PSYCHOMETRIC
SOLUTIONS
GROUP

Examination Report

Refraction Certificate Examination

Birmingham - May 2024

Lucy Foard, Sian Williams, Kiran Sanghara

Contents

1 Introduction

100 candidates sat the Birmingham Refraction Certificate exam between the 14th and 16th May 2024. 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 Assess vision

PM14 To use spectacle lenses and prisms when indicated

PS2 Perform a refractive assessment and provide an optical prescription

C1 Establish a good rapport with patients and relatives

C11 Keep clinical records

BCS6 Optics and Medical physics

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:

- SR1 - SR4: Simulated retinoscopy
- NR1 - NR2: Non-cycloplegic retinoscopy
- SC: Subjective refraction: Cylinder
- LN: Lens neutralisation
- SS: Subjective refraction: Sphere
- BB: Binocular balancing / Further refinement

2 Summary

The Hofstee method of standard setting was used to generate the pass mark for this examination, with a final rounded pass mark of 103/150 (68.7%). On average, candidates scored highest in two of the 'Simulated retinoscopy' stations (SR1 and SR3). Candidates scored lowest in the 'Subjective refraction: Cylinder' (SC) station, followed by the 'Non-cycloplegic retinoscopy 2' (NR2) and Binocular balancing (BB) stations. The overall exam pass rate was 67%; two-thirds of candidates were successful.

The reliability of the exam was α=0.76; this falls close to the desired level of ≥0.80, with all stations contributing positively. All station scores correlated well with overall total exam scores; in particular, the Lens Neutralisation (LN) and Binocular balancing (BB) stations showed strong discriminative power.

3 Standard setting

The pass mark is generated 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 raw Hofstee pass mark (before rounding) for this examination was 103.5/150 (69%).

4 Results

Table 1: Results summary

Statistic	Value	Percentage
Number of candidates	100	
Maximum possible mark	150	
Mean candidate mark	106.24	70.8%
Median candidate mark	110.00	73.3%
Standard deviation	21.59	14.4%
Highest candidate mark	139	92.7%
Lowest candidate mark	33	22.0%
Reliability	0.756	
Standard error of measurement	10.66	7.1%
Hofstee pass mark	103 / 150	68.7%
Pass rate*	67 / 100	67.0%

**Please note that the final pass rate presented reflects any adjustments to candidates' scores. All other analyses are based on original, unadjusted data.*

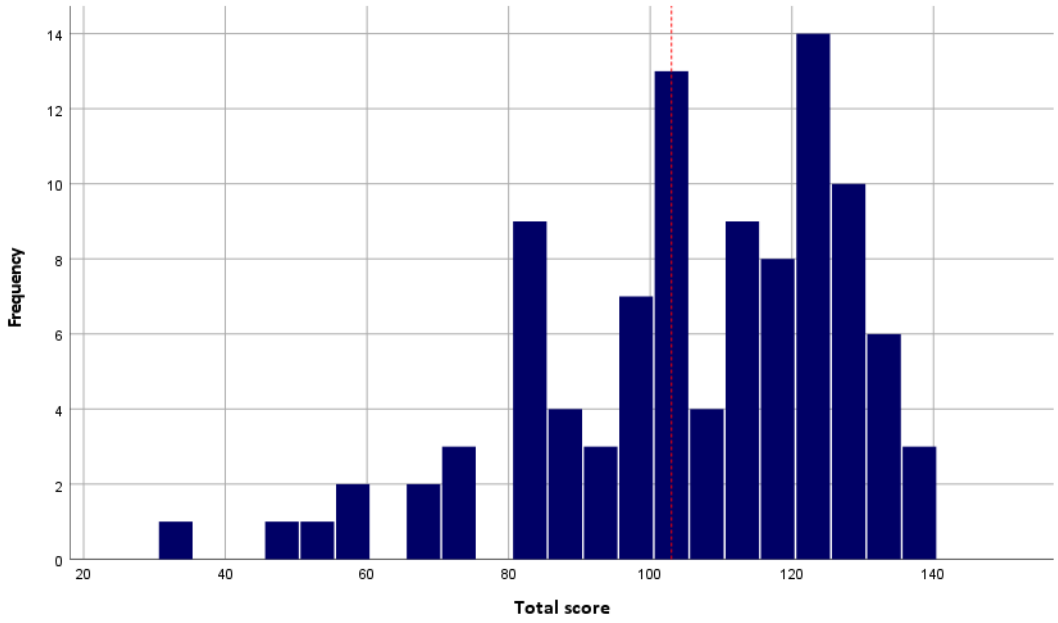

Figure 1: Distribution of marks

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

Table 2: Station summary

Station	Category	Mean	Median	Standard deviation	Minimum	Maximum
1	SR1	12.2	14.0	3.7	2	15
2	SR2	10.9	13.0	4.5	0	15
3	SR3	12.6	14.0	2.6	3	15
4	SR4	11.7	14.0	4.1	0	15
5	NR1	10.7	11.0	3.7	0	15
6	NR2	9.3	9.0	4.2	0	15
7	SC	8.6	9.0	4.2	0	15
8	LN	11.2	13.0	4.6	0	15
9	SS	9.8	10.0	2.9	2	15
10	BB	9.3	9.5	3.7	0	15

Stations with a mean station score above twelve (highest mean scores) are highlighted in green. Stations highlighted red have the lowest mean scores. The LN and SR2 stations see the largest variations in candidate performance.

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%	13.0
Subjective	3	30%	9.0
Other	1	10%	13.0

Table 4: Correlation between stations

	SR1	SR2	SR3	SR4	NR1	NR2	SC	LN	SS
SR2	0.53								
SR3	0.27	0.28							
SR4	0.25	0.37	0.22						
NR1	0.19	0.10	0.06	0.14					
NR2	0.14	0.28	0.15	0.15	0.32				
SC	0.16	0.19	0.12	0.21	0.27	0.28			
LN	0.22	0.35	0.17	0.21	0.18	0.46	0.29		
SS	0.08	0.11	0.09	0.20	0.09	0.30	0.31	0.27	
BB	0.14	0.22	0.18	0.27	0.19	0.29	0.33	0.29	0.68

Within Table 4, cells are highlighted green if the correlation is greater than 0.50 and orange if the correlation is between 0 and 0.20. There were no negative correlations between stations.

The median correlation between all stations was 0.22. There were 19/45 instances of a weak correlation between stations (orange), and 2/45 instances of a strong relationship between stations (green). The weakest correlation was seen between the SR3 and NR1 stations. The strongest positive correlation was seen between the SS (Subjective refraction sphere) and BB (Binocular balancing) station scores (0.68).

Table 5: Correlation between each station score and total score

Station	SR1	SR2	SR3	SR4	NR1	NR2	SC	LN	SS	BB
Correlation with total score	0.39	0.49	0.30	0.39	0.30	0.48	0.42	0.50	0.42	0.50

Table 5 shows the corrected station-total correlations. This is the correlation between the station score and the overall total score without the score of that specific station included. All correlations this exam were positive and of an acceptable strength. Data suggests that the Lens Neutralisation (LN) and Binocular Balancing (BB) stations had the strongest relationships with total scores and were therefore the better discriminators.

5 Breakdown of results

Table 6: Breakdown of results by demographic groups

Demographics	Passed	Total	Pass rate (Rounded)
Ethnicity (grouped)			
Asian	28	44	63.6%
Black	4	4	100%
Mixed	2	3	66.7%
Other	3	10	30.0%
White	17	20	85.0%
Unknown	13	19	68.4%
PMQ			
OS	24	52	46.2%
UK	41	44	93.2%
Unknown	2	4	50.0%
Gender			
Female	23	39	59.0%
Male	40	55	72.7%
Unknown	4	6	66.7%

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 (rounded)
May-24	**Birmingham**	**100**	**69%**	**67%**	**n/a**	**n/a**	**0.76**	**11 (7%)**
Feb-24	Rawalpindi	18	71%	72%	n/a	n/a	0.67	10 (7%)
Feb-24	Chennai	21	67%	52%	n/a	n/a	0.72	12 (8%)
Jan-24	Singapore	14	72%	93%	n/a	n/a	0.40	TBC
Dec-23	Birmingham	75	71%	79%	n/a	n/a	0.70	10 (7%)
Nov-23	Cairo	10	69%	80%	n/a	n/a	0.81	9 (6%)
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	Pass	Total	Pass rate (%)
London	231	308	*75.0*
East Midlands	51	68	*75.0*
East of England	61	84	*72.6*
East of Scotland	15	21	*71.4*
Kent, Surrey, and Sussex	51	66	*77.3*
Mersey	53	69	*76.8*
North of Scotland	15	20	*75.0*
Northwest	28	38	*73.7*
Northwestern	26	33	*78.8*
Northern	43	58	*74.1*
Northern Ireland	19	29	*65.5*
Oxford	28	36	*77.8*
Peninsula (Southwest)	31	63	*49.2*
Severn	26	40	*65.0*
Southeast of Scotland	25	29	*86.2*
South Yorks & Humber	3	6	*50.0*
Wales	39	69	*56.5*
Wessex	38	58	*65.5*
West Midlands	86	122	*70.5*
West of Scotland	42	57	*73.7*
Yorkshire	76	112	*67.9*
Eire	2	6	*33.3*
Europe and Overseas	28	43	*65.1*
Unknown; N/A	53	95	*55.8*
Total	1070	1530	*69.9*