ORIGINAL ARTICLE
Volume 15 Issue 2 2023
DOI: 10.21315/eimj2023.15.2.6
ARTICLE INFO
Received: 09-02-2022
Accepted: 05-11-2022
Online: 30-06-2023

Academic Performance of Preclinical Medical Students in Association with Gender, Ethnicity and Entry Qualification

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To cite this article: Mohamad Zainal NH, Lang DM, Shahbudin SN, Vimalanathan P, Mohd Nor NH. Academic performance of preclinical medical students in association with gender, ethnicity and entry qualification. Education in Medicine Journal. 2023;15(2):71–85. https://doi.org/10.21315/eimj2023.15.2.6

To link to this article: https://doi.org/10.21315/eimj2023.15.2.6

ABSTRACT

Various qualifications are accepted as the entry requirement into the Medical School of Universiti Putra Malaysia (UPM) including Sijil Tinggi Persekolahan Malaysia (STPM), matriculation and Asasi Sains Pertanian (ASPER). We aim to determine the relationship between academic performance of preclinical medical students with sociodemographic factors of gender, ethnicity and entry qualification. A retrospective cohort study was conducted using secondary data from the Deputy Dean's Office (Academic of Medicine) of the Medical School of UPM. Information was obtained on three cohorts of preclinical medical students (n = 308), which includes gender, ethnicity, entry qualification and examination results of Packages 1 to 9 and the Professional Examination I. Their identities and year of enrolment were kept anonymous. Data were analysed using IBM Statistical Package for the Social Science (SPSS) v26.0 using chi-square or Fisher's exact test (significant if $p < 0.05$). No significant association was seen between gender and the academic performances of the preclinical medical students. The Chinese ethnic group had a significant association with good academic performance, whereas the Malay ethnic group had an association with poor academic performance. There were significant associations between STPM intake and good academic performance for Cohort 1 in Package 1 (p = 0.007); 2 ($p < 0.001$); 5 (p = 0.007); 6 (p = 0.012); 7 (p = 0.006); 8 (p = 0.002) and for Cohort 2 in Package 1 (p = 0.049), 6 (p = 0.031) and 9 (p = 0.049) but no significant association for Cohort 3. In conclusion, academic performance is significantly associated with Chinese and Malay ethnicity. Furthermore, STPM graduates outperformed students from other entry qualifications in the Medical School of UPM.

Keywords: *Academic performance, Preclinical medical students, Entry qualification, Sociodemographic factors*

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INTRODUCTION

There are various categories of requirements for admission into medical schools in Malaysia; however, the selection of students is still predominantly based on academic performance. The basis for using such selection is that the effectiveness of completing a complex task correlates to the mental ability or intelligence quotient (IQ) of a person (1). The medical profession is a laborious endeavour that requires a lifetime of devotion to the career, continuous learning, and constant self-improvement. Hence, medical students need to be academically qualified and able to maintain their grades to avoid attrition mid-course. Previous studies indicated that examinations have a predictive value for the competence and future performance of an individual as a future medical practitioner (2). Moreover, predicting the academic performance of medical students is important for improving cost-efficiency, as the inability of students to graduate on time leads to higher operational costs per annum incurred by the university (3). Identification of students who do not achieve their academic potential can be useful for the university in employing strategies to provide them with assistance (4).

Medical schools in public universities in Malaysia accept students from several pre-university programmes including Sijil Tinggi Pelajaran Malaysia (STPM), matriculation and foundation (5). The STPM programme is a two-year course with a centralised public examination, widely known for being difficult but recognised globally (6). On the other hand, the matriculation programme is a one-year course for bumiputera (translates literally to "son of the soil", comprises of Malay and the indigenous people of Sabah and Sarawak) students with a 10% allocation for non-bumiputera (5). Foundation programmes are managed by universities themselves such as Asasi Sains Pertanian (ASPER) by Universiti Putra Malaysia (UPM) and Asasi Sains Hayat in Universiti Malaya (UM) (5). The academic requirements for admission into public medical schools in Malaysia vary. For example, the Medical School of UPM requires a cumulative grade point average (CGPA) of 3.85 at the pre-university level, with minimum A- grade in the subjects of Biology, Chemistry, Physics, or Mathematics (7). However, the CGPA requirement for ASPER students' enrolment in the medical school of UPM is lowered to 3.75 (8).

Previous studies have been conducted to show the association between academic performances and entry qualification. However, there is a dearth of literature involving foundation programmes run by public universities, especially as criteria for intake into medical schools. From prior studies, three factors have been hypothesised to cause variation in academic performance among medical students: gender, ethnicity and entry qualification. Previous research (9–10) suggested that females outperformed males in higher institutions, while another research (11) showed that males performed better than females in medical school. The contradictory findings bring us to analyse the gender factor to provide more evidence for hypothesis confirmation. Moreover, Malaysia is a multi-racial country consisting of predominantly Malay, Chinese, Indian and the indigenous people of East Malaysia. The Malaysian Chinese students were reported to perform better academically compared to their peers of different ethnicities in prior studies (12–14). Previous studies also suggested that STPM leavers are strongly associated with good academic performances (11, 13, 15–16). Based on this evidence, we hypothesise that medical students from the STPM intake will outperform students from other intakes as well.

This study intends to fill the gap by identifying the impacts of the array of entry qualifications alongside other sociodemographic factors on academic performance. Specifically, this study aims to determine the relationship between the

academic performance of preclinical medical students in UPM with gender, ethnicity and different types of entry qualifications such as ASPER, STPM, or matriculation.

METHODS

Study Location, Design and Duration

The research was carried out at the Faculty of Medicine and Health Sciences (FMHS) in UPM Serdang, Selangor. This was a retrospective cohort study conducted using secondary data obtained from the Deputy Dean's Office (Academic of Medicine) FMHS, UPM without any direct approach to the source itself as the data were confidential. This study was conducted from the 26 November 2020 until the 6 June 2021.

Sampling

The calculated sample size was 26 respondents as this study was conducted using the whole population like the previous study conducted in Universiti Sains Malaysia (USM) (15). However, we managed to acquire more than the needed sample size. The sociodemographic data of 308 preclinical medical students at FMHS UPM from three anonymous years of intake were obtained, which included gender, ethnicity, entry qualification and examination grades. Students who dropped out of the medical course were excluded.

Data Collection

The academic performance of the preclinical medical students (Years 1 and 2) in UPM was analysed using the results of the grades obtained in their final examinations for Packages 1 to 9 and the Professional Examination I (PRO1) at the end of their preclinical years which are in Year 2. The PRO1 is taken at the end of the preclinical years; it is necessary to pass to continue to the clinical years which is Year 3. The PRO1 encompasses all nine packages that were studied throughout the two years duration. The examination consists of 50% of Year 1 knowledge and 50% of Year 2 knowledge, each of which has both theoretical and practical parts (17). Figure 1 shows the various subjects taken in Packages 1 to 9 and the PRO1.

Figure 1: Syllabus subjects in Packages 1 to 9 and Professional Examination I of UPM preclinical medical students (Years 1 and 2).

Data Analysis

For categorisation, the students were grouped into three groups: a "good" performance group, a "poor" performance group, and a "fail" group. The "good" performance group consisted of students who obtained A, A-, and B+. The "poor" performance group was students with grades B, B-, C+, and C. Students who failed were categorised into the "fail" group. The purpose of the grouping is for statistical analysis based on a previous study (11). However, for the presentation of the results, only the "good" and "poor" groups are discussed.

The collected data were analysed using SPSS version 25.0. Descriptive analysis of frequency and percentage were calculated for the sociodemographic characteristics. The data were analysed using the chi-square test or Fisher's exact test depending on whether assumptions were met or not. Data collected was analysed with an alpha level of 0.05. Post-hoc z-test on the adjusted residuals with Bonferroni correction was used to determine which pair was statistically significant.

RESULTS

The total number of participants in this study was 308 students from three different unknown cohorts. The enrolment year for each cohort is kept classified by the Deputy Dean's Office (Academic of Medicine) as the specific examination marks are considered confidential. The credibility and the competency of the students that may already graduate and become medical doctors, specialists, or academicians may be disputed if their examination marks were revealed. Thus, the data were analysed without the researchers knowing the year of enrolment. Most of them were female, of Malay ethnicity, and from ASPER as described in Table 1. Table 1 depicted sociodemographic data of preclinical medical students of FMHS UPM in all three cohorts which include gender, ethnicity and entry qualification.

Gender

Generally, female students outnumbered males in all the cohorts (Cohorts 1, 2 and 3). A chi-square test was performed to determine the association between gender and academic performance. The p-value of these tests involving all three cohorts in all packages was considered significant if $p < 0.05$. However, overall, there was no significant association between gender and academic performance of preclinical medical students in all three cohorts.

Table 1: Sociodemographic data of preclinical medical students of FMHS, UPM in all three cohorts (gender, ethnicity, and entry qualification)

Sociodemographic factors	Cohort 1 (n = 100)		Cohort 2 (n = 95)		Cohort 3 (n = 113)	
	Frequency	%	Frequency	%	Frequency	%
Gender						
Female	65	65.00	62	65.26	72	63.70
Male	35	35.00	33	34.74	41	36.30
Ethnicity						
Malay	54	54.00	54	56.84	64	56.60
Indian	18	18.00	20	21.05	27	23.90
Chinese	25	25.00	21	22.11	21	18.60
Bumiputera	3	3.00	0	0.00	1	0.90
Entry qualification						
ASPER	55	55.00	56	58.95	66	58.40
Matriculation	39	39.00	34	35.79	47	41.60
STPM	6	6.00	5	5.26	0	0.00

Ethnicity

As for ethnicity, the chi-square test or Fisher's exact test was carried out based on whether the assumptions were met or not. There were more than 20% cells with an expected count of less than 5 in all the three cohorts' data and Fisher's exact test was performed in the ethnicity variable. Post-hoc *z*-test on the adjusted residuals with Bonferroni correction was used to determine which pair was statistically significant.

Table 2 represents the Fisher's exact test performed to determine the significant association between ethnicity and academic performance for three cohorts of UPM preclinical medical students. For ethnicities in Cohort 1 (Packages 1, 2, 4, 5, 6, 8, 9, PRO1), Cohort 2 (all packages) and Cohort 3 (Packages 1 to 9), the *p*-values are significant (< 0.05) which show there is an association between the ethnicity of that cohort and academic performance.

Table 3 shows adjusted residuals of ethnicity for significant associations. It depicted that in all the three cohorts, Malay groups (Packages 1, 2, 4, 5, 6, 7, 8, 9 and PRO1) were significantly associated with poor academic performance while Chinese groups were significantly associated with good academic performance (Packages 1, 2, 3, 4, 5, 6, 7, 8, 9 and PRO1). For the Indian group, only PRO1 of Cohort 1 showed significance where they were negatively associated with poor academic results.

Entry Qualification

Similarly, for entry qualification, the chi-square test or Fisher's exact test was carried out based on whether the assumptions were met or not. If there were more than 20% cells with an expected count of less than 5, Fisher's exact test was performed. However, if there were less than 20% cells with an expected count of less than 5, the chi-square test was conducted. In Cohorts 1 and 2, there were more than 20% cells with an expected count of less than 5, thus Fisher's exact test was performed for entry qualification. However, in Cohort 3, since there were less than 20% cells with an expected count of less than 5, the chi-square test was conducted for entry qualification. Then, a post-hoc *z*-test on the adjusted residuals with Bonferroni correction was used to determine which pair is statistically significant.

Table 4 represents the chi-square test/ Fisher's exact test performed to assess significant association between entry qualification and academic performance for three cohorts of UPM preclinical medical students. There were significant associations between STPM intake and good academic performance for Cohort 1 in Package 1 ($p = 0.007$), 2 ($p < 0.001$), 5 ($p = 0.007$), 6 ($p = 0.012$), 7 ($p = 0.006$), and 8 ($p = 0.002$); there were also significant associations for Cohort 2 in Package 1 ($p = 0.049$), 6 ($p = 0.031$), and 9 ($p = 0.049$).

Table 2: Association between the ethnicity of UPM medical students in Cohort 1 to 3 and academic performance in Packages 1 to 9 and PRO1

Ethnicity	Cohort 1 (n = 100)				Cohort 2 (n = 95)				Cohort 3 (n = 113)			
	Academic performance		Fisher's exact test		Academic performance		Fisher's exact test		Academic performance		Fisher's exact test	
	Good (%)	Poor (%)	Value	*P*-value	Good (%)	Poor (%)	Value	*P*-value	Good (%)	Poor (%)	Value	*P*-value
Package 1			23.450	< 0.001			31.326	< 0.001			15.584	0.001
Malay	14 (25.9)	40 (74.1)			7 (13.0)	47 (87.0)			5 (7.8)	59 (92.2)		
Indian	5 (27.8)	13 (72.2)			5 (25.0)	15 (75.0)			4 (14.8)	23 (85.2)		
Chinese	20 (80.0)	5 (20.0)			17 (81.0)	4 (19.0)			10 (47.6)	11 (52.4)		
Bumiputera	0 (0.0)	3 (100.0)			0 (0.0)	0 (0.0)			0 (0.0)	1 (100.0)		
Package 2			13.391	0.002			26.761	< 0.001			17.503	< 0.001
Malay	0 (0.0)	54 (100)			1 (1.9)	52 (96.3)			3 (4.7)	61 (95.3)		
Indian	2 (11.1)	16 (88.9)			0 (0.0)	20 (100.0)			2 (7.4)	25 (92.6)		
Chinese	6 (24.0)	19 (76.0)			10 (47.6)	11 (52.4)			9 (42.9)	12 (57.1)		
Bumiputera	0 (0.0)	3 (100.0)			0 (0.0)	0 (0.0)			0 (0.0)	1 (100.0)		
Package 3			5.282	0.714			13.942	0.002			8.682	0.027
Malay	1 (1.9)	50 (92.6)			0 (0.0)	50 (92.6)			1 (1.6)	63 (98.4)		
Indian	0 (0.0)	18 (100.0)			0 (0.0)	18 (90.0)			1 (3.7)	26 (96.3)		
Chinese	0 (0.0)	25 (100.0)			5 (23.8)	16 (76.2)			4 (19.0)	17 (81.0)		
Bumiputera	0 (0.0)	3 (100.0)			0 (0.0)	0 (0.0)			0 (0.0)	1 (100.0)		
Package 4			26.896	< 0.001			26.276	< 0.001			17.465	< 0.001
Malay	3 (5.6)	48 (88.9)			2 (3.7)	52 (96.3)			4 (6.3)	60 (93.8)		
Indian	8 (44.4)	10 (55.6)			2 (10.0)	18 (90.0)			4 (14.8)	23 (85.2)		
Chinese	13 (52.0)	12 (48.0)			12 (57.1)	9 (42.9)			10 (47.6)	11 (52.4)		
Bumiputera	0 (0.0)	3 (100.0)			0 (0.0)	0 (0.0)			**0 (0.0)**	1 (100.0)		
Package 5			29.798	< 0.001			33.538	< 0.001			24.451	< 0.001
Malay	10 (18.5)	44 (81.5)			1 (1.9)	53 (98.1)			0 (0.0)	64 (100.0)		
Indian	9 (50.0)	9 (50.0)			0 (0.0)	20 (100.0)			1 (3.7)	26 (96.3)		
Chinese	20 (80.0)	5 (20.0)			12 (57.1)	9 (42.9)			8 (38.1)	13 (61.9)		
Bumiputera	0 (0.0)	3 (100.0)			0 (0.0)	0 (0.0)			0 (0.0)	1 (100.0)		

(*Continued on next page*)

Table 2: (*Continued*)

Ethnicity	Cohort 1 (n = 100)				Cohort 2 (n = 95)				Cohort 3 (n = 113)			
	Academic performance		Fisher's exact test		Academic performance		Fisher's exact test		Academic performance		Fisher's exact test	
	Good (%)	Poor (%)	Value	*P*-value	Good (%)	Poor (%)	Value	*P*-value	Good (%)	Poor (%)	Value	*P*-value
Package 6			26.873	< 0.001			36.560	< 0.001			19.320	< 0.001
Malay	3 (5.6)	51 (94.4)			0 (0.0)	47 (87.0)			2 (3.1)	62 (96.9)		
Indian	7 (38.9)	11 (61.1)			0 (0.0)	20 (100.0)			3 (11.1)	24 (88.9)		
Chinese	14 (56.0)	11 (44.0)			11 (52.4)	10 (47.6)			9 (42.9)	12 (57.1)		
Bumiputera	0 (0.0)	3 (100.0)			0 (0.0)	0 (0.0)			0 (0.0)	1 (100.0)		
Package 7			4.899	0.169			11.031	0.002			14.778	0.001
Malay	6 (11.1)	48 (88.9)			2 (3.7)	52 (96.3)			4 (6.3)	60 (93.8)		
Indian	6 (33.3)	12 (66.7)			2 (10.0)	18 (90.0)			5 (18.5)	22 (81.5)		
Chinese	5 (20.0)	20 (80.0)			7 (33.3)	14 (66.7)			9 (42.9)	12 (57.1)		
Bumiputera	0 (0.0)	3(100.0)			0 (0.0)	0 (0.0)			0 (0.0)	1 (100.0)		
Package 8			11.950	0.005			50.705	< 0.001			16.396	< 0.001
Malay	14 (25.9)	40 (74.1)			4 (7.4)	50 (92.6)			1 (1.6)	63 (98.4)		
Indian	10 (55.6)	8 (44.4)			3 (15.0)	17 (85.0)			3 (11.1)	24 (88.9)		
Chinese	15 (60.0)	10 (40.0)			19 (90.5)	2 (9.5)			7 (33.3)	14 (66.7)		
Bumiputera	0 (0.0)	3 (100.0)			0 (0.0)	0 (0.0)			0 (0.0)	1 (100.0)		
Package 9			15.798	0.005			44.203	< 0.001			37.639	< 0.001
Malay	7 (13.0)	45 (83.3)			6 (11.1)	48 (88.9)			11 (17.2)	53 (82.8)		
Indian	8 (44.4)	10 (55.6)			4 (20.0)	16 (80.0)			9 (33.3)	18 (66.7)		
Chinese	12 (48.0)	13 (52.0)			19 (90.5)	2 (9.5)			19 (90.5)	2 (9.5)		
Bumiputera	0 (0.0)	3(100.0)			0 (0.0)	0 (0.0)			0 (0.0)	1 (100.0)		
PRO1			14.515	0.009			21.741	< 0.001			12.537	0.068
Malay	1 (1.9)	53 (98.1)			0 (0.0)	53 (98.1)			1 (1.6)	62 (96.9)		
Indian	4 (22.2)	13 (72.2)			2 (10.0)	17 (85.0)			2 (7.4)	25 (92.6)		
Chinese	4 (16.0)	21 (84.0)			8 (38.1)	13 (61.9)			4 (19)	17 (81.0)		
Bumiputera	0 (0.0)	3 (100.0)			0 (0.0)	0 (0.0)			0 (0.0)	1 (100.0)		

Note: Significant value $p < 0.05$

Table 3: Adjusted residuals of ethnicity for significant associations[1]

Ethnicity	Cohort 1 (*n* = 100)		Cohort 2 (*n* = 95)		Cohort 3 (*n* = 113)	
	Academic performance					
	Good	Poor	Good	Poor	Good	Poor
Package 1						
Malay	–2.9*	2.9*	–4.4*	4.4*	–2.9*	2.9*
Indian	–1.1	1.1	–0.6	0.6	–0.3	0.3
Chinese	4.9*	–4.9*	5.7*	–5.7*	4.2*	–4.2*
Package 2						
Malay	–3.2*	3.2*	–3.4*	3.4*	–2.8*	2.8*
Indian	0.5	-0.5	–1.8	0.8	–0.9	0.9
Chinese	3.4*	–3.4*	5.8*	–5.8*	4.7*	–4.7*
Package 3						
Malay	NA	NA	–2.6	1.5	–2.0	2.0
Indian	NA	NA	–1.2	0.2	–0.4	0.4
Chinese	NA	NA	4.4*	–2.0	3.1*	–3.1*
Package 4						
Malay	–4.7*	3.9*	–3.9*	3.9*	–3.2*	3.2*
Indian	2.2	–1.8	–0.9	0.9	–0.2	0.2
Chinese	3.8*	–3.3*	5.6*	–5.6*	4.4*	–4.4*
Package 5						
Malay	–4.5	4.5*	–3.9	3.9*	–3.6	3.6*
Indian	1.1	–1.1	–2.0	2	–0.9	0.9
Chinese	4.9*	–4.9	6.6*	–6.6	5.7*	–5.7
Package 6						
Malay	–4.7*	4.7*	–4.0*	1.7*	–3.4*	3.4*
Indian	1.6	–1.6	–1.8	2.4	–0.2	0.2
Chinese	4.4*	–4.4*	6.6*	–4.4*	4.7*	–4.7*
Package 7						
Malay	NA	NA	–2.8*	2.8*	–3.2*	3.2*
Indian	NA	NA	–0.2	0.2	0.4	-0.4
Chinese	NA	NA	3.5*	–3.5*	3.7*	–3.7*
Package 8						
Malay	–2.9*	2.9*	–5.0*	5.0*	–3.3*	3.3*
Indian	1.6	–1.6	–1.4	1.4	0.3	–0.3
Chinese	2.5	–2.5	7.3*	–7.3*	4.0*	–4.0*
Package 9						
Malay	–3.4*	2.9*	–4.7*	4.7*	–4.4*	4.4*
Indian	1.8	–1.6	–1.2	1.2	–0.1	0.1
Chinese	2.7	–2.4	6.8*	–6.8*	6.0*	–6.0*
PRO1						
Malay	–2.7*	2.9*	–3.8*	3.6*	NA	NA
Indian	2.2	–2.8*	–0.1	–0.4	NA	NA
Chinese	1.4	–1.2	4.7*	–4.0*	NA	NA

Note: *Significance towards academic performance group, [1]Analysed using Bonferroni corrected alpha value 0.0063, NA = non-applicable

Table 4: Association between entry qualification of UPM medical students in Cohorts 1 to 3 and academic performance in Packages 1, 2, 5–9

Entry qualification	Cohort 1 (*n* = 100)				Cohort 2 (*n* = 95)				Cohort 3 (*n* = 113)				
	Academic performance		Fisher's exact test		Academic performance		Fisher's exact test		Academic performance		Chi-square test		
	Good (%)	Poor (%)	Value	*P*-value	Good (%)	Poor (%)	Value	*P*-value	Good (%)	Poor (%)	Value	df	*P*-value
Package 1			9.729	0.007			5.485	0.049			1.146	1	0.316
ASPER	20 (36.4)	35 (63.6)			12 (21.4)	44 (78.9)			9 (13.6)	57 (86.4)			
Matriculation	13 (33.3)	26 (66.7)			15 (44.1)	19 (55.9)			10 (21.3)	37 (78.7)			
STPM	6 (100.0)	0 (0.0)			2 (40.0)	3 (60.0)			0 (0.0)	0 (0.0)			
Package 2			15.491	<0.001			5.694	0.206			0.465	1	0.568
ASPER	3 (5.5)	52 (94.5)			5 (8.9)	50 (89.3)			7 (10.6)	59 (89.4)			
Matriculation	13 (33.3)	26 (66.7)			4 (11.8)	30 (88.2)			7 (14.9)	40 (85.1)			
STPM	6 (100.0)	0 (0.0)			2 (40.0)	3 (60.0)			0 (0.0)	0 (0.0)			
Package 5			9.729	0.007			3.040	0.240			0.033	1	1.000
ASPER	20 (36.4)	35 (63.6)			5 (8.9)	51 (91.1)			5 (7.6)	61 (92.4)			
Matriculation	13 (33.3)	26 (66.7)			7 (20.6)	27 (79.4)			4 (8.5)	43 (91.5)			
STPM	6 (100.0)	0 (0.0)			1 (20.0)	4 (80.0)			0 (0.0)	0 (0.0)			
Package 6			8.179	0.012			9.446	0.031			0.227	1	0.775
ASPER	15 (27.3)	40 (72.7)			3 (5.4)	46 (82.1)			9 (13.6)	57 (86.4)			
Matriculation	5 (12.8)	34 (87.2)			7 (20.6)	27 (79.4)			5 (10.6)	42 (89.4)			
STPM	4 (66.7)	2 (33.3)			1 (20.0)	4 (80.0)			0 (0.0)	0 (0.0)			
Package 7			9.244	0.006			4.947	0.06			1.682	1	0.297
ASPER	12 (21.8)	43 (78.2)			4 (7.1)	52 (92.9)			13 (19.7)	53 (80.3)			
Matriculation	2 (5.1)	37 (94.9)			5 (14.7)	29 (85.3)			5 (10.6)	42 (89.4)			
STPM	3 (50.0)	3 (50.0)			2 (40.0)	3 (60.0)			0 (0.0)	0 (0.0)			

(*Continued on next page*)

Table 4: (*Continued*)

Entry qualification	Cohort 1 (*n* = 100)				Cohort 2 (*n* = 95)				Cohort 3 (*n* = 113)				
	Academic performance		Fisher's exact test		Academic performance		Fisher's exact test		Academic performance		Chi-square test		
	Good (%)	Poor (%)	Value	*P*-value	Good (%)	Poor (%)	Value	*P*-value	Good (%)	Poor (%)	Value	df	*P*-value
Package 8			12.209	0.002			2.727	0.290			0.137	1	0.760
ASPER	23 (41.8)	32 (58.2)			12 (21.4)	44 (78.6)			7 (10.6)	59 (89.4)			
Matriculation	10 (25.6)	29 (74.4)			12 (35.3)	22 (64.7)			4 (8.5)	43 (91.5)			
STPM	6 (100.0)	0 (0.0)			2 (40.0)	3 (60.0)			0 (0.0)	0 (0.0)			
Package 9			5.506	0.216			5.485	0.049			0.098	1	0.842
ASPER	18 (32.7)	37 (67.3)			12 (21.4)	44 (78.9)			22 (33.3)	44 (66.7)			
Matriculation	7 (17.9)	30 (76.9)			15 (44.1)	19 (55.9)			17 (36.2)	30 (63.8)			
STPM	2 (33.3)	4 (66.7)			2 (40.0)	3 (60.0)			0 (0.0)	0 (0.0)			

Note: Significant value $p < 0.05$

Table 5: Adjusted residuals of entry qualification for significant associations[1]

Entry qualification	Cohort 1 (*n* = 100)		Cohort 2 (*n* = 95)	
	Academic performance			
	Good	Poor	Good	Poor
Package 1				
ASPER	–0.6	0.6	2.1	–2.1
Matriculation	–0.9	0.9	0.5	–0.5
STPM	3.2*	–3.2*	–2.3*	2.3*
Package 2				
ASPER	–1	1	NA	NA
Matriculation	–1.6	1.6	NA	NA
STPM	5.5*	–5.5*	NA	NA
Package 5				
ASPER	–0.6	0.6	NA	NA
Matriculation	–0.9	0.9	NA	NA
STPM	3.2*	–3.2*	NA	NA
Package 6				
ASPER	0.8	–0.8	–2.3	0.3
Matriculation	–2.1	2.1	2.0	–0.3
STPM	2.5*	–2.5*	0.6*	–0.1*
Package 7				
ASPER	1.4	–1.4	NA	NA
Matriculation	–2.5	2.5	NA	NA
STPM	2.2*	2.2*	NA	NA
Package 8				
ASPER	0.6	–0.6	NA	NA
Matriculation	–2.2	2.2	NA	NA
STPM	3.2*	–3.2*	NA	NA
Package 9				
ASPER	NA	NA	–2.3	2.3
Matriculation	NA	NA	2.1	–2.1
STPM	NA	NA	0.5*	–0.5*

Notes: *Significance towards academic performance group, [1]Analysed using Bonferroni corrected alpha value 0.0083, NA = non-applicable

Table 5 depicts adjusted residuals of entry qualification for significant associations which demonstrates that STPM leavers had a high association with good academic performance.

DISCUSSION

Gender

Previous research (18–21) showed female predominance in medical schools. On the contrary, our study suggests that there was no association between gender and academic achievement. One may assume that because females outnumber males in terms of enrolment in medical school, which is founded on meritocracy, it is logical to believe that females will outperform males in medical school as well. However, the outcomes of our study did not support this assertion, which is corroborated by earlier research (12). Instead, it was comparable to previous research (20), which found no significant gender differences, most likely due to skewed data favouring females. This is demonstrated in our study by the total number of males (n = 109, 35.39%), which is nearly half of the total females (n = 199, 64.61%).

Ethnicity

From Cohorts 1 to 3, many students were Malays, followed by Chinese, Indians and Bumiputera. According to a previous study (16), the successful applicants were 53.6% Malays, 31.1% Chinese, 11.2% Indians, and 3.6% from other ethnic groups. The results of ethnicity distribution in our article are nearly identical to the figure in their research because medical students are selected based on their previous academic performance. Previous researchers (13) discovered that Chinese students performed better than Malay students in UM, although there was no significant difference observed between Chinese students and other ethnic groups. This is consistent with our conclusion that Chinese counterparts outperform their peers of different ethnicities. Amongst possible reasons is that Malaysian Chinese ethnicity is generally more competitive, which influences the desire to attain academic excellence to maintain their self-esteem, as discovered in a previous study (22). On the other hand, researchers (23) discovered that non-Malay medical students were more anxiety-resistant than Malay medical students in a research conducted at the USM School of Medical Science.

Entry Qualification

The p-values of entry qualification in Cohort 1 (Packages 1, 2, 5, 6, 7 and 8) and Cohort 2 (Packages 1, 6 and 9) are significant (< 0.05) which shows there is an association between entry qualification of that cohort and academic performance. For Cohorts 1 to 3, most students were from ASPER, followed by matriculation and the least from STPM. According to the previous study by Yusoff et al. (16), 88.8% of the students were from matriculation, 6.6% from STPM and 4.6% from A-Level. This difference could be explained by the fact that USM where the research was conducted has no specific foundation pathway for its students, while UPM has its foundation pathway, ASPER which prioritises ASPER graduates in continuing their degree in UPM.

According to our findings, STPM leavers outperformed students from other entry qualifications in Packages 1, 2, 5 and 8 for academic achievement, which is consistent with previous research (15–16, 24). STPM requires two years to complete, as opposed to ASPER and matriculation which need only one-year duration. Although the syllabus is arguably the same because they are all preparatory courses for entering universities (which are Biology, Chemistry, Physics and Mathematics), the STPM syllabus is likely to be more in-depth because it takes longer duration to study and complete. Furthermore, as previously stated by Kies and Freund (25) decompressing one year of study into two years led to improved

student performance. This could be a similar case as the ASPER and matriculation programmes being the compressed courses and STPM being the decompressed course. Due to the extra one year, STPM students are also more mature than other students when they attend medical school. According to a study by Jayanthi et al. (26), being more mature leads to higher CGPA ratings. In addition, the cohorts are ranked by seniority, which means that Cohort 1 graduated before Cohort 2, and Cohort 2 graduated before Cohort 3. Over the years, the increasing number of students' quota in one-year matriculation preparatory courses caused the decreasing number of students to enrol for STPM, resulting in no STPM students in Cohort 3.

CONCLUSION

The study concluded that there was no significant association between student gender and academic achievement of UPM preclinical medical students. Meanwhile, in terms of ethnicity, the Chinese group was significantly associated with high academic achievement, whilst the Malay group was significantly associated with poor academic performance. For each cohort, the Chinese group produced consistent findings. Most notably, STPM graduates outperform students from other entry qualifications in academic performance.

Limitations

We are unable to draw a definitive conclusion as many other confounding factors could affect the results of our research such as age, year of study, emotional maturity, motivation and the difficulty of the examination. Furthermore, it is noteworthy that the matriculation pathway is specifically catered to prioritise the bumiputera ethnicity by implementing a quota system. Hence, we need to factor in the difference in the ethnic distribution in the entry qualification as well, as it is impossible to differentiate whether the findings can be attributed to the entry qualification solely or could be affected by ethnicity as well. Furthermore, because the respondents of this study were medical students of UPM, our findings cannot be generalised to other public or private universities.

Study Strength

This is the first study conducted in UPM that statistically relates academic performance of preclinical medical students to gender, ethnicity and entry qualifications. This is a significant since each medical student's academic performance may be constantly tracked, analysed and predicted. The findings of this study can be used to enhance the medical education system at FMHS by concentrating more on the students who most probably will perform poorly.

Recommendations

We recommend future researchers who use secondary data to confirm the availability of the data before deciding to use them in their study. Furthermore, it would be better to have a larger number of participants or at least ten cohorts of students. This is to reduce the risk of accidentally having extreme or biased groups. In addition, if there was no time constraint, questionnaires can be distributed to the studied population to further investigate factors such as stress, emotional maturity and motivation.

ACKNOWLEDGEMENTS

Our deepest appreciation to Prof. Zamberi Sekawi, Dean of FMHS, UPM for his approval of the accessibility of data and to Ethics Committee for Research Involving Human Subject UPM (JKEUPM) JKEUPM for the opportunity to conduct a research project at UPM.

ETHICAL APPROVAL

The study was conducted post ethical clearance from the Ethics Committee for Research Involving Human Subject UPM (JKEUPM-2021-110) and with approval from the Dean of FMHS.

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