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

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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 socio-demographic 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). 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, socio-demographic factors*

CORRESPONDING

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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 programs including Sijil Tinggi Pelajaran Malaysia (STPM), matriculation, and foundation (5). The STPM program is a two-year course with a centralized public examination, widely known for being difficult but recognized globally (6). On the other hand, the matriculation program is a one-year course for Bumiputera¹ students with a ten per cent allocation for non-Bumiputeras (5). Foundation programs 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 programs run by public universities, especially as criteria for intake into medical schools. From prior studies, three factors have been hypothesized 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 Malays, Chinese, Indians, 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 hypothesize 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 socio-demographic factors on academic performance. Specifically, this study aims to determine the relationship between the academic performance of preclinical medical students in UPM

¹ Translates literally to “son of the soil”, comprises of Malay and the indigenous people of Sabah and Sarawak

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 26th of November 2020 until the 6th of June 2021.

Sampling

The calculated sample size was 26 respondents as this study was conducted using the whole population similar to the previous study conducted in Universiti Sains Malaysia (USM) (15). However, we managed to acquire more than the needed sample size. The socio-demographic 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.

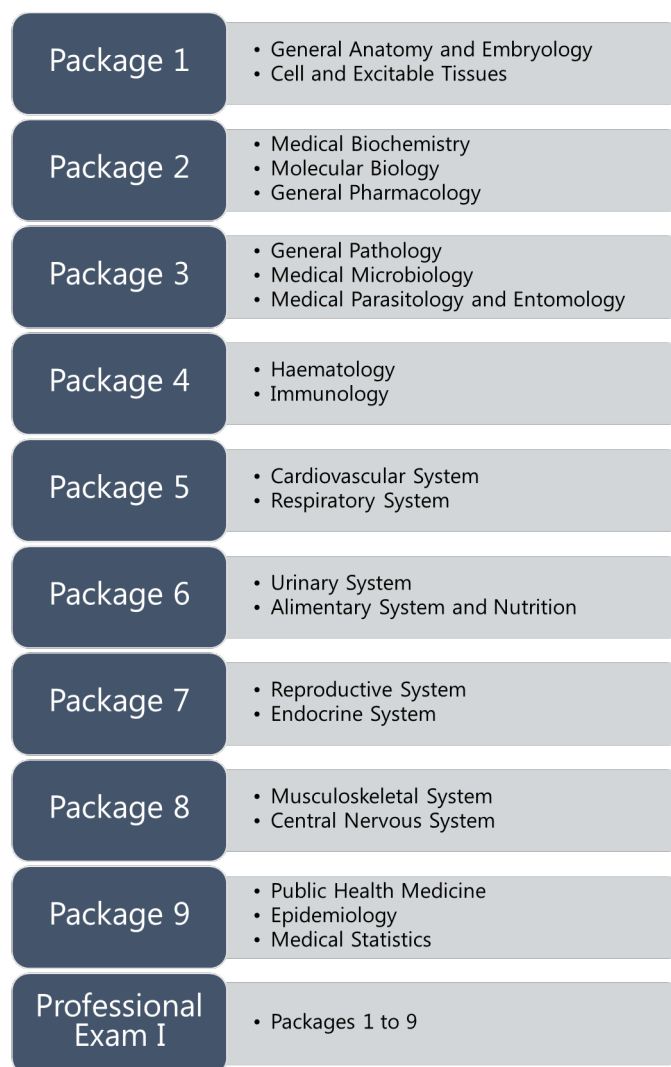


Figure 1: Syllabus subjects in Packages 1 to 9 and Professional Examination 1 of UPM preclinical medical students (Year 1 and 2)

Data Analysis

For categorization, 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 categorized 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. Descriptive analysis of frequency and percentage were calculated for the socio-demographic 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.

Ethical Consideration

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.

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. The majority of them were female, of Malay ethnicity, and from ASPER as described in Table 1. Table 1 depicted socio-demographic data of preclinical medical students of FMHS UPM in all three cohorts which include gender, ethnicity, and entry qualification.

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

| Socio-demographic Factors | | Cohort 1 (n=100) | | Cohort 2 (n=95) | | Cohort 3 (n=113) | |
|----------------------------|---------------|------------------|----------------|-----------------|----------------|------------------|----------------|
| | | Frequency | Percentage (%) | Frequency | Percentage (%) | Frequency | Percentage (%) |
| 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 |
| | ASPER† | 55 | 55.00 | 56 | 58.95 | 66 | 58.40 |
| Entry Qualification | Matriculation | 39 | 39.00 | 34 | 35.79 | 47 | 41.60 |
| | STPM‡ | 6 | 6.00 | 5 | 5.26 | 0 | 0.00 |

Note: †Asasi Sains Pertanian, ‡Sijil Tinggi Persekolahan Malaysia

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.

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 particular 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.

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 | <i>P</i> -value | Good (%) | Poor (%) | Value | <i>P</i> -value | Good (%) | Poor (%) | Value | <i>P</i> -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) | | |
| 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) | | |
| PRO 1 | | | 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

| Ethnicity | Cohort 1 (n=100) | | Cohort 2 (n=95) | | Cohort 3 (n=113) | |
|------------------|----------------------|-------|----------------------|-------|----------------------|-------|
| | Academic Performance | | Academic Performance | | 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 | 2 |
| Indian | NA | NA | -1.2 | 0.2 | -0.4 | 0.4 |
| Chinese | NA | NA | 4.4* | -2 | 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 | 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* | 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* | 5* | -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* | -4* |
| 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* | -6* |
| PRO 1 | | | | | | |
| 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* | NA | NA |

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

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

Table 4: Association between entry qualification of UPM medical students in Cohorts 1 to 3 and academic performance in packages 1, 2, 5 and 8

| 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) | | | |
| 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 $p < 0.05$ [†]Asasi Sains Pertanian, [‡]Sijil Tinggi Persekolahan Malaysia**Table 5:** Adjusted residuals of entry qualification for significant associations

| Entry Qualification | Cohort 1 (n=100) | | Cohort 2 (n=95) | |
|---------------------|----------------------|-------|----------------------|-------|
| | Academic Performance | | 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 | -0.3 |
| 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* |

Note: * Significance towards academic performance group,

[†]Analysed using Bonferroni corrected alpha value 0.0083,

NA= non-applicable

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, the majority of 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 particular cohort and academic performance. For Cohorts 1–3, the majority of students were from ASPER, followed by matriculation, and the least from STPM. According to the previous study (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 prioritizes 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 (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 programs 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 (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 generalized 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.

REFERENCES

1. Hughes P. Can we improve on how we select medical students? *J R Soc Med.* 2002;95(1):18–22.

2. Carr SE, Celenza A, Puddey IB, Lake F. Relationships between academic performance of medical students and their workplace performance as junior doctors. *BMC Med Educ.* 2014;14(1):1–7.
3. Ministry of Higher Education Malaysia. UniTP Silver Book Enhancing Academic Productivity and Cost Efficiency [Internet]. Ministry of Higher Education Malaysia. 2017 [cited 2021 Jun 19]. Available from: <https://www.moe.gov.my/menumedia/media-cetak/penerbitan/university-transformation-programme/1468-unitp-silver-book-enhancing-academic-productivity-and-cost-efficiency/file>
4. Thiele T, Pope D, Singleton A, Stanistreet D. Role of students' context in predicting academic performance at a medical school: a retrospective cohort study. *BMJ Open.* 2016;6(3):e010169.
5. Ministry of Education Malaysia. Pre-University [Internet]. Ministry of Education Malaysia. 2022. Available from: <https://www.moe.gov.my/en/pre-university>
6. Lee C. STPM students should be in school [Internet]. *The Star.* [cited 2021 Jun 19]. Available from: <https://www.thestar.com.my/news/nation/2020/11/11/stpm-students-should-be-in-school>
7. Universiti Putra Malaysia. Syarat kemasukan program bachelar lepasan STPM, Matrikulasi/Asasi dan Diploma/Setaraf Sesi Akademik 2018/2019 [Internet]. Universiti Putra Malaysia. [cited 2021 Jun 19]. Available from: [https://eng.upm.edu.my/upload/dokumen/20181010114708Buku_Syarat_Masuk_STPM_2018_2019_EDITED_15_JAN_2018_\(1\).pdf](https://eng.upm.edu.my/upload/dokumen/20181010114708Buku_Syarat_Masuk_STPM_2018_2019_EDITED_15_JAN_2018_(1).pdf)
8. *The Star.* What you need to know? [Internet]. *The Star.* 2018 [cited 2021 Jun 19]. Available from: <https://www.thestar.com.my/news/education/2018/10/28/what-you-need-to-know>
9. Hasan N, Adam MB, Mustapha N, Midi H. Statistical fact of students' background and academic achievement in higher educational institution. *Procedia-Social Behav Sci.* 2010;8:79–84.
10. Azmi AAC, Mustapha MZ. The role of competitiveness, gender and ethnicity in influencing academic performance. *MOJEM Malaysian Online J Educ Manag.* 2017;2(1):37–47.
11. Hod R. The relationship between pre-admission academic achievements & students' profiles to performance in medical school. *Universiti Sains Malaysia;* 2006.
12. Hassan H, Mohamad R, Ali RHRM, Talib YYA, Hsbollah HM. Factors affecting students' academic performance in higher education: evidence from accountancy degree programme. *Int Bus Educ J.* 2020;13(1):1–16.
13. Da Wan C, Cheo R. Determinants of Malaysian and Singaporean economics undergraduates' academic performance. *Int Rev Econ Educ.* 2012;11(2):7–27.
14. Saad SA, Azziz NHA, Zakaria SA, Yazid NM. Performance of engineering undergraduate students in mathematics: A case study in UniMAP. In: *AIP Conference Proceedings.* AIP Publishing LLC; 2015. p. 50023.
15. Arzuman H, Ja'afar R, Fakri N. The influence of pre-admission tracks on students' academic performance in a medical programme: *Universiti Sains Malaysia.* *Educ Heal.* 2012;25(2):124.
16. Yusoff MSB, Rahim AFA, Baba AA, Esa AR. Medical student selection process and its pre-admission scores association with the new students' academic performance in *Universiti Sains Malaysia.* *Int Med J.* 2011;18(4):327–31.

17. Universiti Putra Malaysia. Kaedah dan peraturan peperiksaan bagi program doktor perubatan [Internet]. Universiti Putra Malaysia. 2019. Available from: <https://medic.upm.edu.my/faildokumen?L=en>
18. Yusoff MSB, Rahim AFA, Yaacob MJ. Prevalence and sources of stress among Universiti Sains Malaysia medical students. *Malaysian J Med Sci MJMS*. 2010;17(1):30.
19. Salam A, Mahadevan R, Rahman AA, Abdullah N, Abd Harith AA, Shan CP. Stress among first and third year medical students at University Kebangsaan Malaysia. *Pakistan J Med Sci*. 2015;31(1):169.
20. Masalamany K, Ngu ST, Abd Manan N, Adam SK. Sleep quality among pre-clinical medical students in Universiti Putra Malaysia and Universiti Malaya, Malaysia. *Educ Med J*. 2017;9(3).
21. Rahman NIA, Ismail S, Ali RM, Alattraqchi AG, Dali W, Umar BU, et al. Stress among first batch of MBBS students of Faculty of Medicine and Health Sciences, Universiti Sultan Zainal Abidin, Malaysia: when final professional examination is knocking the door. *Int Med J*. 2015;22(4):1–6.
22. Yeoh JPS, Yeoh PA. Competitiveness between ethnic Malays and ethnic Chinese in Malaysia. *GSTF J Psychol*. 2015;2(1):1–6.
23. Yusoff MSB, Pa MNM, Rahim AFA. Mental health of medical students before and during medical education: a prospective study. *J Taibah Univ Med Sci*. 2013;8(2):86–92.
24. Nelson S, White CF, Hodges BD, Tassone M. Interprofessional Team Training at the Prelicensure Level: A Review of the Literature [Internet]. Vol. 92, *Academic Medicine*. Lippincott Williams and Wilkins; 2017. p. 709–16. Available from: <https://pubmed.ncbi.nlm.nih.gov/27782914/>
25. Kies SM, Freund GG. Medical students who decompress during the M-1 year outperform those who fail and repeat it: a study of M-1 students at the University of Illinois College of Medicine at Urbana-Champaign 1988–2000. *BMC Med Educ*. 2005;5(1):1–5.
26. Jayanthi SV, Balakrishnan S, Ching ALS, Latiff NAA, Nasirudeen AMA. Factors contributing to academic performance of students in a tertiary institution in Singapore. *Am J Educ Res*. 2014;2(9):752–8.