CAMBRIDGE ASSESSMENT

A report on the predictive validity of the BMAT (2005) for 1st year examination performance on the Medicine and Veterinary Medicine courses at the University of Cambridge

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Background and Summary

This report examines the relationship between BMAT 2005 scores and the subsequent 1st year examination results of students accepted onto the Medicine and Veterinary Medicine courses at the University of Cambridge. Examinations were taken in summer 2007. Pearson correlation coefficients and logistic regression plots are presented in support of the predictive validity of the test. Correlations with total examination marks are higher for Section 2 of the BMAT (Scientific Knowledge and Applications) than for Section 1 (Scientific Aptitude and Skills). Logistic regression plots also indicate a stronger predictive relationship for Section 2. Correlations and logistic regression functions appear particularly strong for the Veterinary Medicine students. In this cohort, BMAT scores clearly predict the probability of attaining the highest degree class and Section 2 scores additionally predict the probability of attaining a 3rd class outcome or below.

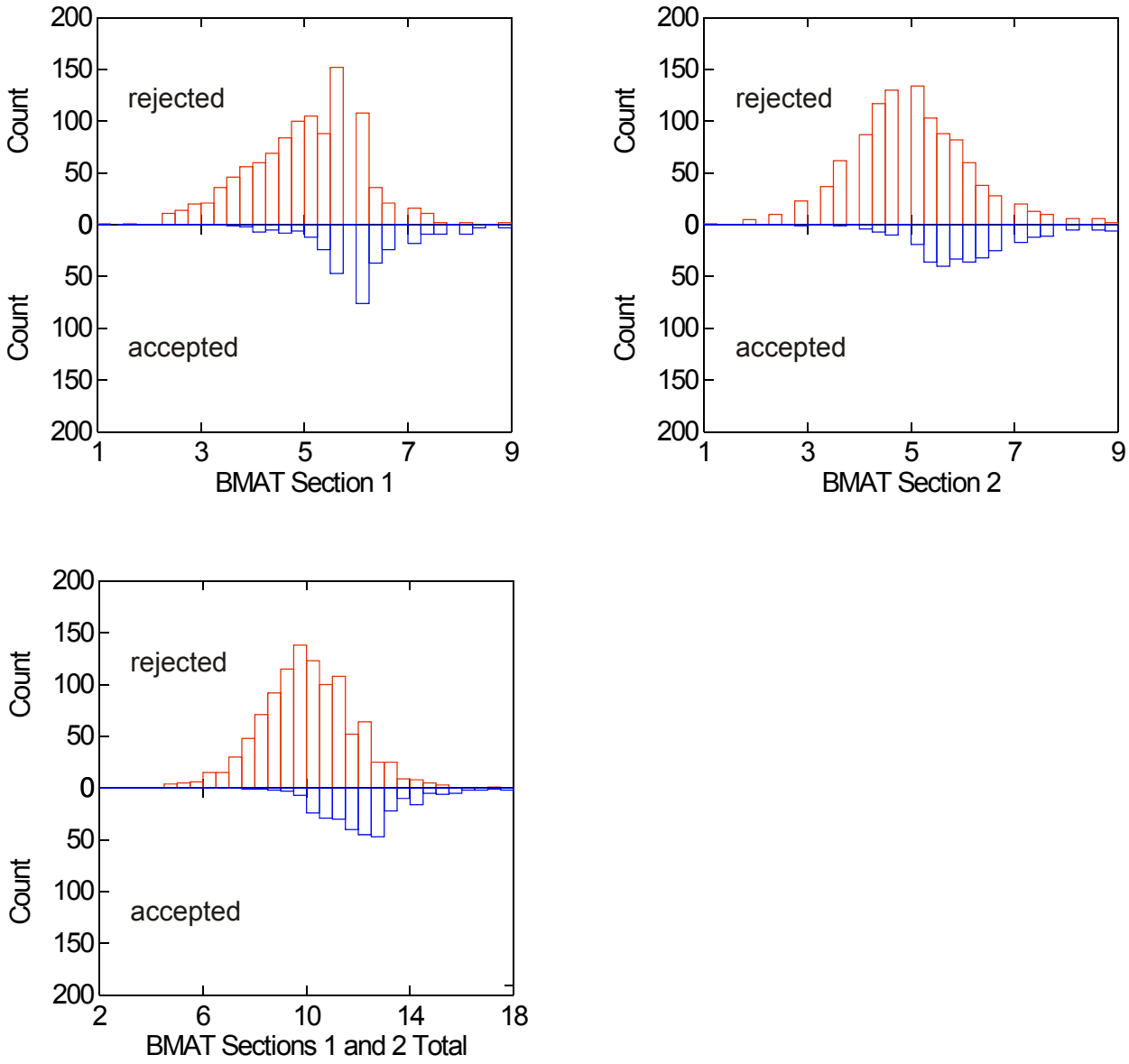
BMAT Score Distributions of Rejected and Accepted Candidates

The BMAT 2005 was taken by 1744 applicants to the University of Cambridge. Of these, 1364 applied to course A100 (Medicine) and 380 applied to course D100 (Veterinary Medicine). Numbers of candidates accepted onto the courses were 300 for Medicine and 103 for Veterinary Medicine. Figure 1 shows the BMAT scores of the rejected and accepted candidates. For details of the BMAT, please refer to the website www.bmat.org.uk

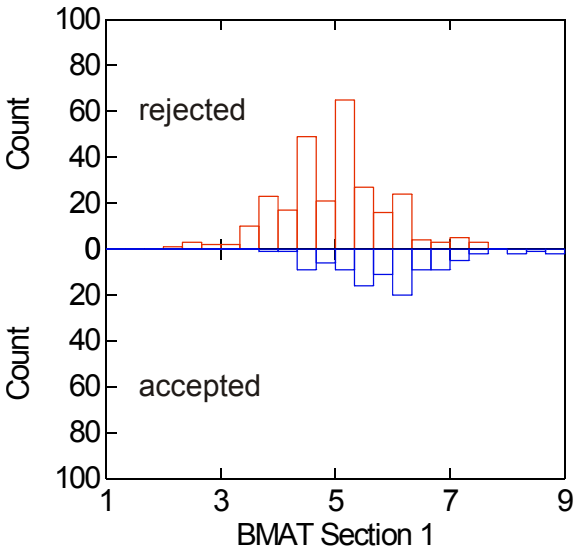
Scores for Sections 1 and 2 of the BMAT are reported on a Rasch-calibrated scale of 1 to 9 with a mean of around 5. It can be seen that there is a considerable overlap of scores between accepted and rejected candidates (particularly in the vets) but the accepted candidates have a higher mean and a narrower range of test scores. Some candidates are admitted with relatively low scores on the BMAT each year due to the compensatory nature of the selection process, which is a mixture of quantitative and qualitative information including interview performance. Despite being only one component of the selection process, those with very low BMAT scores clearly have a low probability of being accepted following interview (the University of Cambridge does not apply any cut scores to the test and currently interview all suitably-qualified candidates).

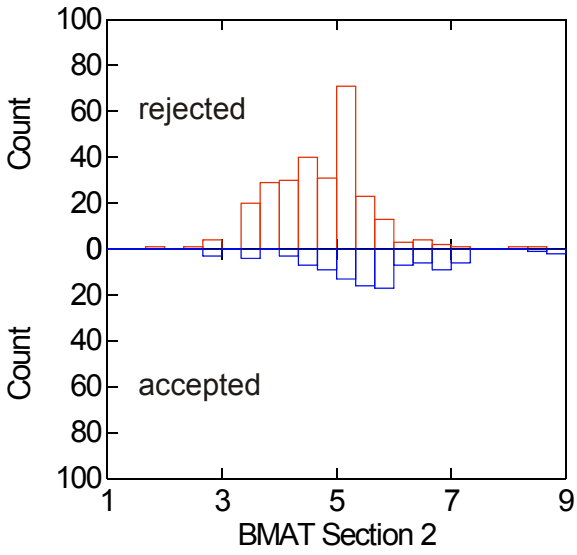
Figure 1: BMAT Score Distributions of Rejected and Accepted Candidates

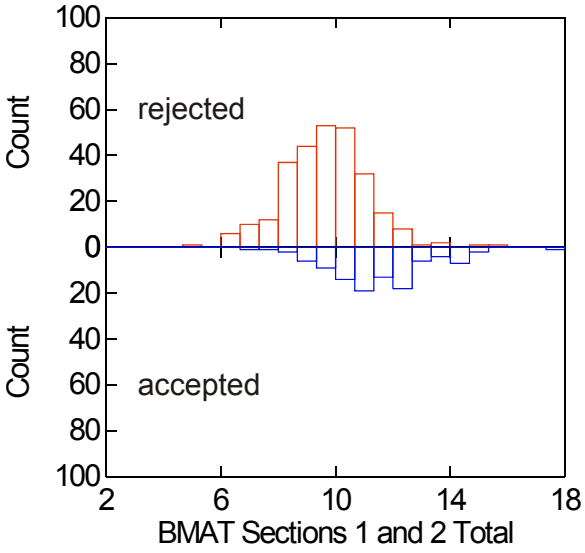
a) Medicine



b) Veterinary Medicine







The narrower range of scores in the accepted candidates is a problem for correlational analysis as it tends to restrict the magnitude of the coefficients. There are corrective formulae for range-restriction (Sackett and Yang, 2000) but these are only appropriate in particular circumstances and should not be routinely applied when the selection process is complex. Thus simple, uncorrected coefficients are presented throughout this report and these may be underestimates of the true strength of the predictive relationships. Table 1 gives guidelines to interpreting uncorrected predictive validity coefficients.

Table 1: Guidelines for interpreting correlation coefficients in predictive validity studies

Validity Coefficient	Interpretation
Above 0.35	very beneficial
0.21 to 0.35	likely to be useful
0.11 to 0.20	depends on circumstances
Below 0.11	unlikely to be useful

Source: US Department of Labor, Employment Training and Administration, 1999

Methods

First year examination data from 2007 were supplied by the University of Cambridge and matched by name to students' BMAT results from 2005. Matches were made for 247 medics and 66 vets. Data were anonymised after matching. The Medical and Veterinary Sciences Tripos (MVST) examinations consist of four components. 'Homeostasis' (HOM) and 'Molecules in Medical Science' (MIMS) are common to both medical and veterinary students. Veterinary students additionally study 'Veterinary Anatomy and Physiology' (VAP) whilst medical students study 'Functional Architecture of the Body' (FAB). Marks for the components are combined into an overall total mark and a classification (Class I, II, III or fail).

Pearson correlations were calculated between BMAT scores (Section 1: Aptitude and Skills, Section 2: Scientific Knowledge and Applications) and examination marks. Logistic regression analyses were carried out on the overall exam classifications. Scores for Section 3 of the BMAT were not analysed: the University of Cambridge uses the essay section to promote discussion during interviews and places little emphasis on these scores when making admissions decisions. Hypotheses were one-tailed as positive correlations were expected.

Results

Table 2: Pearson Correlation Coefficients between BMAT 2005 Scores and 1st Year Examination performance

		Medics and Vets Together		
		Section 1	Section 2	Sections 1 and 2
HOM	**Coefficient**	**0.140**	**0.299**	**0.270**
	Sig. (1-tailed)	0.007	<0.001	<0.001
	N	313	313	313
MIMS	**Coefficient**	**0.150**	**0.315**	**0.285**
	Sig. (1-tailed)	0.004	<0.001	<0.001
	N	313	313	313
total mark	**Coefficient**	**0.168**	**0.338**	**0.310**
	Sig. (1-tailed)	0.001	<0.001	<0.001
	N	313	313	313

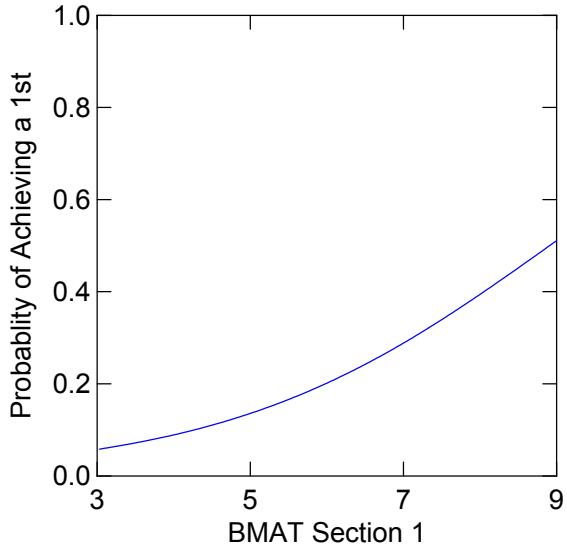
		Medics Only		
		Section 1	Section 2	Sections 1 and 2
HOM	**Coefficient**	**0.097**	**0.267**	**0.224**
	Sig. (1-tailed)	0.065	<0.001	<0.001
	N	247	247	247
MIMS	**Coefficient**	**0.135**	**0.265**	**0.245**
	Sig. (1-tailed)	0.017	<0.001	<0.001
	N	247	247	247
FAB	**Coefficient**	**0.139**	**0.279**	**0.255**
	Sig. (1-tailed)	0.015	<0.001	<0.001
	N	247	247	247
total mark	**Coefficient**	**0.145**	**0.303**	**0.274**
	Sig. (1-tailed)	0.011	<0.001	<0.001
	N	247	247	247

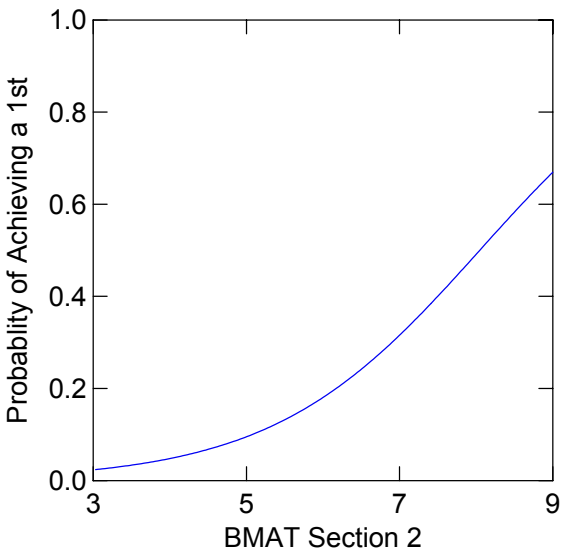
		Vets Only		
		Section 1	Section 2	Sections 1 and 2
HOM	**Coefficient**	**0.277**	**0.368**	**0.396**
	Sig. (1-tailed)	0.012	0.001	0.001
	N	66	66	66
MIMS	**Coefficient**	**0.180**	**0.446**	**0.391**
	Sig. (1-tailed)	0.074	<0.001	0.001
	N	66	66	66
VAP	**Coefficient**	**0.193**	**0.387**	**0.360**
	Sig. (1-tailed)	0.060	0.001	0.001
	N	66	66	66
total mark	**Coefficient**	**0.239**	**0.441**	**0.421**
	Sig. (1-tailed)	0.027	<0.001	<0.001
	N	66	66	66

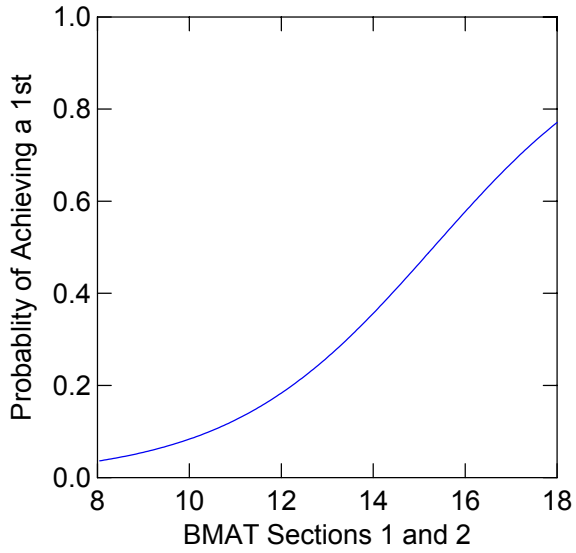
Correlations with Section 2 of the BMAT appear stronger than those for Section 1 in both groups of students. The coefficients are particularly strong for the Veterinary Medicine students and this could be due, in part, to the difference in range restriction between the two groups. The strength of correlations tends to differ between successive cohorts at the same institution and care should always be taken in citing a single number as a test's validity coefficient.

Figure 2: Logistic Regression Plots showing the Probability of Achieving a 1st Class Examination Outcome as a Function of BMAT Scores

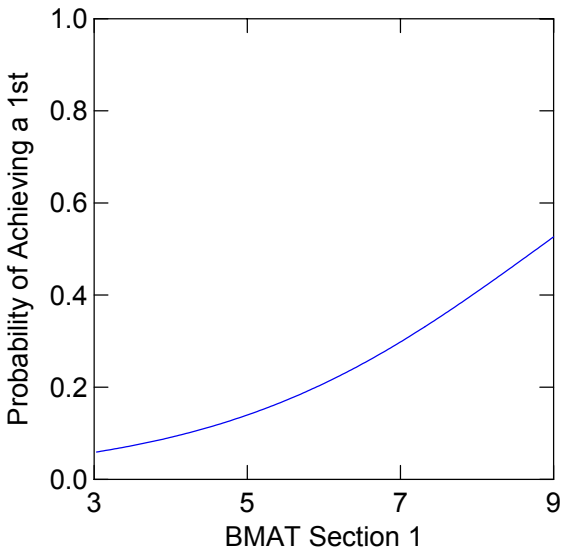
a) Medics and Vets Together

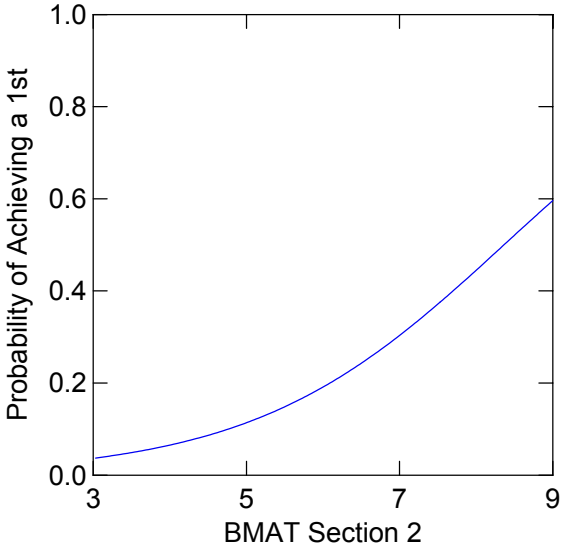


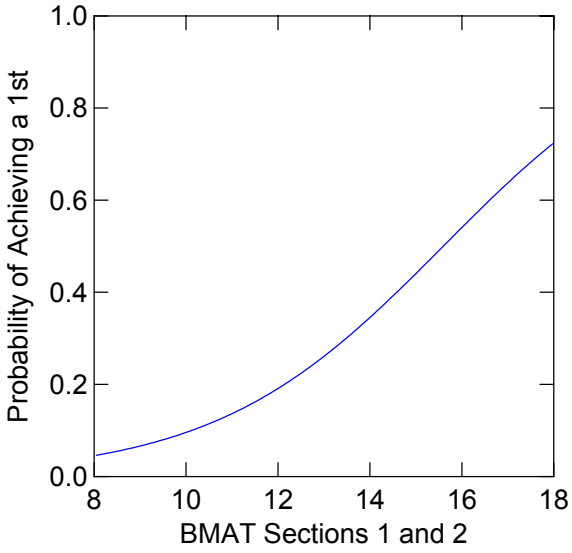




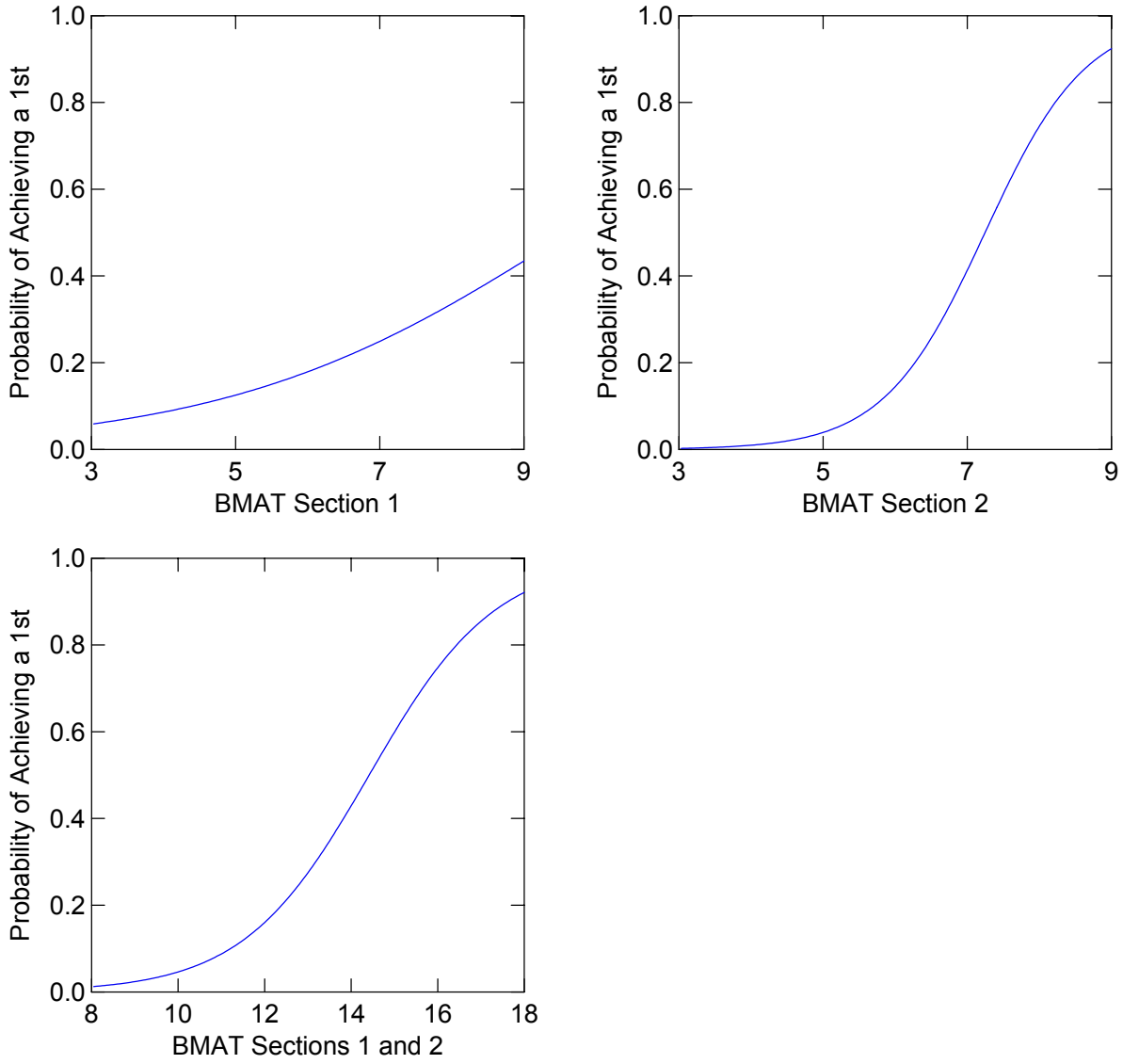
b) Medics Only







c) Vets Only

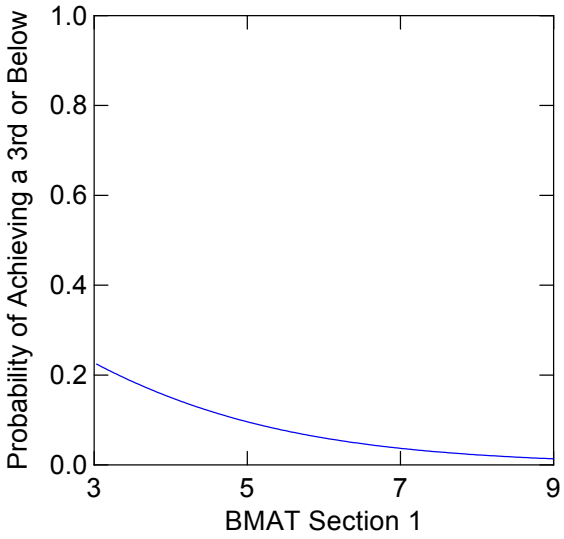


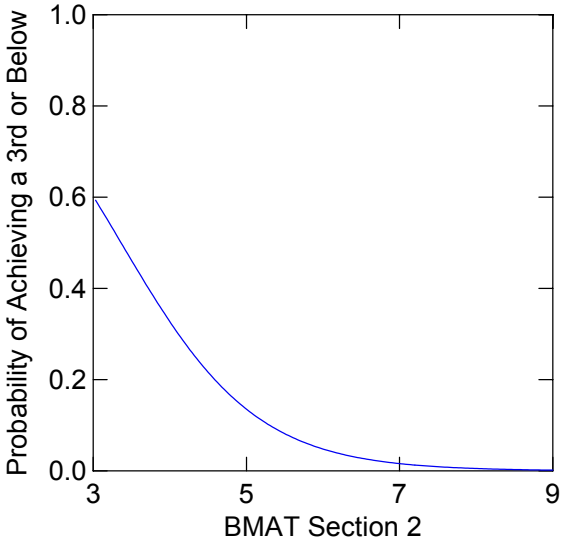
Logistic regression shows the probability of belonging to a particular group or achieving a discrete outcome (here a 1st Class examination outcome) as a function of predictor variables. Logistic regression may be a more suitable technique for assessing predictive validity because it does not make the data assumptions (i.e. linearity and normality) of correlation. Unlike ordinary regression, the magnitude of the relationship is directly implied by the vertical steepness of the curve (a flat, horizontal function implies that no predictive relationship is present).

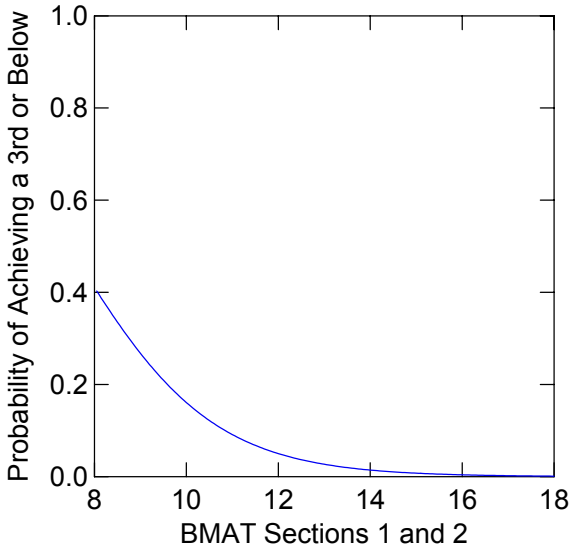
The plots in Figure 2 suggest that BMAT scores make a considerable difference to the probability of achieving an excellent examination outcome for both groups of students in this cohort. It should be noted that the x-axes cover the actual ranges of scores obtained by the accepted candidates, although very few candidates score at the very top end of the range. Again, the predictive relationship of Section 2 appears the stronger. An increase in Section 2 scores makes the greater difference to the probability of success but this is more apparent for the vets than for the medics.

Figure 3: Logistic Regression Plots showing the Probability of Achieving a 3rd Class Examination Outcome (or below) as a Function of BMAT Scores

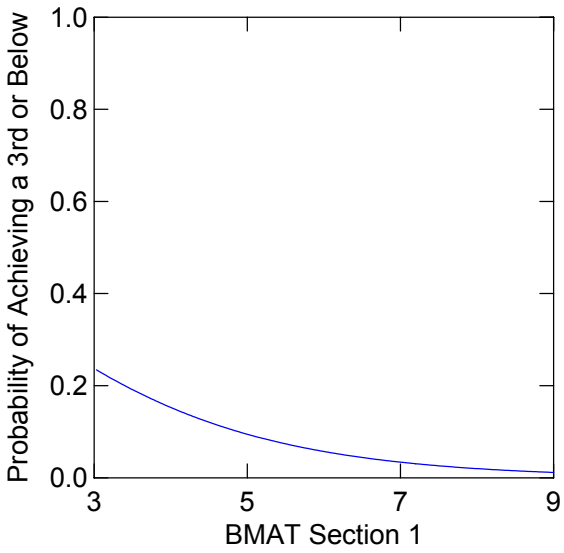
a) Medics and Vets Together

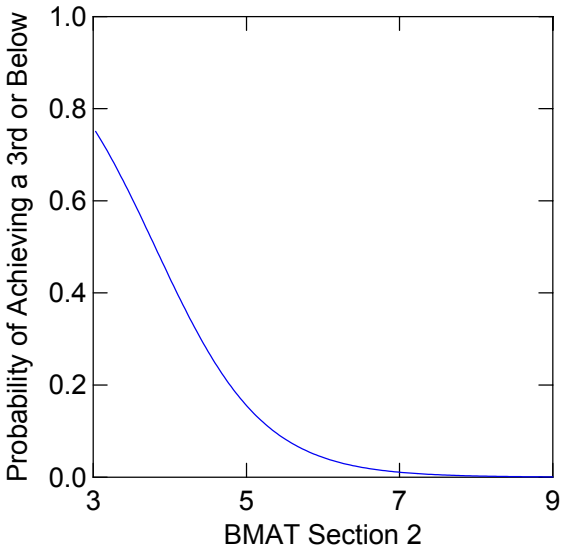


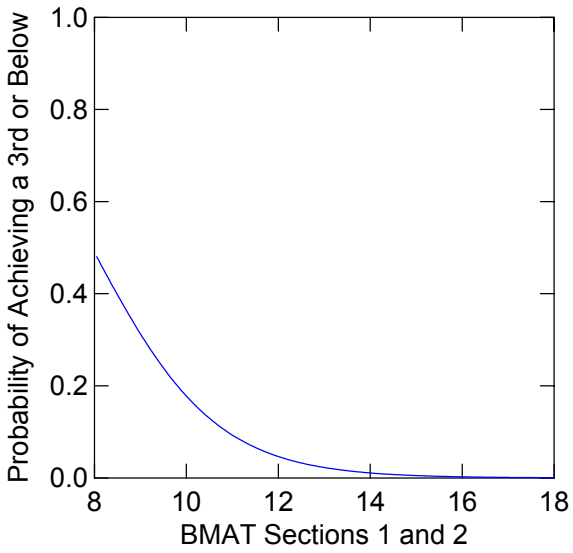




b) Medics Only







The plots in Figure 3 suggest that Section 2 BMAT scores strongly predict the probability of achieving a poor examination outcome in this group of medical students despite the notion that poor examination performance is often for reasons of a non-academic nature. This analysis was not possible for the veterinary students due to small numbers.

Conclusions

Results suggest that the BMAT predicts 1st year examination performance in this particular cohort. The strength of the predictive relationships is hindered by the compensatory nature of the selection process (low BMAT scorers who are admitted

onto the courses are likely to have excelled in some other way that compensated for this, making them atypical of low scorers in general) and by any unreliability in examination marking (e.g. for subjectively-marked questions). A discussion of the problems of evaluating the predictive validity of selection tests can be found in Bell (2007). Nonetheless, correlations with Section 2 of the test are particularly impressive and the BMAT clearly predicts the chances of obtaining an excellent examination outcome in both the Medicine and the Veterinary Medicine students in this cohort.

References

Bell, J F. (2007) Difficulties in evaluating the predictive validity of selection tests. *Research Matters: A Cambridge Assessment Publication*, **3**:5-10.

Sackett PR, Yang H. (2000) Correction for range restriction: an expanded typology. *Journal of Applied Psychology*, **85**:112-8.

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Acknowledgements

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