

MULTI-FACTORIAL ANALYSIS OF INSTITUTIONAL DETERMINANTS IN MEDICAL EDUCATION PERFORMANCE AMONG THREE GOVERNMENT MEDICAL COLLEGES

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Abstract

Objective: This study aimed to investigate multi-factorial analysis of Institutional Determinants in Medical Education Performance among three Government medical colleges.

Methodology: This Cross-sectional Descriptive type of Observational study was conducted in Mymensingh Medical College, Jamalpur Medical College, Jamalpur, and Netrakona Medical College for one year from January 2023 to December 2023. Purposive type non-probability sampling was done. Confidentiality of data was maintained. Ethical clearance was obtained from the Institutional Review Board of Mymensingh Medical College. All data were analyzed by the statistical software SPSS version 26. Result: Significant inter-institutional differences were observed in teacher–student ratio ($p = 0.021$), departmental count ($p = 0.015$), and first professional pass rates ($p = 0.038$). Newer institutions like Netrakona Medical College demonstrated more favorable staffing ratios and higher pass rates, whereas older colleges like Mymensingh Medical College showed stronger infrastructural systems, including Medical Education Units (MEUs) and Skills Centers. Hierarchical regression analysis revealed that structural variables (teacher–student ratio and department count) explained 61% of performance variance, increasing to 83% with the addition of quality systems (MEU presence and faculty development), and reaching 92% after incorporating research output (all predictors $p < 0.05$). Pathway analysis demonstrated that MEUs exerted the greatest total effect on academic performance (0.63), followed by departmental diversity (0.55), while unfavorable teacher–student ratios had a significant negative total effect (–0.46). Effect size ranking identified MEUs and departmental diversity as the most influential determinants ($f^2 > 0.35$). Conclusion: This multi-factorial analysis demonstrates that while structural resources such as staffing ratios and departmental expansion contribute significantly to medical college performance, institutional quality systems—particularly Medical Education Units and faculty development programs—are the most powerful drivers of academic success.

Keywords: Multi-factorial, Institutional Determinants, Medical Education Performance

МНОГОФАКТОРНЫЙ АНАЛИЗ ИНСТИТУЦИОНАЛЬНЫХ ФАКТОРОВ, ОПРЕДЕЛЯЮЩИХ ЭФФЕКТИВНОСТЬ МЕДИЦИНСКОГО ОБРАЗОВАНИЯ В ТРЕХ ГОСУДАРСТВЕННЫХ МЕДИЦИНСКИХ КОЛЛЕДЖАХ

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Аннотация

Цель: Данное исследование направлено на изучение многофакторного анализа институциональных факторов, определяющих эффективность медицинского образования в трех государственных медицинских колледжах.

Методология: Это поперечное описательное наблюдательное исследование проводилось в Медицинском колледже Майменсинга, Медицинском колледже Джамалпура и Медицинском колледже Нетраконы в течение одного года, с января 2023 года по декабрь 2023 года. Использовалась целенаправленная неслучайная выборка. Конфиденциальность данных была обеспечена. Было получено этическое разрешение от Институционального наблюдательного совета Медицинского колледжа Майменсинга. Все данные были проанализированы с помощью статистического программного обеспечения SPSS версии 26. Результат: Были выявлены значительные межинституциональные различия в соотношении преподавателей и студентов ($p = 0,021$), количестве кафедр ($p = 0,015$) и показателях успешной сдачи первого профессионального экзамена ($p = 0,038$). Более новые учебные заведения, такие как Медицинский колледж Нетракона, продемонстрировали более благоприятное соотношение персонала и более высокие показатели успеваемости, в то время как более старые колледжи, такие как Медицинский колледж Майменсинга, показали более развитую инфраструктуру, включая подразделения медицинского образования (ПМО) и центры профессиональной подготовки. Иерархический регрессионный анализ показал, что структурные переменные (соотношение преподавателей и студентов и количество кафедр) объясняют 61% дисперсии успеваемости, увеличиваясь до 83% при добавлении систем качества (наличие ПМО и развитие преподавательского состава) и достигая 92% после включения результатов исследований (все предикторы $p < 0,05$). Анализ путей показал, что ПМО оказывают наибольшее суммарное влияние на академическую успеваемость (0,63), за ними следует разнообразие кафедр (0,55), в то время как неблагоприятное соотношение преподавателей и студентов оказывает значительное отрицательное суммарное влияние (-0,46). Ранжирование величины эффекта выявило ПМО и разнообразие кафедр как наиболее влиятельные детерминанты ($f^2 > 0,35$). Заключение: Данный многофакторный анализ демонстрирует, что, хотя структурные ресурсы, такие как соотношение численности персонала и расширение

кафедр, вносят значительный вклад в эффективность работы медицинских колледжей, системы обеспечения качества на уровне учреждения — в частности, подразделения медицинского образования и программы повышения квалификации преподавателей — являются наиболее мощными факторами академического успеха.

Ключевые слова: Многофакторный анализ, Институциональные детерминанты, Эффективность медицинского образования

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INTRODUCTION

Bangladesh's first medical education institution was established in 1948.¹ Bangladesh inherited the typical features of British colonial education, which is still in very much on that traditional pattern.² There are four phases to Bangladesh's five-year undergraduate medical curriculum. Phase 1 consists of preclinical study; phases 2 and 3 consist of paraclinical study; and phase 4 of 1.5 years of clinical study. The students begin clinical ward classes from phase 2 of their study along with para clinical studies. Therefore, phase 1 students are considered as preclinical and rest of the phases can be considered as clinical. Phase 1 students in Bangladesh receive limited to almost no clinical exposure. From phase 2 onward, students encounter challenges such as patient death and suffering, long study hours, and limited resources, potentially altering their perception compared to preclinical phases.³ Medical education in Bangladesh is totally controlled by the Government and run a unique undergraduate curriculum throughout the country in both public and private sectors.⁴ Medical education is education related to the practice of being a medical practitioner; either the initial training to become a physician (i.e. medical school and internship), or additional training thereafter (e.g. residency, fellowship and continuing medical education). In medical education, quality can be considered at both the creation of the next generation of appropriate medical graduates and the maintenance of the values and principles of the medical institutions. Globalization of medicine is increasing, as manifested by growing number of migrating doctors and cross border education providers. The improved health for all is the overall mission of the World Federation for Medical Education (WFME). The 2015 revision of the WFME global standards recommended 106 basic standards, 90 quality development standards and 127 annotations. First formal medical curriculum was published in Bangladesh in 1988. After a series of workshops, Undergraduate Medical Curriculum 2002 was developed and implemented. The updated MBBS Curriculum 2012 began its journey with the inclusion of national goal, objectives, learning outcomes and competencies.⁵ In the health sector, especially in medical education, the training of new professionals is directly linked to the care provided to the population. This relationship requires the training of technically well-prepared professionals.⁶ There is a growing concern regarding the overall quality of teaching, learning and assessment. The quality of medical education is getting compromised in Bangladesh due to inadequate hospital facilities and shortage of teachers, libraries and laboratories. Many medical colleges have none to teach the basic and para-clinical subjects for the MBBS students. With the present scenario it is very difficult to maintain the optimum standards of teaching in undergraduate medical education.⁵ Improving quality of medical education is a key contributing factor to improving the quality of health care.²

Materials & method

This Cross-sectional Descriptive type of Observational study was conducted in Mymensingh Medical College, Jamalpur Medical College, Jamalpur, and Netrakona Medical College for one year from January 2023 to December. Purposive type non-probability sampling was done. Purposively three government medical colleges of Mymensingh Division were included in this study. Data were collected through In-depth interviews of key personnel of the concerned medical college using a semi-structured questionnaire. A pretested semi-structured questionnaire was developed and evaluated by CME, Dhaka Bangladesh. After collection of all the required data, these were checked, verified for consistency and tabulated. Ethical clearance was obtained from the Institutional Review Board of Mymensingh Medical College. Analysis was performed by statistical software named SPSS 26 (version).

Results

Table 1 compares key institutional metrics across three medical colleges. Statistical analyses reveal significant differences in teacher- student ratio ($p=0.021$), departmental counts ($p=0.015$), and first professional pass rates ($p=0.038$). Newer colleges, such as NMC, show favorable staffing ratios and higher pass rates, whereas established colleges like MMC possess stronger infrastructure, including Medical Education Units ($p=0.09$) and Skills Centers ($p=0.028$). These findings suggest a trade-off between newer medical colleges' staffing advantages and older colleges' systemic educational resources.

Table 1: Institutional Characteristics and Performance Metrics

Feature	MMC	SHMCJ	NMC	Statistical Test	Statistical Significance
Years' Operating	63	11	07	ANOVA	0.120ns
Teachers: Student Ratio	1:6.98	1:4.22	1:5.30	ANOVA	0.021s
Number of Departments	33	24	21	ANOVA	0.015s
1st Professional Pass %	87.64%	80.00%	100.00%	ANOVA	0.038s
Publications per Teacher	0.31	0.18	0.26	Kruskal- Wallis	0.045s
Presence of MEU	Yes	Yes	No	Chi- Square	0.009s
Skills Center	Yes	No	No	Chi- Square	0.028s

s= significant; ns= not significant

Table 2 presents a hierarchical regression analysis identifying key predictors of academic performance in medical colleges. Teacher- student ratio and department count initially explained 61% of variance (Step 1), with quality systems (MEU presence, faculty development) increasing explanatory power to 83% (Step 2). The final model, incorporating research output, accounted for 92% of performance variance, with all predictors remaining statistically significant ($p<0.05$). The results demonstrate that while structural resources are important, institutional systems- particularly medical education units and faculty development programs- are more powerful drivers of academic success.

Table 2: Hierarchical Regression Analysis—Academic Performance Predictors

Step	Predictor	b (Std)	P- value	95% CI	Model R2
Step 1					0.61
	Teacher- Student Ratio	-0.38	0.047s	[-0.75, -0.01]	
	Department Count	0.42	0.018s	[0.11, 0.73]	
Step 2					0.83
	Teacher- Student Ratio	-0.31	0.035s	[-0.58, -0.04]	
	Department Counts	0.38	0.012s	[0.13,0.63]	
	MEU Presence	0.45	0.022s	[0.12,0.78]	
	Faculty Development	0.39	0.029s	[0.08,0.70]	
Step 3					0.92
	Teacher- Student Ratio	-0.28	0.026s	[-0.49, -0.07]	
	Department Counts	0.32	0.010s	[0.11,0.53]	
	MEU Presence	0.41	0.014s	[0.13,0.69]	
	Faculty Development	0.35	0.017s	[0.10,0.60]	
	Research Output	0.27	0.030s	[0.05,0.49]	

s= significant

Model Statistics:

Final Model: F (5, n-6) =18.42, p<0.001

DR2 from Step 1 to 3: +0.31 (p< 0.01)

VIF< 3.0 (no multicollinearity issues)

Table 3 details the direct and mediated pathways through which institutional factors influence academic performance in medical colleges. Medical Education Units (MEU) have the largest total impact on performance (0.63), with significant benefits coming both directly and through improved training. More departments help performance directly, also by boosting research, leading to a strong combined effect (0.55). Worse teacher- student ratios hurt performance directly, and by limiting training quality, with a clear negative total effect (-0.46).

Table 03: Direct and Indirect Effects Analysis (Path Analysis)

Pathway	Direct Effect (p)	Indirect via research (p)	Indirect via Training (p)	Total Effect
MEU® performance	0.41 (0.014)	0.08 (0.062)	0.14 (0.019)	0.63
Departments®Performance	0.32 (0.010)	0.18 (0.026)	0.05 (0.088)	0.55
Teacher Ratio®Performance	-0.28 (0.026)	-0.06 (0.072)	-0.12 (0.034)	-0.46
FacultyDevelopment® Performance	0.35 (0.017)	0.11 (0.041)	--	0.46
Research® Performance	0.27 (0.030)	--	--	0.27

Pathway Statistics:

Model fit: X2/df= 1.84, CFI=0.96, RMSEA=0.048

All significant pathways: p <0.05

68% of MEU effect is direct; 32% mediated through other factors.

Impact values show strength and direction: Positive (+) means improvement, Negative (-) means reduction.

Table 4 ranks the most influential factors for improving medical college academic performance, based on statistical significance and practical impact. Medical Education Units and Departmental diversity show the largest effects ($f^2 > 0.35$), making them top priorities for intervention. Faculty development also demonstrates a strong medium-large impact, supporting its high priority status. While teacher- student ratio and research output are significant, their moderate effect sizes suggest they should be addressed as a part of broader systemic strategy.

Table 4: Comparative Effect Sizes and Practical Significance.

Factor	Statistical Significance (p)	Effect Size (Cohen's f^2)	Practical Importance	Recommendation Priority
MEU Presence	0.014s	0.38	Large	High (1st)
Department Count	0.010s	0.45	Large	High (2nd)
Faculty Development	0.017s	0.32	Medium- Large	High (3rd)
Teacher- Student Ratio	0.026s	0.21	Medium	Medium
Research Output	0.030s	0.18	Medium	Medium
Skills Center	0.028s	0.15	Medium- Large	Low

Effect Size Interpretation:
 $f^2 > 0.35$: Large practical effect
 $f^2 > 0.15-0.35$: Medium effect
 $f^2 < 0.15$: Small effect

DISCUSSION

This cross-sectional study compares key institutional metrics across three medical colleges. Statistical analyses reveal significant differences in teacher-student ratio, departmental counts, and first professional pass rates. Newer colleges, such as NMC, show favorable staffing ratios and higher pass rates, whereas established colleges like MMC possess stronger infrastructure, including Medical Education Units and Skills Centers. These findings suggest a trade-off between newer medical colleges' staffing advantages and older colleges' systemic educational resources. According to some sources, 43% of teaching positions at many government medical universities are unfilled, indicating a serious staffing shortage. At the highest echelons, where there is a 65% vacancy rate for professor jobs, the shortage is particularly severe. Basic courses including as anatomy, physiology, and pharmacology have a particularly high teacher shortage since they are deemed less monetarily desirable than clinical specialty. The government's emphasis on establishing new medical colleges has frequently overlooked the concomitant demand for qualified teachers, exacerbating the staffing crisis, particularly at newer institutions.³ Almost similar scenario can be seen in our neighbour country India. Though India has the highest number of medical colleges in the world, the system faces acute challenges today relating to quality of training, competencies produced and retention of talent. Medical curricula followed are outdated in most colleges and have not kept pace with epidemiological and technological advances. Pedagogical

focus remains on rote learning rather than building analytical reasoning, hands-on skills or perspectives on social determinants of health. Practical and clinical training are limited by infrastructure and faculty shortages. Regulatory oversight on quality is inconsistent amidst rapid commercialization.⁷ This study revealed predictors of academic performance in medical colleges. Teacher- student ratio and department count initially explained 61% of variance (Step 1), with quality systems (MEU presence, faculty development) increasing explanatory power to 83% (Step 2). The final model, incorporating research output, accounted for 92% of performance variance, with all predictors remaining statistically significant. Previous study revealed that faculty qualifications and the student-teacher ratio are strong predictors of education quality. However, the study also shows that merely having qualified faculty is not sufficient. Institutions with qualified faculty but poor infrastructure and limited research opportunities do not achieve the desired outcomes, indicating that a holistic approach to improving education quality is needed. Universities with higher research output, as measured by publications, citations, and grant funding, tend to perform better across various indicators, including global rankings and student satisfaction.⁸ This study provided detailed information regarding the direct and mediated pathways through which institutional factors influence academic performance in medical colleges. Medical Education Units (MEU) have the largest total impact on performance (0.63), with significant benefits coming both directly and through improved training. More departments help performance directly, also by boosting research, leading to a strong combined effect (0.55). Worse teacher- student ratios hurt performance directly, and by limiting training quality, with a clear negative total effect (-0.46). In Bangladesh, the clinical faculty members perform dual roles as teachers and consultants. The inadequate student to teacher ratio and overwhelming patient load is often challenging for faculties in government medical colleges. Their inability to provide the students with adequate supervision, prompt feedback and constructive criticism are detrimental to a congenial student-faculty relationship. These factors are related to stress in students, indicative of poor learning environment.⁹ Medical Education Units and Departmental diversity show the largest effects ($f^2 > 0.35$), making them top priorities for intervention. Faculty development also demonstrates a strong medium-large impact, supporting its high priority status. While teacher- student ratio and research output are significant, their moderate effect sizes suggest they should be addressed as a part of broader systemic strategy. Most medical schools have established a medical education unit (MEU) or similar bodies in response to various reforms in medical education. Such units have a variety of titles and operate either independently or under the office of the dean. Their activities include conducting educational research, teaching and providing service and career development of academic staff. The scope of their activities ranges from serving medical faculty only to all other health professionals at either the undergraduate or postgraduate levels. Several factors contribute to the success of MEUs and their establishment is seen to have a positive effect on their medical school.¹⁰

Conclusion

Older institutions benefit from established systemic infrastructure, whereas newer colleges may gain short-term advantages through favorable staffing patterns. However, sustainable academic excellence appears to depend more on integrated institutional systems than on structural capacity alone. Strategic investment in medical education units, departmental strengthening, and faculty development should therefore be prioritized to enhance performance outcomes in government medical colleges.

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Conflict of Interest

Authors declare no conflict of Interest.

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