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PSYCHOMETRIC
SOLUTIONS
GROUP

Examination Report

Refraction Certificate Examination

Birmingham – September 2023

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1 Introduction

58 candidates sat the Birmingham September 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 101/150 (67.3%). On average, candidates scored highest on the CR3 station, followed by the CR4 and NR1 stations (Retinoscopy stations) and lowest on the BB and CYL (Subjective) stations. The overall exam pass rate was 55.2%, the lowest pass rate seen since the Delhi May 2022 exam.

The reliability of the exam was 0.66; this falls below the desired level of 0.80 but was higher than seen in the previous diet (0.41). Eight of the 10 stations contributed positively to the reliability. The SRS station did not contribute to the reliability. The CYL station saw a 'scale if item deleted' value of 0.712 and had a slight negative item-total correlation of -0.034. The Lens neutralisation (LN) and Cycloplegic retinoscopy 4 (CR4) scores correlate most strongly with overall performance.

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. This pass mark is rounded to the nearest achievable mark.

The Hofstee pass mark for this examination was 101/150 (67.3%).

4 Results

Table 1: Results summary

Statistic	Value	Percentage
Number of candidates	58	
Maximum possible mark	150	
Mean candidate mark	98.41	65.6%
Median candidate mark	101.50	67.7%
Standard deviation (population)	19.30	12.9%
Highest candidate mark	134	89.3%
Lowest candidate mark	57	38.0%
Reliability	0.661	
Standard error of measurement (SEM)	11.24	7.5%
Hofstee pass mark	101/150	67.3%
Pass rate	32/58	55.2%

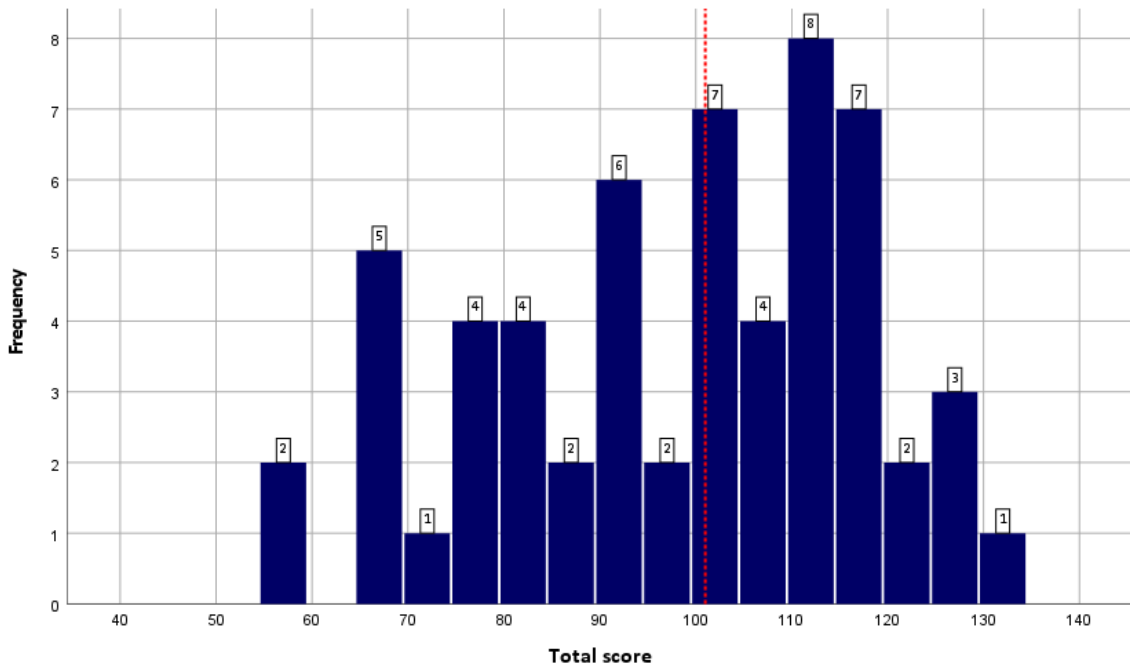


Figure 1: Distribution of marks

The dotted red 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	9.86	11.0	3.87	3	15
2	CR2	9.64	11.0	4.52	1	15
3	CR3	12.53	14.0	3.07	4	15
4	CR4	11.62	13.5	3.67	1	15
5	NR1	11.24	12.0	3.44	3	15
6	NR2	9.72	11.0	4.67	0	15
7	CYL	7.86	8.0	4.41	0	15
8	LN	9.95	11.0	4.98	0	15
9	SRS	8.91	9.0	2.66	4	14
10	BB	7.03	7.0	3.22	0	13

Stations with a mean station score above twelve (highest mean scores) are highlighted in green; only one station met this criterion. Stations highlighted 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%	12.0
Subjective	3	30%	8.0
Other	1	10%	11.0

Table 4: Correlation between stations

	CR1	CR2	CR3	CR4	NR1	NR2	CYL	LN	SRS
CR2	0.41								
CR3	0.41	0.39							
CR4	0.45	0.27	0.36						
NR1	0.07	0.12	0.31	0.28					
NR2	0.12	0.17	0.16	0.26	0.47				
CYL	0.01	0.24	-0.08	0.07	-0.21	-0.16			
LN	0.44	0.40	0.26	0.34	0.13	0.33	0.03		
SRS	0.11	-0.14	0.04	0.13	-0.09	0.00	-0.11	0.26	
BB	0.14	0.17	-0.08	0.03	-0.08	0.11	-0.06	0.30	0.40

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

The median correlation between all stations was 0.14. There were 9 negative correlations between stations (red), and 17/45 instances of a weak relationship between stations (orange). The weakest correlations were seen between the CYL station and both NR stations (NR1 & NR2). The strongest correlation was between NR1 and NR2 station scores, closely followed by the CR1 station and a number of other stations (CR2, CR3, C4 and LN).

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	0.49	0.49	0.40	0.50	0.23	0.32	-0.03	0.58	0.12	0.20

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 the LN (Lens neutralisation) and CR4 (Cycloplegic retinoscopy 4) stations were the best discriminators. CYL (Subjective refraction cylinder) scores correlate negatively with overall total scores.

5 Breakdown of results

Table 6: Breakdown of results by demographic groups

Demographics	Passed	Total	Pass rate (Rounded)
Ethnicity			
Arab	2	5	40%
Asian - Other	3	3	100%
Asian/Asian British - Bangladeshi	0	1	0%
Asian/Asian British - Chinese	7	8	88%
Asian/Asian British - Indian	4	10	40%
Asian/Asian British - Pakistani	4	9	44%
Black / African / Caribbean / Black British - African	1	2	50%
Other	2	7	29%
Unknown	8	9	89%
White - Other	0	1	0%
White English / Welsh / Scottish / Northern Irish / British	1	3	33%
PMQ			
OS	18	40	45%
UK	13	17	77%
Unknown	1	1	100%
Gender			
Female	14	25	56%
Male	17	31	55%
Unknown	1	2	50%

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
Sept-23	Birmingham	58	67%	55%	n/a	n/a	0.66	11 (8%)
June-23	Kuching	44	69%	75%	n/a	n/a	0.41	11 (7%)
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
London	210	284	73.9
East Midlands	42	58	72.4
East of England	55	78	70.5
East of Scotland	15	21	71.4
Kent, Surrey, and Sussex	40	53	75.5
Mersey	47	63	74.6
North of Scotland	14	16	87.5
Northwest	28	38	73.7
Northwestern	17	22	77.3
Northern	36	49	73.5
Northern Ireland	18	28	64.3
Oxford	27	34	79.4
Peninsula (Southwest)	25	55	45.5
Severn	23	37	62.2
Southeast of Scotland	25	29	86.2
South Yorks & Humber	2	3	66.7
Wales	36	65	55.4
Wessex	37	54	68.5
West Midlands	76	109	69.7
West of Scotland	37	51	72.5
Yorkshire	69	104	66.3
Eire	1	2	50.0
Europe and overseas	7	15	46.7
Unknown; N/A	12	24	50.0
TOTAL	899	1292	69.6