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Original Article

Barriers to Achieving Passing BioMedical Admissions Test Scores for Medical and Dental School Admission in Thailand

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Abstract

Background: The BioMedical Admissions Test (BMAT), developed and validated under the UK curriculum, is utilized by many medical and dental schools worldwide for applicant selection. No studies have investigated the fairness of the BMAT in countries with non-UK curricula and limited English usage.

Objectives: To determine the effects of the barriers and compare the disparities in the prevalence between candidates in the Bangkok Metropolitan Region (BMR) and other provinces.

Methods: This study was cross-sectional and quantitative, using contingency tables and nonparametric tests, retrospectively analyzing secondary data from the survey conducted by the RAdiator, a free online education platform targeted at university admission preparation.

Results: From 108 participants with available score data, the presence of BMAT barriers was associated with lower odds of passing the BMAT requirement satisfactory by most medical schools in Thailand and was significantly more prevalent in non-BMR group. The language barrier was the biggest impeding factor to passing the requirement (OR [95% CI], 0.236 [0.103-0.539]; $P < .001$) and the most pronounced difference in prevalence between BMR and non-BMR groups (OR [95% CI], 2.423 [1.277-4.596]; $P = .009$). About 82% of the participants used the RAdiator, limiting the samples to those using free unofficial BMAT resources to alleviate the barriers.

Conclusions: There were BMAT barriers for medical and dental admissions which were more prevalent outside the BMR. English proficiency was the core skill to achieve satisfactory BMAT scores. Admission criteria should be adjusted to align with the context, faculty's values, and learning outcomes.

Keywords: Medical school admission, Dental school admission, BMAT

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Introduction

The medical school admission process plays a pivotal role in the selection of candidates with the potential for success as medical students and physicians.[1] Beyond that, it provides an opportunity to matriculate under-represented groups, fostering equity and enabling individuals from diverse backgrounds to pursue higher education regardless of their socioeconomic status, thereby shaping a healthcare workforce that represents the societal spectrum to provide the best care.[2-4]

The BioMedical Admissions Test (BMAT), administered by Cambridge Assessment Admissions Testing, aimed to assist universities worldwide in selecting candidates for medical, dental, biomedical, and veterinary programs in conjunction with other benchmarks.[5] The BMAT consists of 3 Sections.

Section 1 evaluated problem-solving and critical-thinking abilities, requiring candidates to solve problems using simple numerical operations and perform logical reasoning and critical analysis. Section 2 tested core scientific and mathematical knowledge covered in General Certificate of Secondary Educational (GCSE) and International General Certificate of Secondary Educational (IGCSE) by age 16. The BMAT scores, particularly Section 2, were a robust predictor of early performance in medical courses.[6] Section 3 focused on writing, assessing the ability to express ideas coherently and effectively in concise, compelling, and correct English. This Section also evaluated resourcefulness in general knowledge and was scored on the Quality of Content (QoC) from 0 to 5 and Quality of English (QoE) from E, being the least, to A.[7]

However, multifaceted challenges impeded the BMAT from being utilized to its maximum potential. McElwee et al[8] acknowledged the aspiration of the BMAT for inclusivity to international candidates while highlighting hurdles stemming from dissimilar curricula, particularly in Section 2, where familiarity with GCSE and IGCSE content was crucial. Moreover, candidates with English as a second language might face language barriers and linguistic complexity, exacerbating the difficulties in deciphering the test questions, resulting in increased cognitive load and artificially heightened item difficulty. Waluyo's study[9] revealed the majority of Thai high school graduates only attained the English proficiency level of junior high school students. The combination of these obstacles may hinder their test performance, necessitating additional preparation, and demanding more time and financial investment, and possibly affecting their prospect of securing medical and dental school admission. Moreover, it might discourage them from applying to universities requiring the BMAT.

While the Cambridge Assessment Admissions Testing provided free BMAT preparation resources, several tutoring institutes in Thailand offered onsite and online BMAT tutorials and mock exams.[10-17] Full course prices ranged from about ฿30 000 (US $940)[10] to ฿42 000 (US $1300).[11] Some accepted hourly fees of about ฿1000 (US $31)[13] to ฿1550 (US $48).[10] For context, the gross national income (GNI) per capita of Thailand in 2020 was ฿220 800 (US $6900),[18] meaning that a complete BMAT course could cost up to 19% of an average Thai's annual income. Bangkok Metropolitan Region (BMR) has been a cluster of relatively high socioeconomic conditions.[19] Most of these institutes were in Bangkok, which might pose additional geographical barriers to non-BMR participants. We hypothesize that participants from the BMR may have advantages in achieving passing BMAT scores.

In addition to language, financial, and geographical barriers discussed above, information barriers such as the lack of awareness of the test specifications and available preparatory resources may affect the BMAT scores. Time constraints, such as scheduling conflicts for some Thai students due to the need to prepare for multiple university entrance exams, may exacerbate the issue. Hence, 5 types of barriers were investigated in this study: financial, geographical, language, information barriers, and time constraints.

This study aimed to objectify the impact of the barriers affecting the preparation of the BMAT on the scores and the odds of passing the satisfactory BMAT score requirement of their desired faculties and compare the disparities in the prevalence of barriers between candidates in the BMR and non-BMR in Thailand.

Methods

Study Design

This study was convenience-sampled, cross-sectional, and quantitative, aimed to determine the effect of each type of barrier on the participants' odds of passing the BMAT scores requirement and compare the disparities in the prevalence of barriers to BMAT preparation between participants in the BMR and other provinces using contingency tables and nonparametric statistics.

Setting

In Thailand, the Thai University Central Admission System (TCAS), the centralized higher education admission process, consists of 5 rounds. Candidates could apply in multiple rounds and progress to subsequent rounds if they reject the offer or were not selected by any university.[20] Each round employed different criteria, reflecting varied skill sets preferred by the faculties and institutes. The TCAS round 1 for medical and dental schools, the focus of our study, typically centered on portfolios and BMAT scores. The process typically involved submitting a portfolio detailing accomplishments, BMAT scores, and other relevant achievements. Subsequently, selected candidates proceeded to interviews for final admission. The candidates may apply for medical and dental schools via other rounds with different requirements, though some programs, for example, the Ramathibodi MD-MEng and MD-MM dual degrees, were exclusively available through round 1.[21]

According to the information provided by the Cambridge Assessment Admissions Testing[22] and the number of total medical[23] and dental schools[24] in Thailand, 12 out of 21 medical schools and 7 out of 16 dental schools incorporated the BMAT into their admission criteria.

Data Collection

The study utilized the secondary data collected in a survey by the RAdiator[25], an online learning platform focusing on preparation for medical school admission in Thailand. The survey was deployed via Google Forms by convenience sampling and advertised on the RAdiator Instagram page from 27 November 2021 to 11 February 2022. The participants completed the survey anonymously and voluntarily without compensation.

The survey questionnaire was developed by the investigators and the RAdiator team (Supplementary S1). Then, it was validated among the team and consulted with a health system researcher and a medical education researcher. The content consisted of the participant characteristics, such as level of education and the province that they presently live in, the self-assessment of whether they faced the barriers to BMAT preparation, and optionally their 2021 BMAT scores in each Section.

The inclusion criteria were participants in middle school, Grade 10, Grade 11, Grade 12, and those retaking admission. The included participants must be interested in applying to medical or dental school and require the BMAT scores for the admission process. The raw data from the RAdiator contained 284 entries. After exclusively including the parameters relevant to this study, cleaning incorrect entries, and excluding the participants who did not intend to register for the TCAS round 1 or use the BMAT scores, we were left with 204 entries, 108 of which included their 2021 BMAT scores.

Data Analysis

The participants were categorized into 2 groups: the BMR and non-BMR (other provinces of Thailand). The BMR encompasses Bangkok and the surrounding provinces (Nakhon Pathom, Nonthaburi, Pathum Thani, Samut Prakan, and Samut Sakhon).

Section 3 QoE scores were converted from alphabetical to ordinal with A corresponding to 5. The total score was calculated as the sum of Section 1, 2, and 3 QoC scores, excluding the Section 3 QoE score. The minimum BMAT score requirement set by each faculty varied. Some required a minimum of 8.0 for Sections 1 and 2 combined,[26] some required 5.0 in both Sections 1 and 2 and a minimum of B in Section 3 QoE,[27] some required 12.0 across 3 sections and a minimum of C in Section 3 QoE,[21, 28] and some selected applicants with the highest scores.[29] Therefore, we deemed the total BMAT scores of at least 12.0 and the Section 3 QoE of C satisfactory for most medical schools and defined as a pass.

Descriptive statistics, contingency tables, and nonparametric tests were performed using JASP software (JASP, Version 0.18.1. Amsterdam, NL: University of Amsterdam; 2023). A *P* value of less than .05 was considered statistically significant.

Results

Participant Demographics

Of the 204 participants in this study, 114 participants (55.9%) were from the BMR, and 90 (44.1%) were from non-BMR. Together, they added up to 49 unique provinces out of 77 provinces in Thailand. The majority of participants were grade 11 students (51%) (Table 1).

How the Barriers Affect the Participant's Chance of Passing

The language barrier had the most detrimental impact on the participants' chance of passing the minimum BMAT scores requirement (OR [95% CI], 0.236 [0.103-0.539], $P < .001$). The geographical barrier (OR [95% CI], 0.317 [0.142-0.711], $P = .006$) and time constraints (OR [95% CI], 0.361 [0.149-0.873], $P < .026$) also demonstrated such an effect, but to a lesser extent (Table 2).

BMAT Barriers in the Non-BMR vs BMR Group

Overall, 92.6% of participants experienced at least one type of barrier, accounting for 97.8% of non-BMR and 88.6% of BMR participants (Supplementary S2). The occurrences of each type of barrier in preparing for the BMAT showed intercorrelation between all types of barriers (Supplementary S3). Non-BMR group had higher odds of facing geographical barriers (OR [95% CI], 2.031 [1.143-3.608], $P = .009$), and having at least one type of barrier (OR [95% CI], 5.663 [1.244-25.788], $P = .014$) (Table 3).

Participants in the non-BMR group demonstrated lower odds of passing the minimum BMAT scores requirement than the BMR group (OR [95% CI], 0.400 [0.175-0.913], $P = .030$) (Supplementary S4).

Table 1. Demographic Data of Participants

Variable	No. (%)			*P* Value
	Non-BMR (n = 90)	BMR (n = 114)	Total (N = 204)	
Education level				
Middle school	0	7 (3.4)	7 (3.4)	.030
Grade 10	15 (7.4)	17 (8.3)	32 (15.7)	
Grade 11	54 (26.5)	50 (24.5)	104 (51.0)	
Grade 12	20 (9.8)	37 (18.1)	57 (28.0)	
Retaking admission	1 (0.5)	3 (1.5)	4 (2.0)	
Most desired faculty				
Doctor of Medicine	85 (41.7)	109 (53.4)	194 (95.1)	.701
Doctor of Dental Medicine	5 (2.5)	5 (2.5)	10 (4.9)	

Abbreviation: BMR, Bangkok Metropolitan Region.

Table 2. Odds Ratio of Passing the Minimum BioMedical Admissions Test Scores Requirement With Each Type of Barrier

Barrier		OR (95% CI)	*P* Value
Financial	Odds ratio	0.762 (0.346-1.680)	.547
	Fisher exact test	0.764 (0.322-1.817)	
Geographical	Odds ratio	0.317 (0.142-0.711)	.006
	Fisher exact test	0.321 (0.131-0.764)	
Time	Odds ratio	0.361 (0.149-0.873)	.026
	Fisher exact test	0.365 (0.135-0.956)	
Language	Odds ratio	0.236 (0.103-0.539)	< .001
	Fisher exact test	0.239 (0.095-0.583)	
Information	Odds ratio	0.694 (0.298-1.617)	.513
	Fisher exact test	0.696 (0.275-1.776)	
At least one	Odds ratio	0.274 (0.077-0.977)	.057
	Fisher exact test	0.278 (0.057-1.127)	

Table 3. Odds Ratio of Barriers Experienced

Barrier		OR (95% CI)	*P* Value
Financial	Odds ratio	1.476 (0.828-2.631)	.193
	Fisher exact test	1.473 (0.797-2.750)	
Geographical	Odds ratio	2.031 (1.143-3.608)	.016
	Fisher exact test	2.024 (1.101-3.768)	
Time	Odds ratio	1.494 (0.771-2.894)	.252
	Fisher exact test	1.491 (0.737-3.086)	
Language	Odds ratio	2.423 (1.277-4.596)	.009
	Fisher exact test	2.412 (1.226-4.892)	
Information	Odds ratio	1.137 (0.608-2.125)	.752
	Fisher exact test	1.136 (0.582-2.241)	
At least one	Odds ratio	5.663 (1.244-25.788)	.014
	Fisher exact test	5.625 (1.222-52.682)	

Discussion

Non-BMR participants had higher odds of facing at least one type of barrier. The interpretation of the prevalence of the barriers demands caution since participants without the barriers could enroll in universities via other TCAS rounds that do not use the BMAT scores. Thus, we cannot extrapolate the prevalence of barriers findings in Thai students who do not use BMAT scores. The small sample size in this study was also a limitation.

While all types of barriers were intercorrelated, some affected the score outcomes more than others. Language barriers were associated with lower scores across all sections, leading to lower total scores and odds of meeting the minimum BMAT score requirement satisfied by most medical and dental schools in Thailand. Geographical and financial barriers were also associated with lower Section 1 scores, lower total scores, and lower odds of passing the minimum BMAT scores requirement, though to a smaller extent than language barriers. Hence, non-BMR participants generally achieved lower scores in all sections and were unsurprisingly less likely to achieve satisfactory BMAT scores. Regardless, only the language barrier was a good predictor of BMAT scores in all sections (Table 2 and Supplementary S5).

Additionally, we found that the Section 2 score was not as affected by geographical and language barriers as the other sections (Supplementary S5). We speculated it was because the content in Section 2, scientific and mathematic knowledge, was adequately taught in the Thai Basic Education curriculum; thus, it was less influenced by geographical barriers. The nature of Section 2 might demand relatively less English proficiency to interpret the questions compared to critical thinking and problem-solving in Section 1 and did not require the candidates to write as in Section 3, so language barriers had a weaker effect.

Many elements of the BMAT implied English proficiency as a core skill. Because of the time constraints of the BMAT session, the test takers were expected to comprehend

the test question quickly. This point was well addressed by McElwee et al.[8] Furthermore, Section 3: writing task required considerable English proficiency to generate logically compelling arguments with a sufficient quality of English as explicitly stated in the BMAT specification.[7]

The finding that participants from lower socioeconomic areas, like non-BMR, performed less well was in line with previous literature on the BMAT by Lenkeit et al[30] and the University Clinical Aptitude Test (UCAT) by Griffin et al[31] but not on the BMAT by McElwee et al.[8] The effect of geographical barriers on lower scores was similarly reported in Griffin's[31] work. Lenkeit et al[30] reported early BMAT preparation related to better test performance, which explained the effect of time constraints demonstrated in our study. Financial barriers were correlated with lower scores in Section 1 and the total scores. Nevertheless, they did not impact the participants' odds of passing the score required by most medical and dental schools.

Non-BMR candidates' perception of having less English proficiency could be partly attributed to fewer international schools in non-BMR. The number of international schools was 70 (37%), 1.39 schools per 10 000 square kilometers, 1.18 schools per million population outside the BMR vs 119 (63%), 153.32 schools per 10 000 square kilometer, 10.75 schools per million population in the BMR,[32-35] potentially illustrated the interplay between geographical and language barriers..

By reviewing BMAT tutoring institutions with information available on their websites, we found that most were situated in Bangkok,[10-13,15] with one based in Chiang Mai.[17] We speculated that fewer BMAT institutes in non-BMR contributed to lower scores, as not being coached was correlated with lower scores in the Undergraduate Medical and Health Sciences Admissions Test (UMAT 3) but not the UCAT.[31]

Access to higher education should be equitable to individuals across all socioeconomic backgrounds and financial status.[36] In the healthcare context, an equitable medical school admission is the first step to health equity because of better patient-doctor communication from the same background and linguistics, leading to better adherence and greater patient satisfaction.[37] Furthermore, a study showed that contact with diverse peers significantly improves the educational experience for medical students.[4] However, the results underlined equity concerns about using the BMAT for admission as it presented several barriers within the context of Thailand, especially in programs that only accepted students with BMAT scores.[21] The BMAT scores may not solely reflect a candidate's potential performance in medical and dental school but also reflect the ability to overcome language barriers. Nevertheless, the BMAT may be suitable for faculties demanding English competency.

Policy Implication

In addition to problem-solving, critical thinking, scientific, and writing skills, the BMAT implied an emphasis on English proficiency. Most admission criteria incorporate an English proficiency test such as the International English Language Testing System (IELTS) and Test of English as a Foreign Language (TOEFL).[21, 26-29] This means, instead of only passing the minimum English proficiency test score requirement, the candidates are ranked on the English proficiency because it is the main contributor of the BMAT score. This may emphasize English proficiency more than expected. Hence, the faculty should investigate the core skills assessed by the test and adjust the admission criteria to match

the faculty values and program-level learning outcomes. For example, if English proficiency is deemed less crucial, the faculty could lower the minimum passing scores for the BMAT Section 3, where the English proficiency requirement was the most evident.

The faculty should aim to improve the diversity of student backgrounds.[2-4] However, the BMAT subjected the non-BMR subgroup to a matriculation disadvantage because the scores were partly influenced by geographical and language barriers, which were more prevalent in non-BMR candidates. Hence, the faculty should appraise other criteria to select applicants, such as the nine characteristics of candidates that predict success in the program, which were ethical responsibility to self and others, reliability and dependability, service orientation, social skills, capacity for improvement, resilience and adaptability, cultural competence, oral communication, and teamwork.[38] Developing additional standardized examinations that evaluate problem solving, critical thinking, scientific and mathematics, and writing skills with less emphasis on English competencies are recommended.

We suggest that future studies incorporate cohort studies or qualitative methods to examine the underlying mechanisms and enable the establishment of causation. Participant performance in medical and dental school should be monitored to evaluate the predictive validity of the test in middle-income countries that have limited English usage and to determine whether the differences in BMAT scores stem from the bias within the test or from structural discrimination, as demonstrated by the Medical College Admission Test (MCAT) in the US.[39] To further enhance the scope of this study, the samples should be extended to other groups (eg, those using paid services and those not using additional resources) to allow generalization of the result interpretation. Because 82.4% of the participants in this study applied learning resources from the RAdiator, a free online education platform, it potentially limited the sample to those using free unofficial BMAT resources to alleviate the barriers they were facing.

Conclusions

Education barriers regarding BMAT preparation were disproportionately present in non-BMR candidates and were associated with low BMAT scores. Not having an English language barrier was the most robust predictor of BMAT scores. Universities utilizing the BMAT scores in the admission process should acknowledge English proficiency as the core skill to achieve satisfactory BMAT scores. Admission criteria should be adjusted according to the context, faculty values, and learning outcomes.

Additional Information

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Supplementary Material: Download Supplementary S1-S5 from the following link: https://he02.tci-thaijo.org/index.php/ramajournal/article/view/272773/186573

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