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Original Article

Relationship between admission selection tools and student attrition in the early years of medical school☆

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الملخص

أهداف البحث: يعد الالتحاق بكليات الطب أمرا مطلوبا للغاية في جميع أنحاء العالم مع وجود منافسة شرسة بين المتقدمين. ومع ذلك، فإن بعض أفضل الطلاب ينسحبون بعد قبولهم في كلية الطب. الهدف من هذه الدراسة هو دراسة تناقص الطلاب الأوائل خلال العامين الأولين في كلية الطب وتحديد علاقته بأدوات اختيار القبول.

طريقة البحث: تم إجراء بحث كمي في كلية الطب والعلوم الصحية بجامعة الإمارات العربية المتحدة خلال الفترة من 2016 حتى 2020 حيث تم جمع وتحليل بيانات القبول الروتينية ونتائج امتحانات الطلاب للسنتين الأولى.

النتائج: بلغ معدل التناقص خلال فترة الدراسة 31.7٪. كانت درجات الامتحانات الكتابية في المدارس الثانوية والكليات مرتبطة بشكل كبير باجتياز برنامج ما قبل الطب. سجلت الطالبات درجات أعلى بكثير في المقابلات المصغرة المتعددة مقارنة بنظرائهن من الذكور. ومع ذلك، فإن الاختلاف في نتيجة المقابلات المصغرة المتعددة لم يكن مرتبطا بتناقص الطلاب.

الاستنتاجات: سبب التناقص المبكر معقد ولا يمكن إرجاعه إلى عامل واحد. كانت نتيجة الدراسة الثانوية في المرحلة الجامعية وامتحان القبول الكتابي من العوامل ذات الأهمية الإحصائية فيما يتعلق بمعدل تناقص الطلاب وانخفاض الأداء الأكاديمي. وأظهرت الدراسة أن الطالبات سجلن درجات أعلى بكثير في اختبارات المقابلة المصغرة المتعددة مقارنة بالطلاب الذكور. ومع ذلك، فإن نتيجة المقابلات المصغرة المتعددة وحدها لم تكن مرتبطة بشكل كبير بتناقص الطلاب.

االكلمات المفتاحية: التناقص؛ اختبار القبول في الكلية؛ التسرب؛ التعليم؛ كلية الطب

Abstract

Objectives: Placement in medical schools is highly sought after worldwide with fierce competition among applicants. However, some of the best students withdraw after being accepted to medical school. The aim of this study was to investigate early student attrition within the first 2 years of medical school and determine its relationship to admission selection tools.

Methods: Quantitative research was conducted at the College of Medicine and Health Sciences from 2016 until 2020, during which time routine admission data and students' examination results for the first 2 years were collected and analyzed.

Results: The attrition rate during the study period was 31.7%. High school and college written examination scores were significantly related to completing the

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premedical program ($p = 0.001$ and $p = 0.002$, respectively). Female students scored significantly higher in multiple mini interviews (MMIs) compared with male counterparts ($p < 0.001$). However, the difference in MMI score was not related to student attrition ($p = 0.148$).

Conclusion: The cause of early attrition is complex and cannot be attributed to a single factor.

Undergraduate high school score and written admission examination results were statistically significant factors in relation to student attrition rate and low academic performance. The results of this study showed that the female students scored significantly higher in the multiple MMI tests compared to male students. However, MMI score alone was not significantly related to student attrition.

Keywords: Attrition; College admission test; Dropouts; Education; Medical school

Introduction

Admission to medical school is complex and differs greatly among countries. It is very competitive, with very few seats available. This only allows top excellent students to be accepted through a rigorous admission process. Selection of the accepted students is a challenging task as many cognitive and non-cognitive factors affect the selection process.[1,2]

Medical schools utilize and interpret admission tools differently. Therefore, a careful review of each component of the admission process will help define the overall function of this process and how to improve the admission selection tools.[3–5] The selection process must be evidence-driven, credible, fair, justifiable, and authentic, and the medical schools must be accountable for the effectiveness of the processes.[6,7] The accepted applicant should be able to graduate from the medical school and be successful in his/her subsequent professional practice.[8]

Student attrition carries significant financial and psychological effects on both the student and the school/faculty.[9,10] Furthermore, the number of students leaving a university without a degree impacts the league tables and reputation of the medical school.[11] Most student attrition occurs during the early years for various reasons such as recurrent academic failure and physical or psychological illness.[12] Gender, wealth, and age may also contribute to attrition.[13]

The attrition rate at the College of Medicine and Health Sciences (CMHS) requires more attention because it is high compared to other medical schools. The reported average attrition rate in the literature is 9.1% in different studies.[14] This study investigated medical student attrition in the first 2 years at the CMHS and its relationship to the admission selection tools in order to find ways to improve student retention at our school and other similar medical schools with a high attrition rate.

The CHMS at United Arab Emirates University (UAEU) is the first and highest ranked medical school in the UAE. Only students of UAE Nationality (Arabic speaking) are admitted to the CMHS where the medical curriculum is taught in English. Most of the students admitted to the CMHS are high schoolers. The CMHS delivers a 6-year curriculum of Doctor of Medicine (MD) program without a foundation year. The MD program is divided into the following three subprograms, each of which are 2 years: premedical, preclinical, and clinical programs. All applicants to the CMHS must have UAE nationality and a high score (minimum of 90%) on their high school examination to be allowed to proceed with their applications.[15] Applicants should prove English language proficiency by taking one of the internationally recognized exams such as the International English Language Testing System (IELTS) or the Test of English as a Foreign Language for university study, work, and immigration (TOEFL iBT).[16,17] The minimal required score is 5.5 on the IELTS and 70 on the TOEFL iBT.

All candidates who achieve the required high school and English language scores are required to sit for a CMHS written admission test. The subject areas reflected in the admission examination are biology, physics, chemistry, mathematics, and general knowledge. It also includes questions to assess reasoning capability. The examination is computer-based in English. The exam is composed of 60 multiple-choice questions (MCQs) that must be completed in 75 min. No minimal score is required to pass this examination.[18]

All candidates who fulfilled the required CMHS admission criteria are shortlisted for the MMI examination conducted by trained faculty in the English language. The interviews are held at the CMHS campus. The MMI examination is designed to assess the non-academic skills of the candidates including communication skills, ethical judgement, empathy, problem solving skills, and knowledge of the current healthcare and societal issues in the UAE. The college administration develops a weighted formulas for different examinations and combines the scores to rank the applicants and choose the best students for admission.[19]

Following admission to the MD program, according to CMHS assessment and promotion guidelines, students must achieve a minimum pass mark of 75% at each course in the program. Students who fail more than three courses are dismissed. However, students who fail less than three courses have a chance to remediate at the end of the first year. Students who pass the remediation exams continue to the next year.

Each year, about 700–800 high school students from the whole UAE submit their applications to join the MD program at the CMHS; about 120 (15%) applicants are accepted to join the CMHS; and about 30% of admitted students drop out from the MD program within the first 2 years (premedical program) for various reasons including low academic performance.

Material and Methods

A retrospective study of all students enrolled in the MD program at the CMHS from 2016 through 2020 was performed. All of the admitted students (479) were included in

the study. The collected data included students' age, gender, high school score, English language test score, written admission examination score, and MMI score. In addition, the results of the examinations in the first 2 years of the MD program were also obtained. Data were collected from existing medical school records. The student enrollment data are accurate because they are essential for decision making regarding student progression and university revenues from student enrollment.

The demographic characteristics and scores of all students who dropped out from the CMHS in the first 2 years were compared with students who completed the MD program. Dropouts rate each year was calculated by dividing the number of students who dropped out over the total number of students admitted the same year. The dropout rate in the premedical program (2 years) was calculated by dividing the total number of students who dropped out in the 2 years by the total number of students admitted in the same cohort.

A simple logistic regression test was performed to investigate the relationship between student attrition and each of the tested variables. Backward stepwise multiple logistic regression was performed to determine a set of significant predictors for the likelihood of student failure to complete the MD program and subsequent dropout from the CMHS. Statistical analyses were performed using IBM SPSS Statistics software (version 28). $P < 0.05$ was considered statistically significant. Although some data were missing and this problem could have been solved by data imputation (replacing missing data with substituted estimated values based on the available data), we did not conduct data imputation in the analyses because it distorts the relationship between variables such as correlations leading to less valid conclusions.[20]

Abbreviations: **CMHS**, College of Medicine and Health Sciences; **MD**, Doctor of Medicine; **EmSAT**, Emirates Standardized Test; **GPA**, Grade point average; **IELTS**, International English Language Testing System; **MCQ**, Multiple choice question; **MMI**, Multi mini interview; **TOEFL**, Test of English as a Foreign Language; **TOEFL iBT**, Test of English as a Foreign Language for university study, work, and immigration; **UAE**, United Arab Emirates; **UAEU**, United Arab Emirates University; **UKCAT**, United Kingdom Clinical Aptitude Test.

Results

During the study period, 479 students were admitted to the CMHS, and 349 (72.9%) were females. In the premedical program, 152 (31.7%) students failed and thus dropped out. One-hundred and four (68.4%) of the students who failed were female (Table 1). The results of the second-year examinations of the admitted students in the academic year 2019/2020 were not available during data collection because the students were still in the last semester of the second premedical year.

On average, in each admission cohort, about 35 of 120 students withdrew in their first year compared with 4 of 84 students in the second year (Table 1). The mean admission examinations scores from females compared with males showed that there were no significant gender differences in the mean high school, English language, and CMHS written examination scores. However, there was significant gender bias between admitted students in their mean MMI scores, with females scoring higher ($p < 0.001$) (Table 2).

Simple logistic regression was used to determine significant admission factors related to students' results in the premedical program (Table 3). High school score was significantly related to the likelihood of completing the premedical program ($p < 0.001$) and the odds ratio was 1.176, which means that a 1 point increase in high school score corresponds to a 17.6% increase in the odds of successfully completing the premedical program. English language score and CMHS written exam score were also significantly related to the likelihood of completing the premedical program. A 1 point increase in either of these tests corresponds to a 5.4% and 4.7% increase in the odds of successfully completing the premedical program, respectively. Gender and MMI scores were not significantly related to the odds of successfully completing the premedical program (Table 3).

Stepwise (backward likelihood ratio) multiple logistic regression was performed for the significant admission factors related to students' results in the premedical program (resulted from the simple logistic regression) which were high school, English language, and CMHS written examination scores. This model automatically selected the best variables to predict students' failure or success in the premedical program by removing the less important variable(s) and building the best performing logistic regression model.[21] The p-value for model validity (likelihood ratio test, omnibus test in SPSS) was <0.001 and the p-value for the goodness-of-fit of the model (Hosmer−Lemeshow test) was 0.132. The English language score was automatically removed from the model. The high school examination score and CMHS written examination score were significantly related to

Table 1: Attrition rate in the first 2 years of premedical students at the CMHS (2016−2020).

Cohort	Total Students	Y1 Attrition n (%)	Y2 Attrition n (%)	Premedical Attrition n (%)
2016/2017	122	38 (31.1%)	5 (4.1%)	43 (35.2%)
2017/2018	117	33 (28.2%)	4 (3.4%)	37 (31.6%)
2018/2019	112	37 (33.0%)	2 (1.8%)	39 (34.8%)
2019/2020	128	33 (25.8%)	NA	33 (25.8%)
Total	479	141/479 (29.4%)	11/351 (3.1%)[a]	152/479 (31.7%)

Y1: First premedical year, Y2: Second premedical year, NA: Not available.
[a] The results of the second-year examinations of the admitted students in the academic year 2019/2020 were not available during data collection.

Table 2: Admission examinations scores of females and males ($n = 479$) at the CMHS (2016–2020).

	Gender	N	Mean	Std. Deviation	*P*-value[a]
High school score	F	339	94.57	3.44	0.597
	M	121	94.76	3.30	
English language score	F	181	79.34	10.55	0.305
	M	66	80.86	9.30	
CMHS written exam score	F	300	48.01	11.66	0.353
	M	103	49.39	13.35	
MMI score	F	293	76.31	11.60	<0.001
	M	97	68.53	13.89	

[a] *P*-value of the independent samples *t*-test for comparing the mean examination scores, $p < 0.05$ was considered statistically significant.
F: Female, M: Male.

Table 3: Simple logistic regression defining admission factors related to students' results in the premedical program at the CMHS (2016–2020).

	Coefficient	*P*-value	Odds Ratio	95% CI for Odds Ratio
Gender (M)	−0.325	0.132	0.722	(0.473, 1.103)
High school score	0.162	<0.001[a]	1.176	(1.108, 1.249)
English language score	0.053	<0.001[a]	1.054	(1.024, 1.085)
CMHS written exam score	0.046	<0.001[a]	1.047	(1.026, 1.069)
MMI score	0.013	0.148	1.013	(0.996, 1.030)

[a] Statistical significance was set at $p < 0.05$.

Table 4: Stepwise multiple logistic regression for the significant predictors of students' results in the premedical program at CMHS (2016–2020).

Predictor	Coefficient	*P*-value	Odds Ratio	95% CI for Odds Ratio
High school score	0.159	0.001[a]	1.172	(1.065, 1.291)
CMHS written exam score	0.051	0.002[a]	1.052	(1.018, 1.088)

[a] Statistical significance was set at $p < 0.05$.

successfully completing the premedical program ($p = 0.001$ and $p = 0.002$, respectively) (Table 4).

For the fixed CMHS written examination score, a 1 point increase in high school examination score corresponds to a 17.2% increase in the odds for successfully passing the Premedical program. This corresponds to a 14.7% decrease in the odds of failing the program. Similarly, for a fixed high school examination score, a 1 point increase in the CMHS written examination score corresponds to a 5.2% increase in the odds of successfully passing the premedical program, which corresponds to a 5% decrease in the odds failing the program.

Discussion

The study showed that the attrition rate at the CMHS in the first 2 years (the premedical program) was 31.7%. This outcome was higher than the global average attrition rate of 9.1%.[14]

The link between the admission selection process and students' withdrawal in the early years of medical school is controversial. Most studies, however, suggest that organized targeted medical school admission processes are much better than open admission for all high school graduates because it is associated with a lower attrition rate.[22,23]

The current study showed that female students scored significantly higher in the MMIs compared to male students, similar to the findings of a study by Ross.[24] This important finding needs to be investigated to understand if we rate female applicants higher because they have better non-cognitive skills such as good communication or other alternative reasons that need to be further explored.

As a selection tool, the MMI can highlight some personal traits essential for future physicians such as effective communication skills, enthusiasm, integrity, logical reasoning, and team workability.[25] Several studies have shown that an MMI score is a strong predictor of success in the early years of medical school.[26,27] The current study showed that MMI score alone was not significantly related to student attrition ($p = 0.148$). The disparity could be because the first language of CMHS applicants is Arabic whereas the MMI examination is conducted in English, which could affect an applicant's understanding of the given questions. However, all students have to pass standardized English language tests; thus, it is reasonable to conclude that their English proficiency level is acceptable and may not influence their performance in the MMIs. Nevertheless, adding stations in Arabic language and allowing extra time for stations in the English language may help in selecting more suitable

applicants and enhance the MMI predictability for academic success of the students.

The study showed that high school score and written college examination score were statistically significant factors related to poor academic performance and student attrition rate. These results are in accordance with other studies.[23,28,29] All students applying to the medical program at the CMHS must have a certain high school score (above 90%) to be allowed to submit their application. However, the actual intellectual level of admitted students may differ depending on the type of high school attended (i.e., public, private English, or private Arabic).

This study found that students' English language proficiency at the time of admission to the CMHS was substantially connected to attrition ($p < 0.0001$). It was, however, not significant enough to be selected in the stepwise logistic regression model and was automatically removed from the model which fits the data well. This may be because the CMHS only admits applicants who perform at an acceptable level on international English exams. Gender was not significantly related to student attrition in this study ($p = 0.132$), consistent with a previous study.[14]

Limitations

This study had some limitations. Drop out in medical schools is due to a variety of causes. The different types of attrition were not studied. The data analyses were affected by missing variables. This single-center study was conducted at our institution and thus the data may not be applicable to many medical schools with different admission processes and student demographics. However, similar factors for attrition have been found in many international studies on attrition, suggesting that the results of this study may apply to other schools and can be generalized. This study was database-oriented and many questions can be raised regarding the credibility of the study; however, records of student enrollment at the UAEU are complete and highly accurate because the data are maintained in the Ellucian Banner database (2023 Ellucian Company L.*P. and* its affiliates), which is the main database used to manage student information services by most universities worldwide.

Future studies

More research is needed to differentiate between different types of dropouts and the effects of admission procedure on attrition rate. Future studies on MMI examinations are needed to enhance stations to accommodate non-English speaking students and whether gender discrepancy in MMI scores can be rectified.

Conclusions

The cause of early attrition is complex and cannot be attributed to a single factor.

Undergraduate high school and written admission examination of the CMHS were statistically significant factors in relation to student attrition rate and low academic performance. The study showed that female students scored significantly higher on MMI tests compared to male students. However, MMI score alone was not significantly related to student attrition.

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Conflict of interest

The authors have no competing interests to declare.

Ethics approval and consent to participate

Ethical approval for this study was obtained from the CMHS Social Sciences Research Ethics Committee (Reference No. ERS_2019_6027). The authors confirm that all methods were carried out in accordance with relevant guidelines and regulations. All collected data were anonymized, handled, and stored in accordance with the tenets of the Declaration of Helsinki.

Authors' contributions

All authors conceived the research question and edited the manuscript. A.F.H. and T.M.A. contributed equally to this work; they wrote the main manuscript text, collected the data, and conducted the data analyses and literature review. M.A.Z. reviewed and edited the manuscript. A.A.B. reviewed and edited the manuscript. S.S. analyzed the data and reviewed and edited the manuscript. M.E.M. reviewed and edited the manuscript. T.Z. analyzed the data, and reviewed and edited the manuscript. B.K. revised the first draft, analyzed the data, and reviewed and edited the manuscript. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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Availability of data and material

All data generated or analyzed during this study are included in this published article.

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