

- 1164 (87%) participating in 2013/14
- 75% had taken $\geq$ 6 sets
- 49% $\geq$ 10 sets
- 172 (13%) no sets

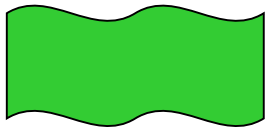
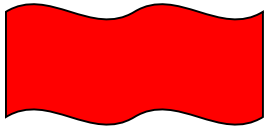


By August 2014

- 1132 (85%) participating
- 208 (16%) no sets

Test & Training Scheme: Participation

- All graders including ROG
- ROG is basis of internal QA assessments
- Minimum 10 sets i.e. 200 image sets per year

- Flag system for participation
  - Green $\geq$ 10 sets in last 12 months 
  - Red < 10 sets in last 12 months 

Setting a standard

So Rates *could be*

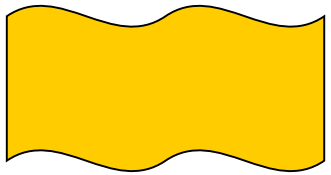
<u>STDR sensitivity</u>

95% Achievable

90% Expected

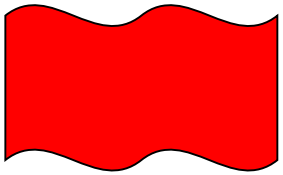
< 85% Yellow Flag Warning

[40 (3.3%) of 1215]



<80% Red Flag remedial threshold

[20 (1.6%) of 1215]



Setting a standard

So Rates *could be*

Specificity

90% Achievable

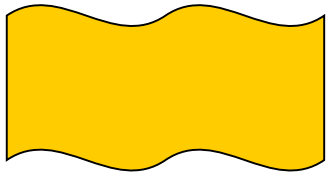
[539 (44%) of 1215]

85% Expected

[903 (74%) of 1215]

<80% Yellow Flag

[126 of 1215]



Test and Training Scheme: the future

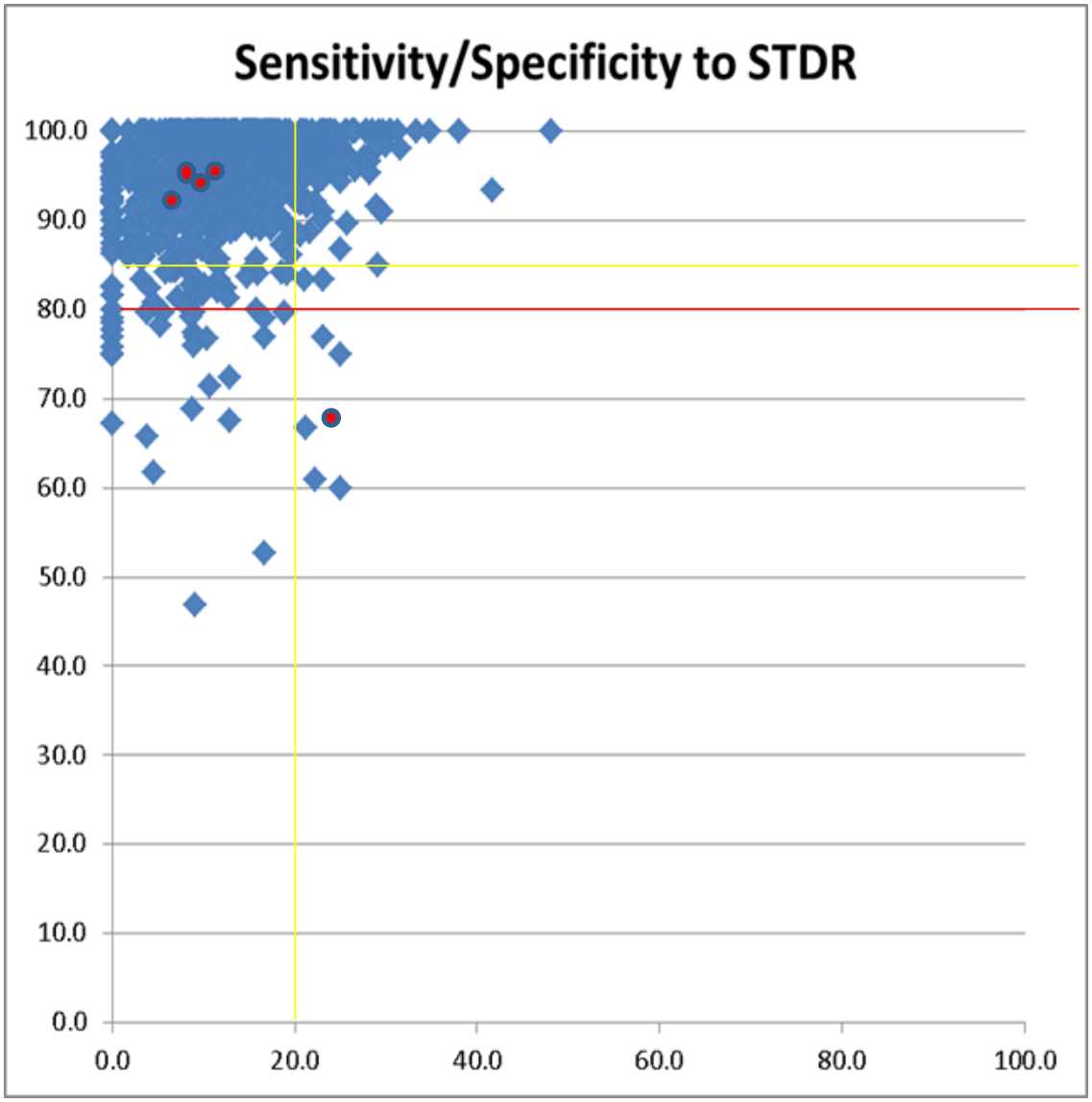
- Flag system for participation: red & green
- Standards for sensitivity & specificity for STDR and flags if below standards
- Reports to clinical lead
- Improved participant feedback report
- Anonymised reports to Programme Board & Regional QA team

DESP Test System Report - All grammes - Rolling 12 months

Report Date Aug 2012 - Aug 2

	Participation			Previous tests STDR Sensitivity				Cumulative sensitivity for the past 12 tests completed	
Grader ID	Programme	Status	Completed last 12 months	T-10 to -12	T-7 to -9	T-4 to -6	Latest 3	For STDR	
								sensitivity %	specificity %
1210	Somewhere	Grader	10	91%	92%	90%	90%	90%	95%
1211	Somewhere	Grader	12	95%	92%	93%	93%	93%	90%
1212	Somewhere	Grader	10	90%	87%	80%	80%	**79%**	82%
1213	Somewhere	Grader	10	90%	92%	95%	95%	95%	95%
1214	Somewhere	Grader	12	94%	95%	97%	97%	95%	95%
1215	Somewhere	Grader	**9**	null	87%	91%	91%	93%	90%
1216	Somewhere	Grader	12	86%	78%	88%	88%	**84%**	95%
1217	Somewhere	Grader	10	100%	100%	98%	98%	95%	95%
1218	Somewhere	Grader	11	98%	97%	95%	95%	98%	100%
1219	Somewhere	Grader	**5**	null	null	89%	89%	92%	90%
1220	Somewhere	Grader	11	95%	97%	94%	94%	92%	95%
1221	Somewhere	Grader	10	100%	98%	98%	98%	100%	**65%**
1222	Somewhere	Trainee	6	null	null	86%	86%	82%	80%
1223	Somewhere	Trainee	3	null	null	null	null	57%	90%

Table must be interpreted according to guidance documentation


Sensitivity/Specificity to STDR
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0.0
20.0
40.0
60.0
80.0
100.0

Screenshot

DESP Test Grade Agreement Report

Programme Name	**Somewhere**	**Start Date**	**1st Mar 2014**
Grader ID	**1124**		
Number of tests	**60**	**End date**	**30th June 2014**

Level	Times Agreed	Times Disagreed	Overgraded		Undergraded	
R0	10	3	as R1	2		
	77%	23%	as R2	0		
			as R3A	1		
R1	22	4	as R2	1	as R0	2
	85%	15%	as R3A	1		
R2	5	8	as R3A	1	as R0	0
	39%	61%			**as R1**	**7**
R3A	5	3			**as R0**	**0**
	62%	33%			**as R1**	**1**
					as R2	2
All R Levels	**42**	**18**	**6**		**12**	
	70%	**30%**	**10%**		**20%**	
M0	34	2	as M1	2		
	94%	6%				
M1	18	6			**as M0**	**6**
	75%	25%				
All M levels	**52**	**8**	**2**		**6**	
	87%	**13%**	**3%**		**10%**	

Summary for Period

Sensitivity to DR	**96**	**Specificity to STDR**	**77**
Sensitivity to STDR	**91**	**Specificity to DR**	**75**
Sensitivity Fastrack	**63**	**Specificity Fastrack**	**94**
Red Box R	**8**	**Red Box M**	**6**

Recommended Pathway for Training Support for Graders

Additional Training Material on
T&T website

TAT & External QA

- Remember TAT only 1 part of the system
- Seek other evidence
- Review internal GA reports

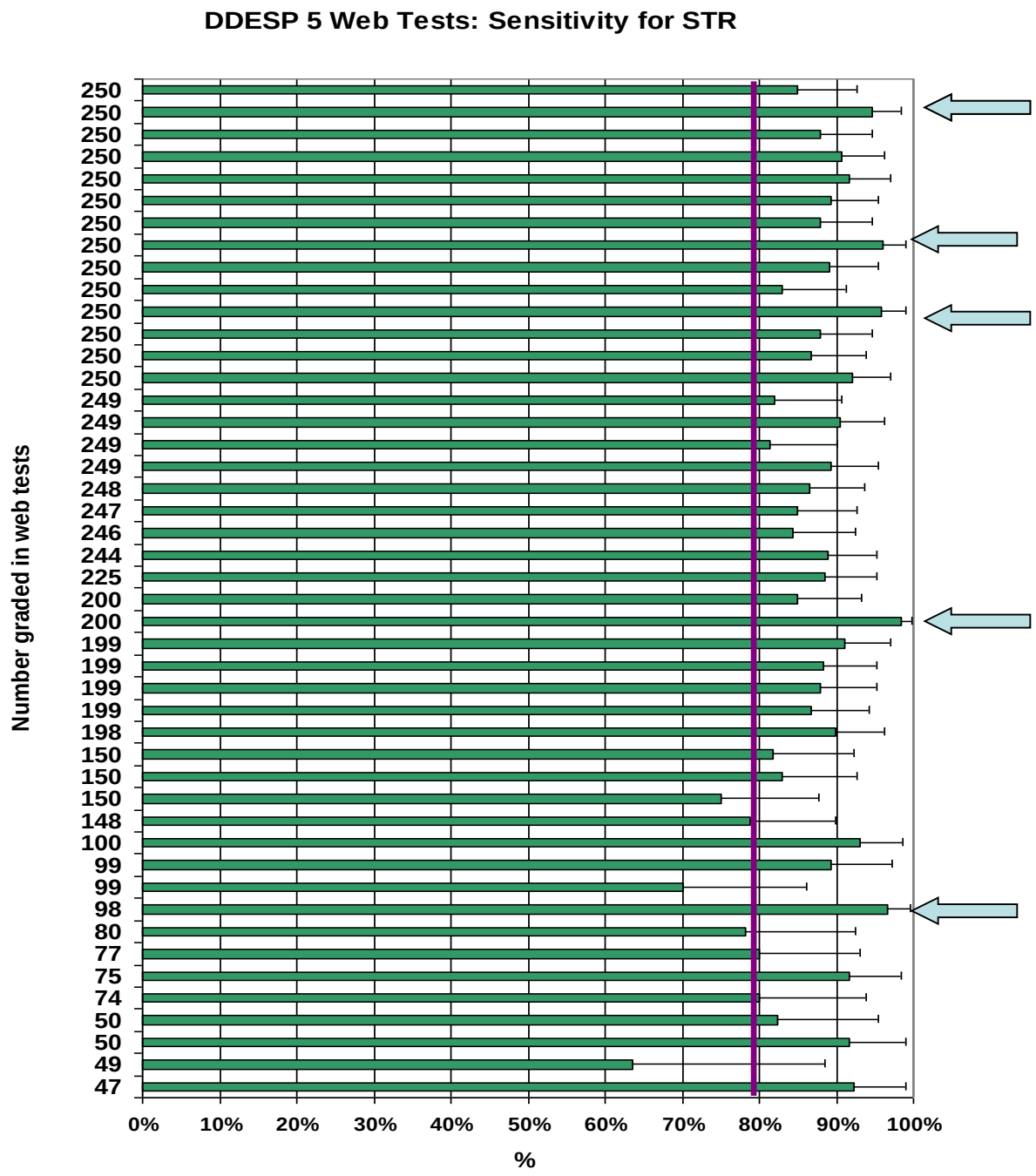
Improving Grading Accuracy: summary

- Set Programme standards for graders
- Set national standards for T&T sets
- Provide feedback
- Provide supportive training
- Ensure continuous CPD

Useful Information Sources

1. Internal Quality Assurance Guidance & Best Practice Toolkit http://diabeticeye.screening.nhs.uk/internal-qa

What are confidence intervals?


DDESP 5 Web Tests: Sensitivity for STR
Number graded in web tests
250
250
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250
249
249
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199
198
150
150
150
148
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99
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98
80
77
75
74
50
50
49
47
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
%

Table b: Grader M

Total agreement:		526/562
Proportion agreement:		93.59%
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Grader Number	0									
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R2M1	0	0	0	1	0	0	7	0	0	0	8
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