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Undergraduate Medical Students' Perceptions of Clinical Teaching Following Implementation of a Structured Clinical Rotation Program: A Cross-Sectional Analysis

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Abstract

Background: Clinical rotations represent a critical phase in undergraduate medical education, enabling students to integrate theoretical knowledge with real-world clinical practice. Despite nationally standardized curricula, the quality and structure of clinical teaching vary substantially across institutions, often resulting in inconsistent learning experiences. To address these challenges, Saidu Medical College implemented a structured clinical rotation program in 2022, emphasizing clearly defined learning objectives, formal orientation, supervised clinical exposure, and competency-based assessment.

Objective: This study aimed to evaluate undergraduate medical students' perceptions of clinical teaching following implementation of the structured clinical rotation program across four core clinical departments and to examine variations in perceptions by department, professional year, and gender.

Methodology: A retrospective cross-sectional secondary analysis was conducted using routine end-of-rotation feedback collected between October and December 2024. A total of 1,377 feedback responses from 357 third-, fourth-, and final-year MBBS students were analyzed. Teaching effectiveness was assessed using the 15-item Clinical Teaching Effectiveness Instrument (CTEI), rated on a five-point Likert scale. Descriptive statistics and Cronbach's alpha were used to assess reliability. A linear mixed-effects model estimated the effects of Department, Professional Year, and Gender while accounting for repeated measures, with Bonferroni-adjusted post-hoc comparisons.

Results: The CTEI demonstrated excellent internal consistency across departments (α = 0.949–0.970). Significant main effects were observed for Department ($p < .001$) and Professional Year ($p < .001$), whereas Gender showed no significant association with perceived teaching effectiveness ($p = .101$). Obstetrics & Gynecology received the highest overall ratings, while Surgery was rated lowest. Final-year students consistently reported more favorable perceptions than junior cohorts.

Conclusion: Undergraduate medical students generally perceived the structured clinical rotation program positively. However, significant variation across departments and professional years highlights the need for targeted faculty development, enhanced supervision, and improved learning opportunities, particularly for junior students and lower-performing departments to ensure more consistent and effective clinical teaching.

Keywords: Clinical rotation, Medical education, Student perception, Structured program.

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Introduction

Clinical rotations, commonly referred to as clerkships, constitute a foundational component of undergraduate medical education, serving as the primary bridge between preclinical learning and clinical practice [1]. During this phase, students are expected to develop core clinical competencies, professional behaviors, and clinical reasoning skills through supervised patient care experiences. However, the structure, supervision quality, and learning opportunities provided during clinical rotations often vary widely across institutions, despite the presence of nationally standardized curricular frameworks [2]. Such variability can significantly influence students' learning experiences and perceived preparedness for independent clinical practice.

In response to these challenges, various clinical placement models have been proposed to optimize learning during clerkships, emphasizing structured learning objectives, consistent supervision, and formal assessment mechanisms [3]. Nevertheless, in many educational settings, clinical teaching remains largely opportunistic, lacking explicit guidance and clearly articulated expectations. This absence of structure can lead to ambiguity regarding learning goals, reduced student engagement, and perceptions of inadequate support, ultimately undermining the educational value of clinical rotations [4].

At Saidu Medical College, the traditional clinical rotation program was historically semi-structured, characterized by inconsistent supervision and limited formal orientation. Student feedback and local studies highlighted dissatisfaction with unclear objectives and uneven learning opportunities, particularly across different departments [5]. Recognizing these shortcomings, the institution undertook a comprehensive reform of its clinical rotation program in 2022. The restructured program introduced mandatory orientation sessions, explicitly defined learning objectives aligned with the "PM&DC Guidelines for the MBBS Curriculum" [6], and structured assessments, including OSCEs for third- and fourth-year students and OSLER for final-year students. These changes were designed to align clinical teaching practices with established recommendations for effective clerkship design, emphasizing clarity of expectations, supervision, and competency-based evaluation [3].

Although the reformed program incorporates key elements of structured clerkships such as defined objectives, active supervision, and formal assessment its effectiveness ultimately depends on students' lived experiences within clinical settings. Student perceptions of clinical teaching provide valuable insights into the strengths and limitations of educational reforms and are increasingly recognized as important indicators of teaching quality and learning environment effectiveness. Instruments such as the Clinical Teaching Effectiveness Instrument (CTEI) have demonstrated strong psychometric properties and are widely used to evaluate clinical teaching behaviors at both individual and departmental levels [7,8,9].

This study aims to examine undergraduate medical students' perceptions of clinical teaching following implementation of the structured clinical rotation program at Saidu Medical College. Using routine end-of-rotation feedback collected in 2024 across four core clinical departments, the study explores overall perceptions of teaching effectiveness and investigates whether these perceptions vary by department, professional year, and gender. By identifying patterns in student feedback, this study seeks to inform ongoing faculty development efforts and contribute to evidence-based improvement of clinical education in similar resource-constrained settings.

Methodology

Study Design

This study employed a retrospective cross-sectional design based on secondary analysis of routinely collected end-of-rotation feedback data from undergraduate medical students. The dataset comprised repeated observations, as each student evaluated multiple clinical departments during the study period. Feedback data were originally collected between October and December 2024 as part of the institution's quality assurance process following implementation of a structured clinical rotation program. A formal research protocol for secondary data analysis was developed in early 2025, and data analysis was conducted after obtaining institutional ethical approval.

Ethics

Ethical approval was granted by the Institutional Ethical Review Board of Saidu Medical College, Swat (Ref. No: 186-ERB/SMC/025). As the study involved retrospective analysis of anonymized data, no direct recruitment or additional informed consent was required at the time of analysis. Students had already provided consent during feedback submission, acknowledging that anonymized responses could be used for educational evaluation and research purposes. Participation in feedback submission was voluntary, confidentiality was ensured, and students were assured that their responses would not affect academic assessment or grading.

Setting

The study was conducted at Saidu Medical College and its affiliated Saidu Teaching Hospital in Swat, Pakistan. Feedback data were obtained from structured clinical rotations conducted in four core clinical departments, Medicine, Surgery, Pediatrics, and Obstetrics & Gynecology during the 2024 academic year. These rotations were part of a restructured clerkship model introduced in 2022, emphasizing predefined learning objectives, orientation sessions, supervised clinical exposure, and formal assessment.

Participants

The study population included all third-, fourth-, and final-year MBBS students who completed clinical rotations in the four selected departments during 2024. First- and second-year students were excluded, as formal clinical rotations commence in the third year at the institution. A total of 357 unique students contributed feedback, generating 1,377 evaluative responses. Although each student was expected to submit feedback for all four departments, participation was voluntary, and 15 students (4.2%) provided fewer than four evaluations. These incomplete responses were retained for analysis to maximize data utilization.

Variables

The primary outcome variable was students' perceived quality of clinical teaching, measured using the 15-item Clinical Teaching Effectiveness Instrument (CTEI) [7]. The CTEI assesses multiple dimensions of clinical teaching, including learning environment, supervision, feedback, clarity of expectations, and promotion of clinical reasoning. Responses were recorded on a five-point Likert scale ranging from 1 (Never/Poor) to 5 (Always/Superb), with higher scores indicating more favorable perceptions [8,9]. Independent variables included clinical department, professional year (third, fourth, final year), and gender. The instrument was administered in English, the standard language of instruction at the institution.

Data Sources/Measurement

Data were collected electronically using Google Forms at the completion of each clinical rotation. Completed forms were exported into Microsoft Excel, merged into a master dataset, and subsequently prepared for analysis. Likert-scale responses were numerically coded from 1 to 5. Prior to analysis, all personally identifiable information was removed to ensure anonymity. The cleaned dataset was securely stored on institutional servers in accordance with data protection protocols.

Bias

As a retrospective study relying on self-reported data, the analysis is subject to inherent limitations, including self-report and social desirability bias [10]. Although anonymity and voluntary participation were emphasized to minimize these effects, students' perceptions may still have been influenced by contextual or interpersonal factors [11]. Feedback was collected immediately following rotations, reducing long-term recall bias; however, selective recall of specific experiences cannot be entirely excluded. Additionally, voluntary participation introduces the possibility of selection bias, although inclusion of all available responses aimed to mitigate systematic exclusion.

Study Size

The final dataset consisted of 1,377 feedback responses contributed by 357 undergraduate medical students across four clinical departments. This sample size was determined by the total number of completed evaluations available during the study period rather than a priori power calculation, which is appropriate for secondary analysis of routinely collected educational data.

Quantitative Variables

Quantitative variables included individual item scores and overall mean scores derived from the 15-item CTEI. These continuous variables, based on Likert-scale responses, were treated as approximately interval-level data for the purpose of statistical analysis, consistent with established practices in medical education research.

Statistical Methods

Data analysis was performed using IBM SPSS Statistics version 26. Descriptive statistics, including means, standard deviations, and frequencies, were calculated to summarize student perceptions across departments, professional years, and gender. Internal consistency reliability of the CTEI was assessed using Cronbach's alpha for each department and for the overall dataset.[12] Given the repeated-measures structure where each student provided evaluations for multiple departmentsa linear mixed-effects model was employed. This model included a random intercept for each student to account for within-subject correlation. Fixed effects included Department, Professional Year, Gender, and all two-way interactions. The model was estimated using restricted maximum likelihood (REML). Model assumptions, including normality of residuals and homogeneity of variance, were assessed and deemed acceptable. Type III tests were used to evaluate fixed effects, and Bonferroni-adjusted pairwise comparisons of estimated marginal means were conducted for significant effects. Statistical significance was set at $p < 0.05$. The

mixed-effects approach allowed inclusion of incomplete cases under the assumption that data were missing at random.

Results

Participants

The analysis included end-of-rotation feedback from undergraduate medical students enrolled in third, fourth, and final year MBBS programs who completed clinical rotations during 2024. A total of 357 unique students contributed feedback, generating 1,377 evaluative responses across four core clinical departments. While complete feedback from all four departments was expected from each student, participation was voluntary. Consequently, 15 students (4.2%) submitted fewer than four evaluations, resulting in 51 missing departmental responses. These incomplete responses were retained to preserve the representativeness of the dataset. Of the total responses, 80.0% were submitted by male students and 20.0% by female students. By professional year, responses were distributed as 36.5% from third-year students, 33.4% from fourth-year students, and 30.1% from final-year students (Table 01).

Descriptive Data

Feedback responses were evenly distributed across the four departments, Medicine, Surgery, Pediatrics, and Obstetrics & Gynecology each contributing approximately one-quarter of the total responses. Within each department, the proportional distribution by gender and professional year closely mirrored the overall student composition, indicating consistency in participation across rotations. This balanced distribution supports meaningful comparison of student perceptions across departments and academic levels, minimizing the risk that observed differences were driven by uneven representation.

Outcome Data

Students' perceptions of clinical teaching effectiveness were assessed using the 15-item Clinical Teaching Effectiveness Instrument (CTEI). Department-level mean scores ranged from 3.07 to 3.85 on the five-point Likert scale, indicating overall moderate to favorable perceptions of the structured clinical rotation program. Obstetrics & Gynecology achieved the highest overall mean score (3.85), while Surgery received the lowest (3.07). Medicine and Pediatrics demonstrated intermediate mean scores (3.33 and 3.32, respectively) (Table 02).

The internal consistency of the CTEI was excellent across all departments, with Cronbach's alpha values ranging from 0.949 to 0.970 and an overall alpha of 0.951. These findings confirm strong reliability of the instrument and support aggregation of item scores to represent overall perceived teaching effectiveness.

At the item level, aspects such as creating a supportive learning environment, providing clear expectations, and asking stimulating questions consistently received moderate to high ratings across departments. In contrast, the Surgery department received comparatively lower ratings on items related to time management for teaching, provision of periodic feedback, stimulation of independent learning, and opportunities to perform level-appropriate clinical tasks. Obstetrics & Gynecology demonstrated consistently higher item-level scores across nearly all teaching domains (Table 03).

Main Results

A linear mixed-effects model was used to evaluate the association of Department, Professional Year, and Gender with perceived teaching effectiveness while accounting for repeated measures from individual students. The analysis revealed a statistically significant main effect of Department ($F(3, 1359) = 22.97$, $p < .001$), indicating that students' evaluations differed meaningfully across clinical departments. Professional Year also showed a significant main effect ($F(2, 1359) = 19.25$, $p < .001$), with final-year students reporting higher teaching effectiveness compared to third- and fourth-year students. Gender was not significantly associated with perceived teaching effectiveness ($F(1, 1359) = 2.69$, $p = .101$).

A significant interaction between Department and Professional Year was observed ($F(6, 1359) = 2.14$, $p = .046$) (Table 04), suggesting that differences between professional years varied by department. Post-hoc comparisons with Bonferroni adjustment showed that Obstetrics & Gynecology was rated significantly higher than Medicine, Surgery, and Pediatrics, while no significant differences were observed among the latter three departments (Table 05).

Final-year students rated their clinical teaching experiences significantly higher than both third- and fourth-year students, whereas perceptions did not differ significantly between third- and fourth-year students.

These findings indicate that while students generally perceived the structured clinical rotation program positively, meaningful variation exists across departments and stages of training, with senior students reporting more

favorable experiences and certain departments outperforming others in perceived teaching effectiveness.

Table 1: Distribution of feedback responses by department, gender, and professional year.

Department	Gender		Professional Year			Total n (%)
	Male n (%)	Female n (%)	Third Year n (%)	Fourth Year n (%)	Final Year n (%)	
Medicine	276 (80.0)	69 (20.0)	125 (36.2)	115 (33.3)	105 (30.4)	345 (25.1)
Surgery	276 (80.0)	69 (20.0)	130 (37.7)	115 (33.3)	100 (29.0)	345 (25.1)
Pediatrics	277 (80.1)	69 (19.9)	125 (36.1)	116 (33.5)	105 (30.3)	346 (25.1)
Obstetrics & Gynecology	273 (80.1)	68 (19.9)	122 (35.8)	114 (33.4)	105 (30.8)	341 (24.8)
Total	1,102 (80.0)	275 (20.0)	502 (36.5)	460 (33.4)	415 (30.1)	1,377 (100)

'n' represents the number of feedback responses. While most students completed evaluations for all four departments, a small number of students (8 in the 3rd year, 2 in the 4th year, 5 in the final year) provided fewer than four responses.

Table 2: Department-level overall mean scores and Cronbach's α for the 15-item Clinical Teaching Effectiveness Instrument (CTEI).

Department	Mean Score	Cronbach's α
Medicine	3.33	0.949
Surgery	3.07	0.97
Pediatrics	3.32	0.954
Obstetrics & Gynecology	3.85	0.962
Overall	3.39	0.951

Table 3: Item-level mean scores and standard deviations of student perceptions across departments.

Item	Medicine	Surgery	Pediatrics	Obstetrics & Gynecology	Overall
Creating a good learning environment	3.38 ± 1.04	3.08 ± 1.17	3.40 ± 0.97	3.87 ± 1.06	3.43 ± 1.10
Stimulating me to learn independently	3.17 ± 1.15	2.90 ± 1.17	3.16 ± 1.08	3.84 ± 1.07	3.27 ± 1.17
Allowing me to perform level-appropriate tasks	3.34 ± 1.14	2.97 ± 1.24	3.25 ± 1.07	3.80 ± 1.09	3.34 ± 1.17
Managing time for both teaching and patient care	3.25 ± 1.10	2.95 ± 1.25	3.34 ± 1.04	3.82 ± 1.12	3.34 ± 1.17
Giving periodic feedback (compliments or criticisms)	3.12 ± 1.12	2.93 ± 1.22	3.23 ± 1.05	3.86 ± 1.07	3.28 ± 1.17
Providing clear expectations during clinical rotation	3.40 ± 1.07	3.13 ± 1.19	3.39 ± 1.02	3.96 ± 1.01	3.47 ± 1.11
Adjusting teaching to students' needs	3.40 ± 1.10	3.11 ± 1.22	3.40 ± 1.03	3.95 ± 1.02	3.46 ± 1.14
Asking stimulating questions	3.44 ± 1.08	3.14 ± 1.14	3.46 ± 0.97	3.97 ± 1.00	3.50 ± 1.09
Giving clear explanations for opinions/suggestions	3.46 ± 1.06	3.21 ± 1.16	3.40 ± 1.08	3.97 ± 1.02	3.51 ± 1.12
Adjusting teaching in varying places (bedside, OT, etc.)	3.40 ± 1.16	3.11 ± 1.24	3.39 ± 1.09	3.84 ± 1.05	3.43 ± 1.17
Supervising clinical skills/techniques	3.33 ± 1.17	2.98 ± 1.23	3.26 ± 1.13	3.69 ± 1.16	3.32 ± 1.20
Using study/practical guides in teaching	3.23 ± 1.10	3.08 ± 1.21	3.18 ± 1.14	3.82 ± 1.07	3.33 ± 1.17
Teaching diagnostic reasoning	3.39 ± 1.05	3.20 ± 1.21	3.42 ± 1.09	3.91 ± 1.07	3.48 ± 1.13
Teaching effective communication skills	3.34 ± 1.08	3.18 ± 1.20	3.36 ± 1.04	3.77 ± 1.11	3.41 ± 1.13
Using cost-effective healthcare principles	3.24 ± 1.13	3.07 ± 1.21	3.21 ± 1.11	3.70 ± 1.18	3.30 ± 1.18

Values are given as mean ± SD

Table 4: Type III tests of fixed effects on overall mean CTEI scores.

Source	Numerator df	Denominator df	F	p
Department	3	1359	22.97	< 0.001*
Professional Year	2	1359	19.25	< 0.001*
Gender	1	1359	2.69	0.101
Department × Professional Year	6	1359	2.14	0.046
Department × Gender	3	1359	1.75	0.155
Professional Year × Gender	2	1359	0.36	0.702

*Significant at $p<0.05$

Table 5: Pairwise comparisons of overall mean CTEI scores with Bonferroni adjustment.

Departmental Comparisons					
(I) Department	**(J) Department**	**Mean Difference (I-J)**	**SE**	**p-value**	**95% CI**
Obstetrics & Gynecology	Medicine	0.47*	0.08	<0.001*	(0.25, 0.69)
Obstetrics & Gynecology	Surgery	0.66*	0.08	<0.001*	(0.44, 0.88)
Obstetrics & Gynecology	Pediatrics	0.49*	0.08	<0.001*	(0.27, 0.71)
Medicine	Surgery	0.19	0.08	0.127	(-0.03, 0.41)
Pediatrics	Surgery	0.17	0.08	0.244	(-0.05, 0.39)
Medicine	Pediatrics	0.02	0.08	1.000	(-0.20, 0.24)
Professional Year Comparisons					
(I) Professional Year	**(J) Professional Year**	**Mean Difference (I-J)**	**SE**	**p**	**95% CI**
Final Year	Third Year	0.38*	0.07	<0.001*	(0.20, 0.55)
Final Year	Fourth Year	0.42*	0.07	<0.001*	(0.25, 0.60)
Third Year	Fourth Year	0.05	0.07	1.000	(-0.12, 0.21)

*Significant at $p < 0.05$. Positive mean differences indicate the first group rated higher than the second group.

Table 6: Item-level Comparison of mean scores and standard deviations of student perceptions across Professional Years.

Item	**3rd Year (Mean ± SD)**	**4th Year (Mean ± SD)**	**Final Year (Mean ± SD)**	**p-value**
Creating a good learning environment	3.24 ± 1.11	3.33 ± 1.09	3.78 ± 0.99	<0.001*
Stimulating independent learning	3.20 ± 1.12	3.14 ± 1.21	3.49 ± 1.15	<0.001*
Allowing level-appropriate clinical tasks	3.28 ± 1.15	3.18 ± 1.19	3.58 ± 1.15	<0.001*
Managing time for both teaching and patient care	3.19 ± 1.16	3.23 ± 1.18	3.63 ± 1.13	<0.001*
Giving periodic feedback	3.23 ± 1.13	3.15 ± 1.20	3.49 ± 1.16	<0.001*
Providing clear expectations	3.36 ± 1.13	3.35 ± 1.09	3.73 ± 1.09	<0.001*
Adjusting teaching to students' needs	3.38 ± 1.16	3.34 ± 1.14	3.70 ± 1.07	<0.001*
Asking stimulating questions	3.35 ± 1.09	3.40 ± 1.08	3.78 ± 1.06	<0.001*
Giving clear explanations	3.36 ± 1.15	3.40 ± 1.11	3.81 ± 1.02	<0.001*
Adjusting teaching in varying places	3.38 ± 1.16	3.24 ± 1.18	3.71 ± 1.11	<0.001*
Supervising clinical skills	3.25 ± 1.20	3.16 ± 1.21	3.56 ± 1.16	<0.001*
Using study or practical guides	3.25 ± 1.16	3.19 ± 1.18	3.59 ± 1.11	<0.001*
Teaching diagnostic reasoning	3.28 ± 1.16	3.35 ± 1.12	3.86 ± 1.01	<0.001*
Teaching communication skills	3.33 ± 1.12	3.30 ± 1.14	3.62 ± 1.09	<0.001*
Using cost-effective healthcare principles	3.14 ± 1.19	3.19 ± 1.14	3.63 ± 1.15	<0.001*

*Significant at $p < 0.05$.

Table 7: Overall mean CTEI scores by department and professional year.

Professional Year	Medicine	Surgery	Pediatrics	Obstetrics & Gynecology	Overall
Third Year	3.29 ± 0.72	2.87 ± 1.01	3.27 ± 0.83	3.70 ± 0.95	3.28 ± 0.93
Fourth Year	3.04 ± 0.89	3.00 ± 0.96	3.18 ± 0.84	3.85 ± 0.82	3.26 ± 0.94
Final Year	3.70 ± 0.80	3.39 ± 0.99	3.54 ± 0.78	4.04 ± 0.77	3.67 ± 0.87
Overall	3.33 ± 0.84	3.07 ± 1.01	3.32 ± 0.83	3.85 ± 0.87	3.39 ± 0.93

Values are given as mean ± SD

Discussion

This study examined undergraduate medical students' perceptions of clinical teaching following the implementation of a structured clinical rotation program across four core departments at a public-sector medical college in Pakistan. Overall, the findings indicate that students perceived the structured rotation program positively, with high internal consistency of feedback responses and meaningful variation across departments and professional years. These results align with existing literature demonstrating that the quality of clinical teaching is strongly influenced by the organization of clerkships, supervision quality, and clarity of learning objectives [2,3,13].

The Clinical Teaching Effectiveness Instrument (CTEI) demonstrated excellent internal consistency across all departments (α = 0.949–0.970), supporting its reliability in this context and justifying the aggregation of item scores to represent overall perceived teaching effectiveness [7,12]. These findings are consistent with previous validation studies reporting strong psychometric properties of the CTEI across diverse educational settings [8,9]. While very high Cronbach's alpha values may sometimes suggest item redundancy, in this context they primarily reflect consistent student perceptions across multiple teaching domains, reinforcing confidence in the observed departmental and year-wise differences.

Significant variation was observed across departments, with Obstetrics & Gynecology consistently receiving the highest ratings and Surgery the lowest. Lower scores in Surgery were particularly evident for items related to supervision, feedback, time management for teaching, and opportunities for hands-on, level-appropriate clinical tasks. These findings echo international literature suggesting that high clinical workload, unpredictable schedules, and service-oriented priorities in surgical settings can limit structured teaching opportunities and student engagement [2,14].

In contrast, the consistently higher ratings for Obstetrics & Gynecology suggest a learning environment characterized by clearer expectations, active engagement, and effective supervision. Students particularly valued interactive teaching behaviors such as asking stimulating questions and providing clear explanations—qualities repeatedly identified as core attributes of effective clinical teachers [15]. Medicine and Pediatrics demonstrated intermediate scores, indicating generally satisfactory teaching experiences but also highlighting opportunities for further enhancement.

Professional year emerged as a significant determinant of perceived teaching effectiveness, with final-year students consistently rating clinical teaching more favorably than third- and fourth-year students across all CTEI items. This pattern has been reported in previous studies, where senior students demonstrate greater appreciation of clinical teaching due to increased clinical exposure, confidence, and ability to contextualize learning within patient care [16,17].

The most pronounced differences were observed in cognitively demanding domains such as clinical reasoning, diagnostic thinking, and integration of knowledge. Junior students may struggle to fully recognize the value of teaching in these areas due to limited clinical experience and difficulty applying theoretical knowledge in complex clinical contexts [16,18]. Interestingly, ratings from third- and fourth-year students were largely comparable, with a notable shift occurring only in the final year, reflecting the transition toward greater clinical responsibility and professional identity formation [19,20].

The significant Department × Professional Year interaction further highlights that junior students face greater challenges in certain rotations particularly Surgery while departments such as Obstetrics & Gynecology appear more developmentally responsive across all training levels. Departments demonstrating smaller gaps between junior

and senior students may offer important insights into effective scaffolding, supervision, and orientation practices [21,22].

These findings underscore the importance of tailoring clinical teaching to learners' developmental stages. For junior students, explicit modeling of clinical reasoning, structured case-based discussions, and closely supervised clinical tasks may enhance engagement and perceived learning value [23-25]. Departments with consistently higher ratings may serve as internal benchmarks, offering strategies that can be adapted to improve learning environments in lower-performing rotations. Faculty development initiatives focused on feedback provision, supervision, and protected teaching time are likely to yield substantial educational benefits [2,15].

Limitations

Several limitations should be considered when interpreting these findings. First, the study relied on self-reported student perceptions, which may not directly reflect objective measures of clinical competence. Perception-based evaluations, while valuable, should ideally be complemented by objective assessments of learning outcomes. Second, the retrospective cross-sectional design and absence of pre-reform baseline data limit causal inference. Although findings reflect student perceptions following implementation of the structured rotation program, they cannot definitively attribute observed outcomes to the reform itself rather than contextual or temporal factors. Longitudinal studies comparing pre- and post-implementation data would strengthen causal conclusions. Third, although the majority of students completed evaluations for all departments, a small proportion provided incomplete feedback. While mixed-effects modeling accounted for missing data under the assumption of missing at random, unmeasured factors influencing non-response may have introduced residual bias. Fourth, while the CTEI demonstrated excellent reliability, its use assumed construct validity within the Pakistani context without formal local validation or testing for measurement invariance. Differences between groups should therefore be interpreted cautiously, as they may partly reflect differential interpretation of items rather than true variation in teaching quality. Finally, this was a single-institution study conducted at a public-sector medical college in Khyber Pakhtunkhwa, Pakistan. The gender imbalance in the sample and institutional context may limit generalizability to other settings, including private institutions or medical schools with different resource profiles and teaching cultures.

Conclusion

This study provides a comprehensive analysis of undergraduate medical students' perceptions of clinical teaching following implementation of a structured clinical rotation program. The findings demonstrate that student feedback was highly reliable and that overall perceptions of clinical teaching were favorable. However, significant variation across departments and professional years highlights persistent disparities in learning experiences.

Surgery emerged as a department requiring targeted educational support, particularly for junior students, while Obstetrics & Gynecology exemplified a consistently effective teaching environment across training levels. Final-year students reported significantly more positive perceptions than their junior counterparts, emphasizing the importance of developmentally appropriate teaching strategies. These findings underscore the need for ongoing faculty development, improved supervision, and structured learning opportunities tailored to students' stage of training. Future research should incorporate longitudinal designs, objective outcome measures, and qualitative approaches to more fully evaluate the impact of structured clinical rotation reforms and to guide evidence-based improvement of undergraduate clinical education.

Authors' Contributions:

All authors meet the ICMJE criteria for authorship.

Author 1: Substantial contribution to conception and design, drafting the manuscript, final approval, agreed to be accountable for all the work.
Author 2: Substantial contribution to conception and design, data acquisition, drafting the manuscript, final approval, agreed to be accountable for all the work.

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