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PSYCHOMETRIC
SOLUTIONS
GROUP

Examination Report

Refraction Certificate Examination

May 2023

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1 Introduction

75 candidates sat the May 2023 Refraction Certificate exam. The examination consists of 10 objective structured clinical examination (OSCE) stations, covering a range of skills required to assess visual acuity, refractive error and the prescription of spectacles.

1.1 Examination blueprint

The Refraction Certificate (RCert) is designed to assess the following learning outcomes from the Royal College of Ophthalmologists curriculum for ophthalmic specialist training (OST):

CA2	Vision
CA7	Motility
PM1	Management plan
PM14	Spectacles
PS2	Refraction
PS21	Hand hygiene
C1	Rapport
C2	Communication
C12	Records
BCS6	Optics
BCS14	Instrument technology
AER16	Time management

1.2 Examination structure

The examination consists of 10 OSCE stations. Each station contributes 15 marks to the overall total. The stations used for the examination were:

- CR1 - CR4: Cycloplegic retinoscopy
- NCR1 - NCR2: Non cycloplegic retinoscopy
- CYL: Subjective refraction cylinder
- LN: Lens neutralisation
- SRS: Subjective refraction sphere
- BB: Binocular balance

2 Summary

The Hofstee method of standard setting was used to generate the pass mark for this examination, with a final pass mark of 105/150 (70.0%). Candidates scored highest on the NR1 and CR4 (Retinoscopy) stations and lowest on the BB, SRS and CYL (Subjective) stations. The overall exam pass rate was 70.7%.

The exam demonstrated satisfactory reliability (station-level), with an alpha of 0.792. Nine of the 10 stations contributed positively to the reliability. The CR3 station did not contribute to the reliability and saw the lowest correlation between station and total scores. All other stations saw station-total correlations above the 0.3 recommended minimum value.

3 Standard setting

Candidates must be able to accurately assess visual acuity, measure refractive error and recommend an appropriate spectacle correction to pass the RCert. The pass mark is identified using the Hofstee method.

3.1 Hofstee method

After the examination, examiners were asked to review the parameters for the standard setting based upon their judgment of the difficulty of the stations. The following values were used to set the pass mark:

- The maximum credible pass mark for the examination = 75%
- The minimum credible pass mark for the examination = 60%
- The maximum credible pass rate for the examination = 100%
- The minimum credible pass rate for the examination = 0%

The cumulative fail rate as a function of the pass mark and the co-ordinates derived from the four values above were plotted on a graph. The point where a line joining the two coordinates intersects the cumulative function curve is used to identify the pass mark.

The Hofstee pass mark for this examination was 105/150 (70.0%).

4 Results

Table 1: Results summary

Statistic	Value	Percentage
Number of candidates	75	
Maximum possible mark	150	
Mean candidate mark	107.21	71.5%
Median candidate mark	114	76.0%
Standard deviation	22.02	14.7%
Highest candidate mark	137	91.3%
Lowest candidate mark	46	30.7%
Reliability	0.792	
Standard error of measurement (SEM)	10.04	6.7%
Hofstee pass mark	105/150	70.0%
Pass rate	53/75	70.7%

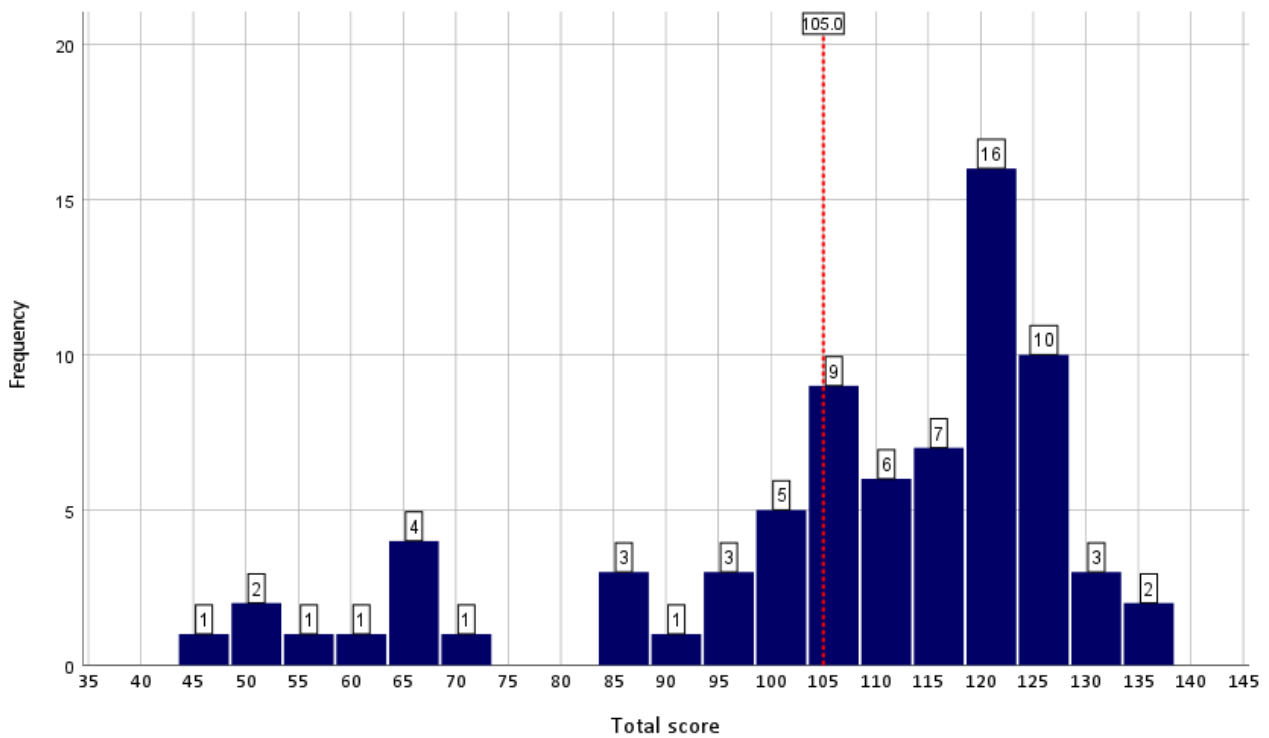


Figure 1: Distribution of marks

The vertical line denotes the point on the mark distribution where the pass mark lies.

Table 2: Station summary

Station	Category	Mean	Median	Standard deviation	Minimum	Maximum
1	CR1	11.55	13	3.78	0	15
2	CR2	10.53	12	4.45	0	15
3	CR3	11.75	13	3.16	3	15
4	CR4	12.41	14	3.36	1	15
5	NR1	12.04	14	4.01	1	15
6	NR2	10.29	11	4.20	0	15
7	CYL	9.71	11	4.19	0	15
8	LN	11.03	12	4.10	0	15
9	SRS	9.49	10	2.52	3	14
10	BB	8.28	8	3.11	1	14

Stations highlighted in green have a mean station score above twelve (highest mean scores) whilst the stations coloured red have the lowest mean scores.

The relative weights for each skill in refraction (based upon the number of stations) are shown in table 3 below.

Table 3: Weights for each skill

Clinical Skill	Number of stations	Contribution to total marks	Median mark
Retinoscopy	6	60%	13.00
Subjective	3	30%	9.00
Other	1	10%	12.00

Table 4: Correlation between stations

	CR1	CR2	CR3	CR4	NR1	NR2	CYL	LN	SRS
CR2	0.41								
CR3	0.19	0.18							
CR4	0.37	0.30	0.16						
NR1	0.27	0.30	0.24	0.31					
NR2	0.32	0.35	0.15	0.10	0.49				
CYL	0.25	0.14	0.05	0.08	0.39	0.22			
LN	0.27	0.33	0.27	0.20	0.58	0.46	0.43		
SRS	0.30	0.18	0.23	0.07	0.40	0.10	0.13	0.26	
BB	0.40	0.26	0.20	0.12	0.47	0.37	0.18	0.36	0.65

Cells are highlighted green if the correlation is greater than 0.5, orange if the correlation is between 0 and 0.2 and red if the correlation is negative (none seen).

The median correlation between all stations was 0.27. There were no negatively correlated stations, and 14/45 instances of a weak relationship between stations. Scores on stations CR3 and CR4 correlated least well with scores on the other stations. The strongest correlation was between SRS and BB scores (0.65).

Table 5: Correlation between each station score and total score

Station	CR1	CR2	CR3	CR4	NR1	NR2	CYL	LN	SRS	BB
Correlation with total score	0.52	0.46	0.29	0.32	0.66	0.50	0.35	0.61	0.41	0.55

Table 5 shows the corrected station-total correlation. This is the correlation between the station score and the overall total score without the score of that specific station included. Data suggests that stations NR1 and LN are the best discriminators.

5 Breakdown of results

Table 6: Breakdown of results by demographic groups

Demographics	Pass	Total	Pass rate (%)
Ethnicity (grouped)			
Asian	20	28	71.4
Black	2	3	66.7
Middle Eastern	3	6	50.0
White	15	19	78.9
Other	3	3	100.0
Unknown	10	16	62.5
PMQ			
UK	30	38	78.9
OS	23	35	65.7
Unknown	0	2	0.0
Gender			
Male	22	33	66.7
Female	27	37	73.0
Unknown	4	5	80.0

6 Comparison to previous examinations

Table 7: Comparison to previous years' exams

Date	Centre	Number of Candidates	Pass mark	Pass rate	Pass rate in OST	% of candidates in OST	Reliability (alpha)	SEM
May-23	Birmingham	75	70%	71%	n/a	n/a	0.79	10 (7%)
Jan-23	Singapore	22	71%	82%	100%	5%	0.54	9 (6%)
Dec-22	London	63	69%	62%	86%	22%	0.73	11 (7%)
Jul-22	Glasgow	109	72%	81%	n/a	n/a	0.85	9 (6%)
May-22	Birmingham	83	72%	80%	94%	20%	0.77	9 (6%)
May-22	Delhi	33	66%	39%	n/a	n/a	0.81	11 (7%)
Apr-22	Cairo	36	73%	86%	n/a	n/a	0.76	8 (5%)
Dec-21	Singapore	131	72%	79%	80%	31%	0.78	10 (6%)
May-21		171	71%	57%	58%	42%	0.83	10 (7%)
Jan-21		39	74%	92%	n/a	n/a	0.51	9 (6%)
Dec-20		141	70%	57%	72%	56%	0.81	11 (8%)
Jun-19		40	70%	57%	n/a	n/a	0.73	11 (7%)
Jun-19		52	74%	67%	n/a^	n/a^	0.76	9 (6%)
Apr-19		87	72%	59%	68%	51%	0.54	12 (6%)
Dec-18		68	72%	54%	70%	63%	0.7	11 (6%)
Jul-18		64	75%	67%	77%	55%	0.74	11 (6%)
Jun-18		39	75%	74%	n/a^	n/a^	0.69	10 (5%)
Apr-18		60	75%	68%	73%	75%	0.55	10 (6%)
Dec-17		63	71%	56%	59%	65%	0.72	11 (6%)
Jul-17		62	72%	61%	68%	60%	0.7	12 (6%)
Apr-17		63	73%	67%	69%	62%	0.7	11 (6%)
Jan-17		62	72%	63%	64%	90%	0.6	10 (6%)
Jul-16		64	70%	64%	67%	67%	0.6	12 (7%)
Jun-16		23	70%	57%	n/a^	n/a^	0.7	11 (6%)
Mar-16		57	77%	81%	83%	70%	0.9	7.7 (4%)
Jan-16		70	70%	60%	60%	81%	0.8	10 (6%)
Jul-15		31	66%	58%	55%	65%	0.65	9.4 (5%)
Jun-15		33	69%	58%	n/a^	n/a^	0.73	10 (6%)
Apr-15		57	77%	65%	73%	65%	0.4	11 (7%)
Dec-14		63	71%	68%	77%	68%	0.6	12 (7%)
Jul-14		34	74%	62%	55%	65%	0.4	11 (6%)
Apr-14		56	73%	84%	89%	66%	0.6	9.5 (5%)
Dec-13		75	72%	67%	76%	65%	0.7	10 (6%)
Jul-13		42	72%	74%	90%	48%	0.7	10 (6%)
Apr-13		64	74%	61%	64%	64%	0.8	11 (6%)

Table 8: Performance of candidate by deanery for all examinations to date, where deanery is known

	Deanery	Total passes	Total candidates	Pass rate %
UK	London	207	278	74.5
	East Midlands	41	57	71.9
	East of England	53	76	69.7
	East of Scotland	15	21	71.4
	Kent, Surrey and Sussex	38	50	76.0
	Mersey	47	62	75.8
	North of Scotland	14	16	87.5
	Northwest	28	38	73.7
	North Western	17	21	81.0
	Northern	35	47	74.5
	Northern Ireland	18	26	69.2
	Oxford	26	33	78.8
	Peninsula (Southwest)	25	55	45.5
	Severn	23	37	62.2
	Southeast of Scotland	24	28	85.7
	South Yorks & Humber	1	1	100.0
	Wales	36	65	55.4
	Wessex	37	53	69.8
	West Midlands	73	105	69.5
	West of Scotland	37	51	72.5
Yorkshire	65	99	65.7	
OS	Eire	1	2	50.0
	Europe and Overseas	3	10	30.0
	Total	864	1231	70.2