

# What factors affect the academic performance of undergraduate medical students? The impact of attendance and gender



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**Abstract** Class attendance has been proven to be the main determinant of student performance; students with high attendance achieve higher academic performance. This study aimed to evaluate attendance among final-year medical students, assess its relationship with their academic performance, and examine the effect of gender on this relationship. The research methodology employed census sampling and included 248 female and 30 male medical students who had completed their final year end-of-rotation examinations over two academic years. Data about their gender, attendance and academic performance in the end-of-rotation examinations were retrieved manually by authors and registered in an Excel spreadsheet. A comparison between gender groups was performed using an independent-sample t-test. Pearson's correlation was used to study the correlation between attendance and continuous assessment and the theory and clinical scores of students in the end-of-rotation examinations. Findings revealed that attendance was better among females than males; however, the difference was insignificant. Male students performed better than female students in all exam components, with a significant difference in the theory component. The relationship between students' attendance and performance in the end-of-rotation exam revealed a statistically significant increase in student scores with attendance. The results highlight the importance of student attendance for undergraduate medical students' performance regardless of gender. Therefore, we recommend that undergraduate medical students attend all activities to improve their understanding and academic performance.

**Keywords:** medical students, attendance, gender, assessment, clinical, performance, theory

## 1. Introduction

Class attendance may be the principal determinant of learner performance; students with high attendance achieve higher academic performance in continuous assessments and examinations than those with poor attendance (Park & Kerr, 1990; Nyamapfene, 2010). However, despite the development and strict implementation of attendance policies and regulations, decreased adherence and low attendance at teaching and learning activities are ongoing concerns at undergraduate medical education institutions (Emahiser et al., 2021; Khan et al., 2019). A recent study from Canada reports that when many students are absent during classes, the teaching and learning process is severely impacted, student and teacher interest is decreased, and academic standards are compromised (Rawlani et al., 2018). Medical educators have advocated that undergraduate attendance strategies extend beyond physical presence during activities by promoting more interaction between students and facilitators, which is critical to enhancing learning and subsequent performance (Amerstorfer & Münster-Kistner, 2021; Ahmed et al., 2015). However, another study of preclinical students conducted at the College of Medicine at the University of Central Florida reported that different student qualities of self-directed learning affected attendance, with low attendance rates among highly confident students, and that attendance at teaching and learning classes can no longer be taken as a good sign of student performance in assessment activities (Kauffman et al., 2018). A retrospective study of data records conducted in India concluded that regular class attendance improves students' ability to understand topics during discussions (Mitra et al., 2022). A second study in India, conducted at Melaka Manipal Medical College, aimed to determine whether there was any relation between class attendance and students' academic accomplishment. It concluded that attendance policies and regulations correlated well with significant differences in academic performance. Still, researchers could not establish the link between attendance and the best and worst performances because of the small number of students involved in the study (Subramaniam et al., 2013). In the Gulf, a study conducted at the College of Medicine, King Saud Bin Abdulaziz University for Health Sciences in Saudi Arabia, advised that attendance is paramount for learning even when a student-centred approach like problem-based learning medical curriculum is adopted (Bamuhair et al., 2016). A comparable study was executed jointly in Bahrain and Jordan, demonstrating a statistically significant connection between attendance and



performance during a clerkship course in general surgery, though no gender differences in attendance or performance were identified (Al Shenawi et al., 2021). A study in Saudi Arabia determined a positive correlation between student attendance and performance in the theory part of the end-of-year examinations among undergraduate respiratory care program students (Faddelemoula, 2018).

Regarding the impact of gender on student performance, in a study conducted at the College of Applied Medical Sciences of King Khalid University in Saudi Arabia, the average performance of female medical sciences students was shown to be significantly higher than that of male students, with no differences in attendance found between female and male students. They attributed this sex-based variation to specific behavioural and personal characteristics that were difficult to study in their context (Hakami, 2021). Researchers from Sudan highlighted a difference in performance between females and males in a study conducted at the College of Medicine at the University of Kordofan. Still, the difference was not statistically significant (Yusuf & Elfaki, 2022). The College of Medicine and Health Sciences (COMHS) at the National University of Science and Technology, Oman, adopts an outcome-based curriculum with a wide range of teaching and learning activities. During its final year, the medicine sub-internship course comprises five central teaching and learning activities: Student-Led Seminars (SLSs), bedside sessions, bedside clinical skills, outpatient clinical exposure, and on-call duties. In each six-week rotation, students are assessed by an end-of-rotation exam, which includes a continuous assessment in the form of a Mini-CEX, weekly quizzes, and SLS assessments; theory in the form of MCQs and SAQs; and a clinical examination in the form of short clinical cases. End-of-rotation exam reports have shown variability in students' attendance and performance.

Studies on the attendance rates and academic performance of medical students in Oman are uncommon and have not touched on performance in the practical clinical components of exams. Our study aimed to evaluate the attendance and performance of final-year medical students and assess the relationship between attendance, performance, and gender.

## 2. Materials and Methods

### 2.1. Design and setting

This study is a cross-sectional study conducted from June 25, 2023, to August 25, 2023, at the College of Medicine and Health Sciences at the National University of Science and Technology in Sohar, Oman.

### 2.2. Participants and sampling

This study included all final-year medical students from the National University of Science and Technology, Oman, who registered for the medicine sub-internship course and sat for the end of rotation examination during the academic years 2021–2022 and 2022–2023. We employed census sampling technique and the results of all 278 students were included in this study.

### 2.3. Tools/Instrument

The researchers designed a master excel spreadsheet to register the retrieved data. The leading independent variables were attendance during the course and student gender. The primary outcome variable was the end-of-rotation examination score, including continuous assessment scores, theory scores and clinical examination results.

### 2.4. The End of Rotation Examination

After each sub-internship course rotation in medicine, students undergo a structured assessment to evaluate their clinical competence, theoretical knowledge, and practical skills. This approach utilizes continuous assessment, theory tests and clinical assessment to ensure holistic development and minimize biases in students' evaluation. The details of the end-of-rotation examination are shown in Table 1.

### 2.5. Data collection methods

Following the acquisition of ethical clearance from the Ethics and Biosafety Committee of the College of Medicine and Health Sciences/National University of Science and Technology (NU/COMHS/EBC0011/2023), the researchers retrieved participants data from the portfolio records of the medicine sub-internship course for the two successive academic years. During the study period, the authors retrieved and analysed the data. All the retrieved information was transferred to the master excel spreadsheet and double checked for any wrong entries or missing data and correctness of entered data was insured. Portfolio records of the medicine sub-internship were revisited when there were any missing data.

### 2.6. Data Analysis

The retrieved data were entered on a computer using the Microsoft Excel program (2010) and then transferred to statistics software IBM SPSS 25.0 (IBM Inc., Armonk, NY, USA) for statistical analyses. We summarized the data using means and standard deviations for the quantitative variables and frequencies and percentages for the qualitative variables. A comparison between groups was performed using an independent-sample t-test for quantitative variables. Pearson correlation

coefficients were calculated to test the association between different quantitative variables. Assumptions for the independent-sample t-test and Pearson correlation tests (e.g., normality, linearity and homogeneity of variance for the t-test) were assessed prior to analysis. Normality was tested using Kolmogorov-Smirnov and found to be normal. Interquartile range was used to check for outliers and no outliers were present among test variables. P-values less than 0.05 were considered statistically significant, and those less than 0.01 were considered highly significant.

**Table 1** Components of the end-of-rotation examination and their description.

Exam component	Description
Continuous Assessment	
1. Mini-CEX (Mini-Clinical Evaluation Exercise)	Direct observation of clinical interactions with real patients including history-taking, physical exams, data interpretation, evidence-based patient care and professionalism, followed by immediate feedback
2. Weekly MCQ Tests	Timed multiple-choice question assessments to gauge retention of core concepts and clinical guidelines
3. Student-Led Seminar Evaluation	Faculty assessments of presentations on clinical topics, focusing on content accuracy, communication, and critical thinking using validated checklist
4. Clinical Capsules	Case-based assessments requiring students to synthesize patient data, formulate differential diagnoses, and propose management plans
5. SDL (Self-Directed Learning) Assessment	Faculty evaluation of independent learning through reflective structured logbook which covers ten common cases in internal medicine
Theory Examination	
1. MCQ (Multiple-Choice Questions)	A summative written exam testing foundational knowledge and its application covering diagnosis, pharmacology, and evidence-based practice
2. SAQs (Short Answer Questions)	Structured responses to clinical scenarios, assessing problem-solving, diagnostic reasoning, and management strategies
Clinical examination	
1. Short cases	Students interact with real patients under timed conditions. Each case is assessed using validated checklists with criteria-based scoring for physical examination, critical thinking and evidence-based management. A pre-agreed scoring rubric is used for calibration and rater training to minimize inter-rater and intra-rater biases
2. OSCE (Objective Structured Clinical Examination)	Simulated clinical tasks (e.g., interpreting labs, procedural skills, patient counseling) assessed via standardized checklists.

### 3. Results

#### 3.1. Student characteristics

This study included 278 final-year students who had finished their end-of-rotation exams. All data was available in the records and no participant was dropped for the study for incomplete records or missing data. Female students constituted 89.2% of the group (n = 248), while male students constituted only 10.8% (n = 30).

#### 3.2. Relationship between attendance and performance

The attendance (%) was  $91 \pm 5.48$  (80% - 100%). The average performance among participants was  $75.5 \pm 6.5$  (50-92) in CA,  $65.3 \pm 12.8$  (55-92) in theory, and  $76.2 \pm 7.0$  (51-97) in the clinical component. There was a positive correlation between attendance and performance in all the components of the examination as demonstrated in Table 2.

#### 3.3. Effect of gender on the relationship between attendance and performance

The participants' attendance and performance were further analyzed based on their gender. Table 3 shows the mean, standard deviation, and student's t-test between performance and attendance according to gender. Attendance was better among females than males; however, the difference was insignificant ( $p = 0.855$ ). Male students performed better than female students in all exam components, but this difference was only significant in the theory component of the examination ( $p = 0.015$ ).

**Table 2** Correlation of attendance with students' performance in the different components of the end-of-rotation exam.

Sl.NO/Description	Pearson correlation coefficient (r)	Probability-value (
1 Continuous assessment (CA) (%)	0.543	0.00001 *
2 Theory (%)	0.436	0.00001 *
3 Clinical (%)	0.218	0.00001 *

\* p-value < 0.05 is significant.

### 4. Discussion

Class attendance has been reported to be the principal determinant of student performance in examinations. Therefore, we aimed to evaluate attendance and performance among final-year medical students and assess the relationship between attendance, performance, and gender. Decreased students' attendance at teaching and learning activities has been a longstanding problem for educators in undergraduate medical education (Emahiser et al., 2021; Khan et al., 2019). The results of this study provide essential insight into the relationship between gender, attendance, and academic performance in end-of-rotation examinations among final-year medical students.

**Table 3** Mean, standard deviation, and student's t-test between study variables.

Sl.NO/Description	Male (n = 30)	Female (n = 248)	Probability-value
1 Attendance (%)	90.8 ± 5.9	91.0 ± 5.6	0.855
2 Continuous assessment (CA) (%)	76.6 ± 5.7	75.3 ± 6.4	0.307
3 Theory (%)	70.7 ± 9.5	64.7 ± 12.9	0.015 *
4 Clinical (%)	78.2 ± 5.1	75.9 ± 7.2	0.099

\* p-value < 0.05 is significant.

In this study, student attendance was high, reflecting the strict attendance policies and regulations adopted by the College of Medicine and Health Sciences. Regarding the relationship between student attendance and academic performance, we found a significant positive correlation between attendance and scores in all the components of the end-of-rotation examinations. Similarly, in a collaborative study conducted in Bahrain and Jordan, researchers reported a statistically significant correlation between students' attendance and performance during a clerkship course in general surgery (Al Shenawi et al., 2021). A second supporting study undertaken in Saudi Arabia also found a positive correlation between class attendance and performance in the theory component of final examinations among undergraduate students in a respiratory care program (Faddelemoula, 2018).

On the contrary, a study conducted at Melaka Manipal Medical College in India concluded that while attendance regulations correlated with better academic performance, they didn't predict a direct link between attendance and performance. This failure to anticipate a link between attendance and performance was attributed to the small sample sizes in each batch of students involved in the study (Subramaniam et al., 2013).

About 89.2% of the students in our study were female (248). Attendance was better among female students compared to male students, but the difference was not statistically significant, with similar results reported in studies conducted in Saudi Arabia (Al Shenawi et al., 2021; Hakami, 2021). Regarding performance and gender, male students performed better than female students in all exam components. This result contradicts a study conducted in Saudi Arabia, where female students performed better than male students (Hakami, 2021). This contradiction between the two studies regarding the effect of gender on performance could be explained by factors like student-teacher interaction and student-learning style, which may influence the performance of both sexes rather than being attributed to gender only (Amerstorfer & Münster-Kistner, 2021; Ahmed et al., 2015; Yusuf & Elfaki, 2022).

Strikingly, male students' performance in the theory component of the exam was significantly higher than that of female students. One explanation for this gender disparity in theory exam performance may be different learning styles or approaches to theory-based assessments. The correlation between students' attendance and their scores was the most compelling result of this study, underscoring the importance of attendance as a critical factor influencing student success, regardless of gender.

Future research should study the triggering reasons for these gender differences in students' performance, particularly the impact of learning styles and strategies. It should also develop interventions to optimize attendance and participation for academic success while minimizing the effect of gender. Additionally, targeted studies may be needed to address the specific academic challenges that male and female students face in different exam components, ensuring a more balanced and equitable academic environment. However, the generalizability of the effect of gender on performance in this study is limited by the low number of males in this cohort of students. Important limitations in this study is the failure to cover genuine confounding factors such as institutinal/ cultural factors and the effect of students' prior performance. However, we recommend studying these factors in a future comprehensive study.

## 5. Conclusions

Based on the findings, it can be concluded that students' gender does not affect students' attendance. However, students' gender may impact performance, and male students may outperform female students in all the components of the examinations (continuous assessment, theory exam, and clinical exam), but the impact of gender on performance may be significant only for the theory component of the examinations. Furthermore, undergraduate medical student can improve their performance in all examination components through regular attendance of teaching and learning activities.

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## Ethical considerations

The Ethics and Biosafety Committee of the College of Medicine and Health Sciences/National University of Science and Technology approved this study (NU/COMHS/EBC0011/2023). The authors retrieved the data from records and had no access to information that could identify individual participants during or after data collection (e.g., name, age, date of birth) or other sensitive data, and consent was not needed.

## Conflict of Interest

The authors declared no potential conflicts of interest concerning this study, authorship, or publication.

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