

Research and Evaluation Division, University of Cambridge Local Examinations Syndicate

BMAT scores and outcomes of applications to the University of Cambridge for medical and veterinary courses in 2003

This report contains summary statistics and initial analyses of performance of applicants to the University of Cambridge on the Biomedical Admissions Test (BMAT), set in November 2003, and subsequent admissions decisions.

The test was developed by the Research and Evaluation Division of the University of Cambridge Local Examinations Syndicate, and was administered in 2003 by Oxford, Cambridge and RSA Examinations (OCR). It contained three sections. Sections 1 and 2 consisted of objectively marked multiple choice or short-answer questions, and were marked by UCLES. Section 3 contained a choice of open ended tasks, which were passed to the applicants' colleges for marking and use as interview tools. This report is concerned only with Sections 1 and 2.

It should be noted that the scores referred to in this report are scores on the BMAT scale, which runs from 1.0 to 9.0 and is reported to one decimal place. The use of BMAT scores, rather than raw marks, allows the performance of candidates who have taken different versions of the test, which will inevitably vary slightly in absolute difficulty, to be reported on a common scale. The initial calibration of the BMAT scale was based on an analysis of the performance of candidates who sat the final Medical and Veterinary Admissions Test (MVAT). BMAT scores of 5.0, 6.0 and 7.0 approximate to performance at the 50th, 80th, and 95th percentiles respectively of MVAT candidates in 2002.

Summary Statistics

Mean scores and standard deviations for 1783¹ applicants for Medicine (including CGCM) and Veterinary Medicine are provided in table 1, by section and for the total of Sections 1 and 2. The test's level of difficulty was appropriate to discriminate within this highly able target group.

Table 1: Summary Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Section 1	1783	2.3	8.5	5.09	0.745
Section 2	1783	1.1	8.7	5.10	0.831
Sections 1 + 2	1783	4.7	16.4	10.19	1.373

Table 2 provides details of means and standard deviations of scores for sub-groups of applicants by course and gender.

Table 2: Summary statistics by course and sex

		Valid N	Section 1		Section 2		Sections 1 + 2	
			Mean	S.D.	Mean	S.D.	Mean	S.D.
MED	female	664	5.01	0.71	5.10	0.78	10.11	1.28
	male	593	5.17	0.79	5.29	0.90	10.47	1.48
CGCM	female	72	4.92	0.75	4.61	0.83	9.53	1.44
	male	75	5.46	0.94	4.96	0.75	10.42	1.56
VET	female	296	5.03	0.60	4.86	0.75	9.89	1.18
	male	83	5.23	0.75	5.14	0.61	10.36	1.24
Total		1783	5.09	0.74	5.10	0.83	10.19	1.37

¹ This excludes applicants who did not take the BMAT; those who withdrew their applications; and those (n = 30) for whom no decision regarding selection is available to RED at the time of writing.

On average, males tended to perform a little better than females. This difference was most marked amongst CGCM applicants. Indeed, on Section 1, the average scores of male CGCM applicants was the highest of all the sub-groups, whilst the average scores of female CGCM applicants was the lowest. Overall, medical applicants had the highest mean scores.

Table 3 gives the means and standard deviations of scores for the sub-groups applying from different types of school within the UK, from schools in EU countries and elsewhere, and for mature candidates – in this case all those over 21 by October in the year they intend to start the course.

Table 3: Summary statistics by school type

	Valid N	Section 1		Section 2		Sections 1 + 2	
		Mean	S.D.	Mean	S.D.	Mean	S.D.
UK Comprehensive	335	5.05	0.67	4.99	0.70	10.04	1.15
UK FE/6th Form College	160	4.97	0.67	4.89	0.72	9.86	1.20
UK Selective	269	5.23	0.70	5.21	0.67	10.44	1.21
UK Independent	581	5.18	0.76	5.26	0.79	10.44	1.34
UK Other Maintained	6	5.18	0.65	5.18	0.45	10.37	0.99
School in EU Country	52	4.61	0.69	4.55	0.85	9.15	1.34
Non-EU Overseas School	147	4.97	0.68	5.61	0.97	10.58	1.45
Mature - MED/VET	86	4.77	0.81	4.45	1.04	9.22	1.70
Mature - CGCM	147	5.19	0.90	4.79	0.81	9.98	1.57
Total	1783	5.09	0.74	5.10	0.83	10.19	1.37

For UK school types, the mean total (Section 1+2) scores for applicants from FE/6th Form Colleges and Comprehensive Schools were significantly lower than those of applicants from Selective schools in the state sector and Independent schools, who shared the highest mean total score. There were only a very small number of candidates from Other Maintained schools (all of which, in 2003, were City Technology Colleges).

Applicants from non-EU overseas schools had the highest mean total score, their mean Section 2 score being significantly higher than all other sub-groups. In contrast, the mean scores for applicants from schools in EU countries were lower than those of all UK school types on both sections of the test.

Mature applicants for undergraduate courses in Medicine and Veterinary Medicine appeared to find the BMAT relatively difficult, performing poorly on both sections of the test. In contrast, CGCM applicants performed well on Section 1, although their mean score on Section 2 was lower than that of applicants from all UK school types.

Variations in BMAT scores and selection outcomes

Table 4 shows the means and standard deviations of BMAT scores of those offered a place, those rejected, and those offered a place or rejected after having been pooled.

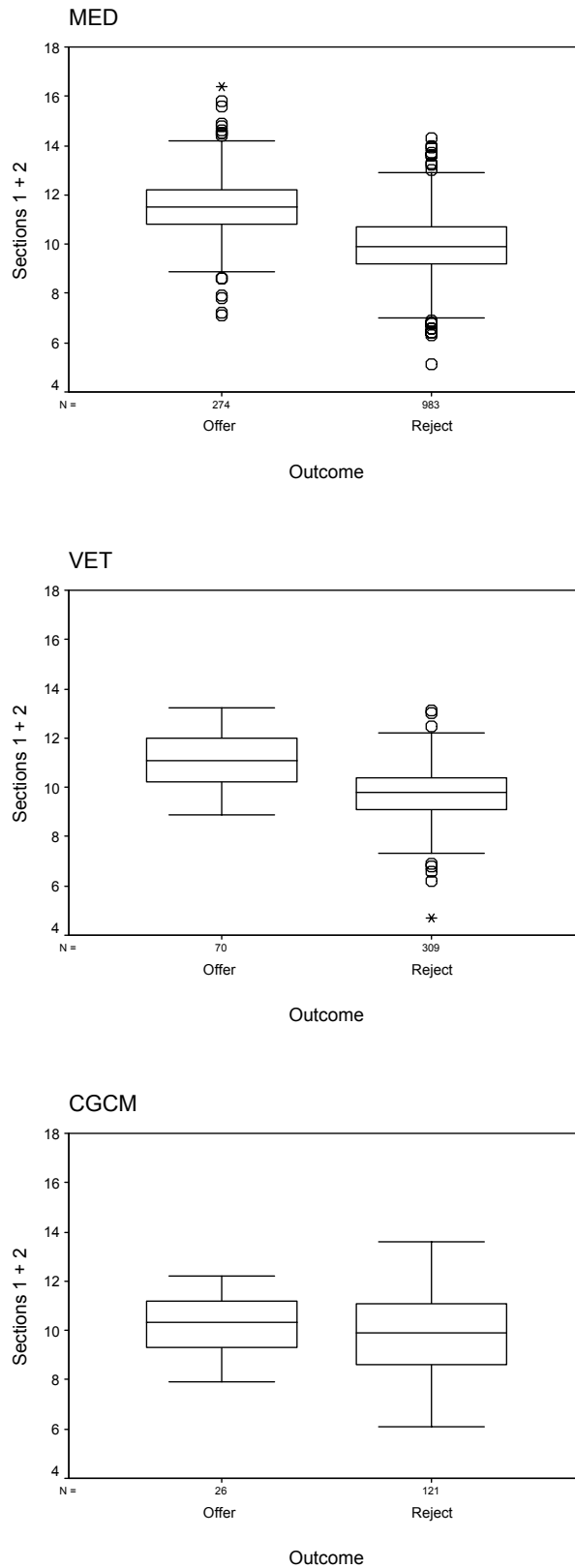
Table 4: Summary statistics by selection decision

Decision	Valid N	Section 1		Section 2		Sections 1 + 2	
		Mean	S.D.	Mean	S.D.	Mean	S.D.
Offer	328	5.71	0.68	5.69	0.81	11.40	1.29
Pool - offer	42	5.65	0.78	5.43	0.91	11.07	1.45
Pool - reject	223	5.26	0.64	5.41	0.72	10.67	1.05
Reject	1190	4.87	0.66	4.87	0.75	9.74	1.19
Total	1783	5.09	0.74	5.10	0.83	10.19	1.37

There is considerable overlap in BMAT scores between those accepted and those rejected, as might be expected given the range of factors contributing to selection decisions. This is illustrated by the boxplots in Figure 1 (where the box contains the middle 50% of the distribution). BMAT scores of

successful and unsuccessful candidates appear to be relatively well separated in the case of both Medicine and Veterinary Medicine, whilst there is a great deal of overlap in the case of CGCM applicants.

Figure 1: Boxplots showing BMAT scores for successful and unsuccessful applicants, by course.



The correlation between offers and BMAT scores (shown in Table 5) was 0.44 (for the total of Sections 1+2). The correlation between Section 1 and offers was higher (0.42) than that for Section 2 (0.38). The correlation between Sections 1 and 2 was 0.52. (These correlations are similar to those observed between MVAT scores and outcomes in previous years.)

Table 5: Pearson correlations between scores on Sections 1 & 2 and outcome

	Section 2	Sections 1 + 2	OUTCOME
Section 1	.52	.86	.42
Section 2		.89	.35
Sections 1 + 2			.44

N = 1783: all correlations significant at the 0.01 level

Table 6 details the means and standard deviations of BMAT scores for those accepted and rejected from different types of schools etc. The table also shows, for each school type, the percentages of applicants accepted or rejected.

Table 6: Summary statistics by school type and outcome

		% of school type	Valid N	Section 1		Section 2		Sections 1 + 2	
				Mean	S.D.	Mean	S.D.	Mean	S.D.
UK Comprehensive	Offer	20.30	68	5.75	0.58	5.51	0.76	11.26	1.09
	Reject	79.70	267	4.87	0.56	4.86	0.62	9.73	0.95
UK FE/Sixth Form College	Offer	14.38	23	5.44	0.77	5.44	0.84	10.88	1.36
	Reject	85.63	137	4.89	0.62	4.79	0.65	9.69	1.08
UK Selective	Offer	30.48	82	5.74	0.62	5.70	0.65	11.44	1.10
	Reject	69.52	187	5.01	0.62	4.99	0.57	10.01	0.98
UK Independent	Offer	23.41	136	5.81	0.73	5.88	0.78	11.69	1.29
	Reject	76.59	445	4.99	0.65	5.07	0.69	10.06	1.10
UK Other Maintained	Offer	16.67	1	5.60	-	5.90	-	11.50	-
	Reject	83.33	5	5.10	0.69	5.04	0.31	10.14	0.91
School in EU Country	Offer	5.77	3	5.13	0.12	5.83	1.12	10.97	1.00
	Reject	94.23	49	4.57	0.70	4.47	0.78	9.04	1.28
Non-EU Overseas School	Offer	10.20	15	5.83	0.62	6.41	0.91	12.23	1.36
	Reject	89.80	132	4.87	0.61	5.53	0.94	10.39	1.34
Mature - MED/VET	Offer	18.60	16	5.20	0.91	4.94	0.93	10.14	1.73
	Reject	81.40	70	4.67	0.76	4.33	1.04	9.01	1.64
Mature - CGCM	Offer	17.69	26	5.44	0.65	4.96	0.72	10.40	1.20
	Reject	82.31	121	5.14	0.93	4.75	0.82	9.89	1.62
Total			1783	5.09	0.74	5.10	0.83	10.19	1.37

The percentage of applicants receiving offers varied quite widely across UK school types, ranging from 14% for FE/6th Form Colleges to 30% for non-independent Selective schools. Of applicants from Independent schools, 23% received offers.

Only 6% of applicants from EU schools received offers, together with 10% of those from non-EU overseas schools.

Mature medical and veterinary applicants had a success rate of 19%. Of CGCM applicants, 18% were successful. BMAT scores of both groups of mature applicants were disappointing when compared to those of applicants from schools, particularly on Section 2 of the test.

Of candidates receiving offers, those from Independent, Selective and Comprehensive schools had fairly similar mean scores on Section 1. Mean scores on Section 2 showed a greater degree of variation between UK school types, with Independent schools performing relatively well.

Demographic variables and selection outcomes

Tables 7, 8 and 9 relate gender, UK v Overseas² status, Independent v other UK school backgrounds, and the outcome of selection. In each case, applicants for different courses are considered separately.

Table 7: Cross-tabulation of sex and outcome

CGCM	OUTCOME		Total	% Success
	Reject	Offer		
female	56	16	72	22.22
male	65	10	75	13.33
Total	121	26	147	17.69

$\chi^2 = 1.994$ (1 d.f.) not significant

MED	OUTCOME		Total	% Success
	Reject	Offer		
female	509	155	664	23.34
male	474	119	593	20.07
Total	983	274	1257	21.80

$\chi^2 = 1.972$ (1 d.f.) not significant

VET	OUTCOME		Total	% Success
	Reject	Offer		
female	245	51	296	17.23
male	64	19	83	22.89
Total	309	70	379	18.47

$\chi^2 = 1.380$ (1 d.f.) not significant

A higher proportion of female than male CGCM applicants were offered places, although this difference was not statistically significant.

In the case of medical applicants, greater numbers of females than males were offered places, both in terms of numbers of offers and proportions of applicants. These differences were not statistically significant.

In the case of applicants for Veterinary Medicine, although a greater number of females were offered places, a higher proportion of male applicants received offers. Again, these differences were not statistically significant.

² Overseas status refers to the location of the candidate's centre, not the candidate's fee status.

Table 8: Cross-tabulation of UK/Overseas status and outcome

MED	OUTCOME		Total	% Success
	Reject	Offer		
UK	778	249	1027	24.25
Overseas	160	17	177	9.60
Total	938	266	1204	22.09

$\chi^2 = 18.803$ (1 d.f.) Sig. 0.000

VET	OUTCOME		Total	% Success
	Reject	Offer		
UK	263	61	324	18.83
Overseas	21	1	22	4.55
Total	284	62	346	17.92

$\chi^2 = 2.857$ (1 d.f.) not significant

A significantly higher proportion of UK applicants for Medicine received offers than did Overseas applicants. Although a similar, pattern was observed in the case of Veterinary applicants, this difference was not statistically significant.

Table 9: Cross-tabulation of school sector and outcome (UK candidates only)

MED	OUTCOME		Total	% Success
	Reject	Offer		
Not independent	411	129	540	23.89
Independent	367	120	487	24.64
Total	778	249	1027	24.25

$\chi^2 = 0.079$ (1 d.f.) not significant

VET	OUTCOME		Total	% Success
	Reject	Offer		
Not independent	185	45	230	19.57
Independent	78	16	94	17.02
Total	263	61	324	18.83

$\chi^2 = 0.283$ (1 d.f.) not significant

Of those applying for Medicine, a marginally higher proportion (25%) of those from Independent schools received an offer of a place than did those from other types of UK schools (24%). This difference was not statistically significant.

In the case of applicants for Veterinary Medicine, a lower proportion of those from Independent schools received offers than did their counterparts from maintained schools. Again, this difference was not statistically significant.

Modelling selection outcomes

The above comparisons of the proportions of applicants from different backgrounds offered places fail to take into account the ability of the applicants (amongst many other relevant factors). The following analyses take BMAT performance into account, answering the question ‘are applicants from different backgrounds with equivalent BMAT scores equally likely to be accepted?’ by fitting logistic regression models.

The dependent variable is the (binary – accept or reject) selection outcome. The independent continuous variables are scores on Sections 1 and 2 of the BMAT. Gender, nationality and school sector form independent categorical variables.

Model 1: Gender (CGCM candidates only)

The model fitted was:

$$\log \text{ odds (accept)} = \alpha + \beta_1 (\text{sec 1}) + \beta_2 (\text{sec 2}) + \beta_3 (\text{male}) + \text{error}$$

CGCM

	B	S.E.	Wald	df	Sig.	Exp(B)
Section 1	.531	.354	2.247	1	.134	1.700
Section 2	.059	.375	.025	1	.874	1.061
MALE	-.979	.491	3.981	1	.046	.376
Constant	-4.186	1.535	7.441	1	.006	.015

n 147

Model 1 explores the effects of BMAT scores and gender on selection outcomes for CGCM applicants. The B parameters show the size and direction of each variable. The effect of each variable can be seen in the final column, which gives the exponent of the B parameter – in effect the odds of success.

For CGCM applicants overall, the effect of BMAT scores on the odds of success is small, and not statistically significant. However, when BMAT performance of males is taken into account, they have worse odds of being offered a place – only 0.38 of those of females with similar BMAT scores. It would appear that although male applicants for this course have higher mean scores than female applicants, this is not reflected in their odds of success.

Model 2: Nationality and gender

The model fitted was:

$$\log \text{ odds (accept)} = \alpha + \beta_1 (\text{sec 1}) + \beta_2 (\text{sec 2}) + \beta_3 (\text{male}) + \beta_4 (\text{UK}) + \text{error}$$

Model 2 considered the effects of BMAT scores, nationality and gender on the outcome of medical and veterinary applications. As would be hoped, both sections 1 and 2 of the BMAT have significant effects in respect of both medical and veterinary applications.

Model 2

MEDICAL

	B	S.E.	Wald	df	Sig.	Exp(B)
Section 1	1.623	.154	110.768	1	.000	5.068
Section 2	1.121	.136	67.738	1	.000	3.069
MALE	-.929	.181	26.217	1	.000	.395
UK	1.585	.331	22.927	1	.000	4.878
Constant	-16.991	1.111	233.994	1	.000	.000

n 1204

VETERINARY

	B	S.E.	Wald	df	Sig.	Exp(B)
Section 1	1.710	.319	28.766	1	.000	5.531
Section 2	.825	.300	7.545	1	.006	2.283
MALE	-.158	.387	.167	1	.683	.854
UK	1.237	1.157	1.143	1	.285	3.445
Constant	-16.048	2.255	50.662	1	.000	.000

n 346

For medical applicants, after allowing for performance on the BMAT, the effects of both gender and nationality were statistically significant. The odds of a UK medical applicant being offered a place were almost five times greater than those of a non-UK³ applicant, perhaps reflecting the competition between high quality non-EU overseas students for a limited number of places. When gender was considered, the odds of male medical applicants being offered a place were less than half (0.39) those of females with similar BMAT scores.

For veterinary applicants, gender effects were less strong, with males being only slightly less likely (0.85) to receive an offer than females with equivalent BMAT scores – an effect that was not statistically significant. The effect of nationality on veterinary applications was similar to that for Medicine, though less strong. UK veterinary applicants have odds of receiving an offer that are 3.4 times those of non-UK applicants with similar BMAT scores, although this effect is not statistically significant, given the small numbers of overseas applicants involved.

Model 3: School type and gender (UK candidates only, excluding mature candidates)

The model fitted was:

$$\log \text{ odds (accept)} = \alpha + \beta_1 (\text{sec 1}) + \beta_2 (\text{sec 2}) + \beta_3 (\text{male}) + \beta_4 (\text{UK non-indep}) + \text{error}$$

Model 3

MEDICAL

	B	S.E.	Wald	df	Sig.	Exp(B)
Section 1	1.589	.160	99.113	1	.000	4.897
Section 2	1.241	.150	68.176	1	.000	3.461
Male (1)	-.989	.192	26.630	1	.000	.372
non-independent (1)	.335	.182	3.400	1	.065	1.398
Constant	-16.022	1.098	213.094	1	.000	.000

n 1027

VETERINARY

	B	S.E.	Wald	df	Sig.	Exp(B)
Section 1	1.699	.324	27.448	1	.000	5.470
Section 2	.928	.314	8.719	1	.003	2.531
Male (1)	-.174	.392	.197	1	.657	.840
non-independent (1)	.392	.373	1.107	1	.293	1.480
Constant	-15.566	1.992	61.067	1	.000	.000

n 324

Model 3 was employed to consider the effects of BMAT scores, school type and gender on the outcome of both medical and veterinary applications – excluding mature candidates.

In this model too, effects relating to both sections of the BMAT were highly significant for medical and veterinary applications, with effects for gender similar to those estimated by model 2: with males' odds

³ Non-UK status refers to the location of the candidate's centre, not the candidate's fee status.

of receiving an offer being 0.37 (medicine) and 0.84 (veterinary) of those of females with equivalent BMAT scores.

The school-type effects are similar for both courses. For both medical and veterinary applications, candidates from non-independent schools appear to have slightly better odds of being offered a place than candidates from independent schools. Non-independent school applicants have odds of receiving an offer that are 1.40 (medicine) and 1.48 (veterinary) those of candidates from independent schools with similar BMAT scores. In each case, however, these differences are not statistically significant.

We must caution against over-interpretation of these results, because so many other factors that must influence selection outcomes (e.g. interviews, GCSE results, predicted A level grades, school reports etc.) have not been included in the models. These initial analyses will, however, provide better evidence than a simple comparison of the proportions of applicants who are successful.

Mark Shannon, 14.04.04