

Research Article

# Association between Undergraduate Medical Education Factors and Self-Reported Quality of Patient Care among Junior Doctors in Tertiary Care Hospitals

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## ABSTRACT

**Background:** Undergraduate medical education (UME) shapes the knowledge, skills, professional behaviours, and preparedness of doctors entering clinical practice. However, evidence linking specific UME factors with the quality of patient care reported by junior doctors in Pakistan remains limited.

**Objective:** To assess the association between key UME factors and self-reported quality of patient care among junior doctors working in tertiary care hospitals.

**Methods:** This cross-sectional analytical study included 425 house officers, postgraduate trainees, and medical officers who had graduated within the preceding five years and were recruited consecutively from tertiary care hospitals between January and June 2026. A structured questionnaire assessed ten UME domains and five patient-care quality domains using five-point Likert scales. Associations were examined using Spearman correlation, group differences using Welch's t-test and one-way ANOVA, and independent predictors using multiple linear and binary logistic regression adjusted for age, gender, designation, college type, and curriculum type.

**Results:** Perceived preparedness was moderate across all UME domains (mean scores 3.45-3.53), whereas the mean self-reported patient-care quality score was  $4.13 \pm 0.52$ ; 63.1% of respondents were classified in the good-care category. All ten UME domains were positively correlated with total care quality (Spearman  $\rho = 0.597-0.666$ ; all  $p < 0.001$ ). The linear regression model explained 83.7% of the variance in care quality (adjusted  $R^2 = 0.83$ ). Interprofessional learning, ethics and professionalism, teaching methods, and clinical exposure showed the largest standardized coefficients. Unadjusted care-quality scores did not differ significantly by gender, designation, college type, or curriculum type.

**Conclusion:** UME factors were consistently associated with self-reported patient-care quality. Interprofessional learning, ethics and professionalism, teaching methods, and clinical exposure emerged as prominent predictors. Strengthening these areas may improve graduates' preparedness and support safer, more patient-centred care.

**Keywords:** Undergraduate Medical Education, Patient Care Quality, Tertiary Care Hospitals, Clinical Competence, Patient Safety, Pakistan.

## INTRODUCTION

Undergraduate medical education (UME) provides the knowledge, clinical skills, attitudes, and professional behaviours that

form the foundation of medical practice. Internationally, health-professions education has increasingly moved toward competency-based, team-oriented curricula that respond

more directly to patient and health-system needs [1]. This emphasis is relevant because the quality and safety of care depend not only on individual knowledge and skills but also on the systems and processes within which clinicians work [2]. Junior doctors constitute an important part of the workforce in tertiary hospitals, yet evidence suggests that newly qualified doctors may feel insufficiently prepared for some aspects of clinical practice [3]. Educational performance may also have implications beyond graduation. Scores on a national clinical-skills examination have been associated with subsequent complaints to medical regulatory authorities [4], while differences in patient outcomes have been reported among graduates of different residency programmes [5]. Communication training is similarly relevant because effective doctor-patient communication is associated with improved health outcomes [6]. In addition, simulation-based education with deliberate practice has demonstrated advantages over traditional clinical education for the acquisition of selected clinical skills [7].

Medical students are also influenced by the hidden curriculum, including institutional culture, assessment practices, role modelling, and the broader learning environment [8]. The World Health Organization has therefore promoted multi-professional patient-safety education as part of health-professions training [9]. In Pakistan, the rapid expansion of medical colleges has generated concern regarding the consistency and quality of undergraduate medical education. Qualitative work involving inspectors and medical educationists has identified commercialisation, weak regulatory capacity, limited accreditation standards, and shortages of appropriately trained inspectors as important challenges [10]. A subsequent review also described concerns regarding variability in graduate standards, although direct evidence linking undergraduate training quality with later clinical performance in Pakistan remains limited [11]. Taken together, the available literature indicates that undergraduate training influences preparedness [3], that educational and professional competencies may be associated with later clinical performance [4-6], and that local quality-assurance concerns warrant further empirical evaluation [10,11].

A systematic evaluation of the relationship between UME factors and the quality of care reported by recent graduates in Pakistani tertiary care hospitals is therefore needed. Unlike staffing levels or hospital infrastructure,

many educational factors are potentially modifiable through curriculum design, teaching methods, assessment, faculty development, and learning-environment reform. Identifying the domains most strongly associated with care quality may help medical colleges and teaching hospitals prioritise educational improvements and strengthen feedback between undergraduate training and early clinical practice. Accordingly, this study aimed to determine the UME factors associated with self-reported quality of patient care among junior doctors working in tertiary care hospitals in Lahore and Islamabad.

The specific objectives were to assess perceived preparedness across ten UME domains (curriculum, clinical exposure, teaching methods, assessment, communication, ethics and professionalism, patient safety, faculty, learning environment, and interprofessional learning); measure self-reported patient-care quality; examine associations between UME domains and care quality; determine whether these associations persisted after adjustment for age, gender, designation, college type, and curriculum type; and identify evidence-based priorities for educational improvement. The null hypothesis was that no UME domain would be significantly associated with patient-care quality, whereas the alternative hypothesis was that at least one UME domain would show a significant association. A secondary hypothesis was that at least one UME domain would independently predict care quality after adjustment for the prespecified covariates.

## METHODS

This cross-sectional analytical study was conducted in tertiary care teaching hospitals in Lahore and Islamabad from January to June 2026. Eligible participants were house officers, postgraduate trainees, and medical officers who had obtained an MBBS degree from a Pakistani medical college within the previous five years, had worked in the participating hospital for at least three months, and provided written informed consent. Doctors who had graduated from medical schools outside Pakistan and respondents with incomplete questionnaires were excluded.

The sample size was calculated at a 95% confidence level ( $Z = 1.96$ ), using an expected proportion of 50% ( $p = 0.50$ ) and a 5% margin of error ( $d = 0.05$ ), which yielded a minimum sample of 385 participants [12]. After allowing 10% for non-response, the target sample was

428. Participants were recruited by consecutive non-probability sampling and distributed proportionately across participating hospitals and designations. Data were collected using a structured, self-administered questionnaire with three sections. The first section recorded age, gender, hospital, designation, years since graduation, medical-college type (public/private), curriculum type (traditional/integrated), and department. The second assessed three to five items across ten UME domains: curriculum, clinical exposure, teaching methods, assessment, communication, ethics and professionalism, patient safety, faculty, learning environment, and interprofessional learning. The third assessed five patient-care domains: clinical reasoning, procedural skills, communication, patient safety, and teamwork. All items were rated on a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). Items were adapted from relevant literature and established educational-environment instruments, including the Dundee Ready Education Environment Measure (DREEM) [13], which has been validated in Pakistan [14], and the Postgraduate Hospital Educational Environment Measure (PHEEM) [15]. Content validity was reviewed by medical educationists and senior clinicians. The questionnaire was pilot-tested among 20-30 doctors who were excluded from the final analysis, and internal consistency was assessed using Cronbach's alpha, with values  $\geq 0.70$  considered acceptable [16]. Domain scores were calculated as the mean of their constituent items. The overall patient-care quality score was calculated as the mean of the five care items and categorised as poor ( $<3.0$ ), moderate ( $3.0-3.99$ ), or good ( $\geq 4.0$ ). After permission from the participating hospitals, eligible doctors were approached in their departments, the study purpose was explained, and written informed consent was obtained. Questionnaires were completed anonymously using coded identifiers and were checked for completeness at collection. Ethical approval was obtained from the relevant Institutional Review Board before data collection. Participation was voluntary, withdrawal was permitted at any stage, personal identifiers were not collected, and data were stored securely for research purposes in accordance with the Declaration of Helsinki.

Data were analysed using R software (version 4.6.1). Continuous variables were summarised as mean  $\pm$  standard deviation (SD), and categorical variables as frequencies and percentages. For the first objective, preparedness in each UME domain was described using mean scores, SDs, and the proportions of respondents who agreed (score  $\geq 4$ ) or disagreed (score  $< 3$ ). Patient-care domain scores and the total care-quality score were summarised similarly. Normality of the total care-quality score was assessed using the Shapiro-Wilk test.

Spearman rank correlation was used to examine associations between each UME domain and total patient-care quality because the total care-quality score was not normally distributed and the underlying items were ordinal. Care-quality scores were compared by gender, college type, and curriculum type using Welch's t-test, and by designation using one-way ANOVA. Multiple linear regression was performed with total patient-care quality as the outcome and the ten UME domains, age, gender, designation (dummy-coded with house officer as the reference category), college type, and curriculum type as predictors. Unstandardised coefficients (B), standardised coefficients ( $\beta$ ), and 95% confidence intervals (CIs) were reported. Multicollinearity was assessed using variance inflation factors (VIFs), residual independence using the Durbin-Watson statistic, and residual distribution through model diagnostics. Binary logistic regression was additionally performed for good care (score  $\geq 4.0$ ) versus poor/moderate care, with adjusted odds ratios (aORs) and 95% CIs reported. All tests were two-tailed, and  $p < 0.05$  was considered statistically significant.

## RESULTS

A total of 425 doctors completed the questionnaire and were included in the analysis. The mean age was  $26.5 \pm 2.9$  years, and the mean time since graduation was  $1.9 \pm 2.0$  years. House officers comprised 59.1% of the sample, followed by postgraduate trainees (27.5%) and medical officers (13.4%). Overall, 55.5% had graduated from public medical colleges and 44.5% from private colleges; 56.9% had studied a traditional curriculum and 43.1% an integrated curriculum (Table 1).

Table 1. Characteristics of the Respondents (N = 425)

| Characteristic         | n (%) / mean $\pm$ SD |
|------------------------|-----------------------|
| Age (years)            | 26.5 $\pm$ 2.9        |
| Years since graduation | 1.9 $\pm$ 2.0         |
| Gender                 |                       |
| Male                   | 211 (49.6)            |
| Female                 | 214 (50.4)            |
| Designation            |                       |
| House officer          | 251 (59.1)            |
| PG trainee             | 117 (27.5)            |
| Medical officer        | 57 (13.4)             |
| College type           |                       |
| Public                 | 236 (55.5)            |
| Private                | 189 (44.5)            |
| Curriculum type        |                       |
| Traditional            | 242 (56.9)            |
| Integrated             | 183 (43.1)            |

Perceived preparedness was moderate across all ten UME domains. Mean domain scores ranged from 3.45 for curriculum to 3.53 for faculty and teaching methods (Table 2, Figure

1). The proportion of respondents scoring  $\geq 4$  ranged from 22.8% to 27.5%, whereas the proportion scoring  $< 3$  ranged from 18.8% to 24.9%.

Table 2. Perceived Preparedness by UME Domain and Its Spearman Correlation with Total Patient Care Quality Score

| UME domain                 | Mean | SD   | % Agree ( $\geq 4$ ) | % Disagree ( $< 3$ ) | Spearman $\rho$ | p         |
|----------------------------|------|------|----------------------|----------------------|-----------------|-----------|
| Faculty                    | 3.53 | 0.71 | 27.5                 | 20.7                 | 0.649           | $< 0.001$ |
| Teaching methods           | 3.53 | 0.68 | 26.1                 | 20.0                 | 0.657           | $< 0.001$ |
| Interprofessional learning | 3.51 | 0.74 | 27.3                 | 21.6                 | 0.653           | $< 0.001$ |
| Assessment                 | 3.51 | 0.72 | 26.8                 | 20.7                 | 0.664           | $< 0.001$ |
| Communication              | 3.49 | 0.67 | 25.2                 | 18.8                 | 0.624           | $< 0.001$ |
| Clinical exposure          | 3.48 | 0.69 | 24.9                 | 24.9                 | 0.654           | $< 0.001$ |
| Patient safety             | 3.48 | 0.67 | 25.9                 | 20.9                 | 0.597           | $< 0.001$ |
| Ethics & professionalism   | 3.48 | 0.69 | 25.6                 | 23.5                 | 0.666           | $< 0.001$ |
| Learning environment       | 3.47 | 0.70 | 26.6                 | 24.0                 | 0.633           | $< 0.001$ |
| Curriculum                 | 3.45 | 0.70 | 22.8                 | 21.2                 | 0.619           | $< 0.001$ |

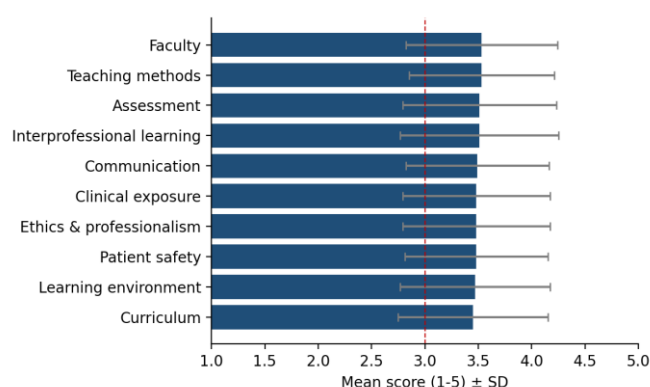


Figure 1. Mean Perceived Preparedness by UME Domain (Error Bars = SD; Dashed Line = Neutral Score Of 3)

The mean total patient-care quality score was  $4.13 \pm 0.52$ . Among individual care domains,

communication had the highest mean score ( $4.15 \pm 0.62$ ), while procedural skills and

teamwork had the lowest mean scores ( $4.12 \pm 0.63$  and  $4.12 \pm 0.64$ , respectively) (Table 3). Overall, 268 respondents (63.1%) were classified in the good-care category, 150 (35.3%) in the moderate category, and 7

(1.6%) in the poor category (Figure 2). The total care-quality score was not normally distributed on the Shapiro-Wilk test ( $p < 0.001$ ); therefore, Spearman rank correlation was used for bivariate associations.

Table 3. Quality of Patient Care Scores by Domain

| Care quality domain | Mean | SD   |
|---------------------|------|------|
| Clinical reasoning  | 4.14 | 0.64 |
| Procedural skills   | 4.12 | 0.63 |
| Communication       | 4.15 | 0.62 |
| Patient safety      | 4.14 | 0.66 |
| Teamwork            | 4.12 | 0.64 |
| Total score         | 4.13 | 0.52 |

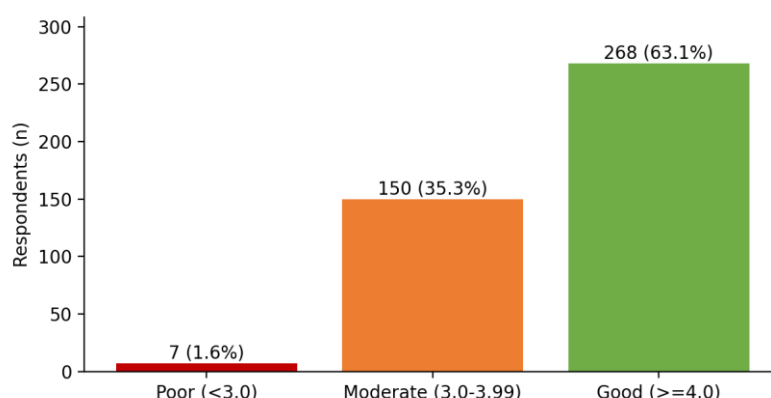


Figure 2. Distribution of Respondents by Patient Care Quality Category

All ten UME domains showed positive, statistically significant correlations with total patient-care quality, with coefficients ranging from  $\rho = 0.597$  for patient safety to  $\rho = 0.666$  for ethics and professionalism (all  $p < 0.001$ ) (Table 2, Figure 3). The composite UME score

was strongly correlated with total care quality ( $\rho = 0.89$ ,  $p < 0.001$ ). In unadjusted comparisons, total care-quality scores did not differ significantly by gender, college type, curriculum type, or designation (all  $p > 0.05$ ) (Table 4).

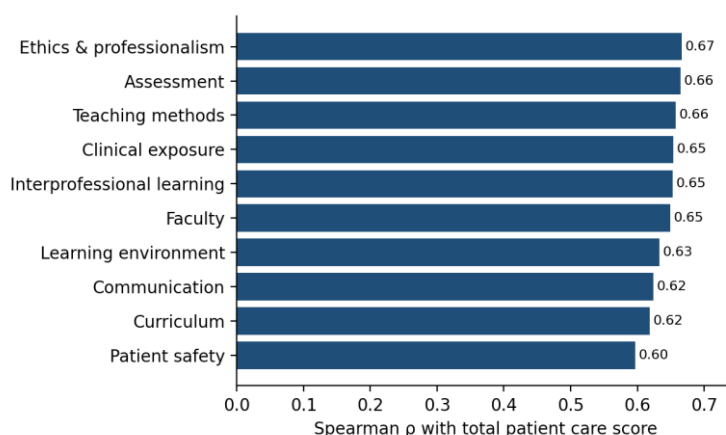


Figure 3. Spearman Correlation Coefficients (P) Between UME Domains and Total Patient Care Score

Table 4. Comparison of Total Patient-Care Quality Scores across Respondent Characteristics

| Variable | Category | n   | Mean $\pm$ SD   | p-value |
|----------|----------|-----|-----------------|---------|
| Gender   | Male     | 211 | $4.13 \pm 0.51$ | 0.891   |

|                 |                 |     |             |       |
|-----------------|-----------------|-----|-------------|-------|
|                 | Female          | 214 | 4.14 ± 0.54 |       |
| College type    | Public          | 236 | 4.11 ± 0.54 | 0.274 |
|                 | Private         | 189 | 4.16 ± 0.50 |       |
| Curriculum type | Traditional     | 242 | 4.12 ± 0.52 | 0.605 |
|                 | Integrated      | 183 | 4.15 ± 0.52 |       |
| Designation     | House officer   | 251 | 4.11 ± 0.53 | 0.293 |
|                 | PG trainee      | 117 | 4.20 ± 0.50 |       |
|                 | Medical officer | 57  | 4.12 ± 0.50 |       |

HO = house officer; PGT = postgraduate trainee; MO = medical officer. p-values are from Welch's t-test for two-group comparisons and one-way ANOVA for designation.

The multiple linear regression model was statistically significant ( $F = 130.82$ ,  $p < 0.001$ ) and explained 83.7% of the variance in patient-care quality (adjusted  $R^2 = 0.83$ ). There was no evidence of problematic multicollinearity (maximum VIF = 3.22), and residuals showed

acceptable independence (Durbin-Watson = 1.83). All ten UME domain scores were significant independent predictors in the linear model. The largest standardised coefficients were observed for interprofessional learning, ethics and professionalism, teaching methods, and clinical exposure. Among the covariates, integrated curriculum type was independently associated with a lower total care-quality score relative to traditional curriculum (Table 5, Figure 4).

Table 5. Multiple Linear and Binary Logistic Regression of Predictors of Patient-Care Quality

| Predictor                                    | B      | Std. $\beta$ | 95% CI (B)       | p      | aOR  | 95% CI (aOR) | p      |
|----------------------------------------------|--------|--------------|------------------|--------|------|--------------|--------|
| Curriculum type: integrated (vs traditional) | -0.172 | -0.164       | -0.215 to -0.130 | <0.001 | 0.25 | 0.11 to 0.52 | <0.001 |
| Interprofessional learning                   | 0.116  | 0.164        | 0.078 to 0.153   | <0.001 | 2.50 | 1.27 to 4.89 | 0.008  |
| Ethics & professionalism                     | 0.122  | 0.162        | 0.082 to 0.162   | <0.001 | 4.42 | 2.03 to 9.60 | <0.001 |
| Teaching methods                             | 0.124  | 0.161        | 0.083 to 0.164   | <0.001 | 3.82 | 1.78 to 8.17 | <0.001 |
| Clinical exposure                            | 0.112  | 0.149        | 0.072 to 0.152   | <0.001 | 3.57 | 1.83 to 6.96 | <0.001 |
| Assessment                                   | 0.091  | 0.125        | 0.052 to 0.131   | <0.001 | 2.76 | 1.33 to 5.75 | 0.007  |
| UME curriculum domain                        | 0.090  | 0.120        | 0.051 to 0.128   | <0.001 | 1.15 | 0.58 to 2.28 | 0.679  |
| Learning environment                         | 0.087  | 0.117        | 0.047 to 0.127   | <0.001 | 2.33 | 1.21 to 4.50 | 0.012  |
| Patient safety                               | 0.081  | 0.105        | 0.041 to 0.122   | <0.001 | 2.80 | 1.38 to 5.70 | 0.005  |
| Faculty                                      | 0.065  | 0.088        | 0.024 to 0.105   | 0.002  | 1.54 | 0.74 to 3.20 | 0.251  |
| Communication                                | 0.064  | 0.083        | 0.022 to 0.106   | 0.003  | 1.55 | 0.74 to 3.23 | 0.247  |
| Age                                          | 0.009  | 0.047        | -0.004 to 0.021  | 0.190  | 1.03 | 0.82 to 1.30 | 0.778  |
| PG trainee (vs HO)                           | -0.044 | -0.038       | -0.118 to 0.030  | 0.244  | 0.63 | 0.17 to 2.35 | 0.495  |
| Medical officer (vs HO)                      | -0.032 | -0.021       | -0.125 to 0.062  | 0.504  | 0.74 | 0.17 to 3.29 | 0.695  |
| College type: private (vs public)            | -0.015 | -0.014       | -0.057 to 0.027  | 0.486  | 0.63 | 0.31 to 1.29 | 0.210  |

|                          |   |   |                 |       |      |              |       |
|--------------------------|---|---|-----------------|-------|------|--------------|-------|
| Gender: female (vs male) | - | - | -0.055 to 0.028 | 0.521 | 0.54 | 0.26 to 1.10 | 0.090 |
|--------------------------|---|---|-----------------|-------|------|--------------|-------|

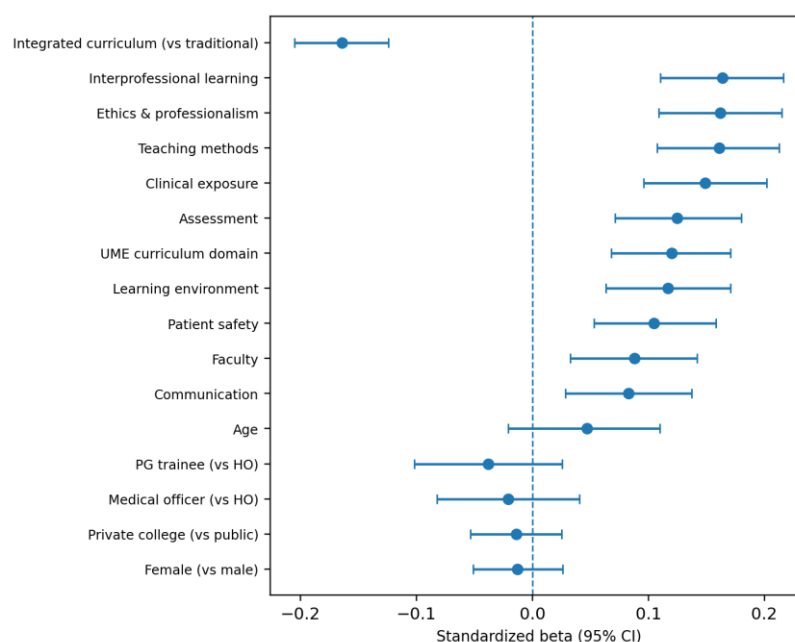


Figure 4. Standardised Regression Coefficients (95% CI) For Predictors of Patient-Care Quality

In the logistic regression model comparing good care (score  $\geq 4.0$ ) with poor/moderate care, clinical exposure, teaching methods, assessment, ethics and professionalism, patient safety, learning environment, and interprofessional learning were independently associated with higher odds of good care. In contrast, the UME curriculum-domain score, faculty score, communication score, age, designation, college type, and gender were not statistically significant in the logistic model (Table 5).

## DISCUSSION

This study examined the association between undergraduate medical education factors and self-reported quality of patient care among junior doctors working in tertiary care hospitals. Graduates reported moderate preparedness across all ten UME domains but relatively high self-rated care quality. Every UME domain was positively correlated with total care quality, and the adjusted linear model explained a large proportion of the observed variance. Interprofessional learning, ethics and professionalism, teaching methods, and clinical exposure showed the largest standardised coefficients. These findings reject the null hypothesis of no association, although the cross-sectional and self-reported design does not permit causal inference.

Perceived preparedness scores were moderate rather than high, with mean domain scores between 3.45 and 3.53 and only 22.8%-27.5% of respondents scoring  $\geq 4$  in individual domains. International evidence has similarly shown that graduates vary in how well prepared they feel for work after qualification [17]. The lower proportions observed in the present study may reflect differences in measurement thresholds, local training conditions, or genuine gaps in preparation. The narrow range of mean scores across domains also suggests that perceived strengths and weaknesses were distributed broadly across the educational experience rather than concentrated in a single area.

By contrast, self-reported patient-care quality was high, with a mean score of  $4.13 \pm 0.52$  and 63.1% of respondents classified in the good-care category. This finding should be interpreted cautiously because self-ratings may differ from externally observed competence [18]. Social desirability and limited insight into one's own performance may contribute to higher self-assessment scores. It is also possible that supervision and workplace learning after graduation partly compensate for gaps in undergraduate preparation; however, this study did not include supervisor ratings or objective hospital-quality indicators and therefore could not test that explanation.

All UME domains were positively associated with care quality, and the composite UME score showed a particularly strong correlation with the outcome ( $p = 0.89$ ). The plausibility of these associations is supported by related literature, although most previous studies have assessed constructs that are not identical to those used here. For example, unprofessional behaviour during medical school has been associated with later disciplinary action [19], supporting the relevance of ethics and professionalism.

Technology-enhanced simulation has also shown positive effects on knowledge, skills, and behaviours, with more variable evidence for patient-related outcomes [20]. Likewise, although interprofessional learning showed one of the largest standardised coefficients in the present model, a Cochrane review found limited and heterogeneous evidence regarding its effects on professional practice and healthcare outcomes [21]. The present findings should therefore be viewed as supportive of further evaluation using objective clinical outcomes rather than as proof of causal effects.

After adjustment for demographic and educational covariates, the UME domains remained independently associated with total care quality in the linear model. Clinical exposure, assessment, patient safety, learning environment, and interprofessional learning also remained significant in the logistic model for good care. The broadly similar effect sizes across several domains may indicate the value of a well-rounded educational programme, but they may also reflect overlap between related constructs. Although multicollinearity diagnostics were acceptable, the very strong composite correlation and common self-report source warrant caution when interpreting the unique contribution of individual domains.

Unadjusted care-quality scores did not differ significantly by gender, designation, college type, or curriculum type. However, integrated curriculum type showed a negative adjusted coefficient in the multivariable models, an unexpected finding that should be interpreted cautiously. Residual confounding, differences in implementation across institutions, graduates' perceptions of newer curricula, or chance may have contributed to this result. Confirmation in larger multicentre studies with institution-level information and objective outcome measures is needed before drawing conclusions about curriculum structure.

The findings have practical implications for medical colleges, teaching hospitals, and

regulators. Medical colleges may strengthen supervised clinical exposure and simulation-based skills training; embed communication, ethics, professionalism, and patient safety longitudinally within assessed curricula; expand structured interprofessional learning with nursing and allied health disciplines; and invest in faculty development and workplace-based assessment. Teaching hospitals can contribute by providing structured feedback to medical colleges regarding graduates' preparedness and early workplace performance. Regulators may also consider graduate preparedness and early-practice outcomes as complementary indicators in accreditation and quality-assurance processes. Because the present design cannot establish causality, any educational reforms based on these findings should be accompanied by prospective evaluation.

This study has several limitations. First, its cross-sectional design identifies associations but cannot establish temporal or causal relationships. Second, preparedness and patient-care quality were reported by the same respondents at the same time, making the results susceptible to common-method variance and potentially inflating the observed correlations [22]. Third, self-reported care quality may not correspond closely to externally observed competence [18]. Fourth, generalisability is limited by the use of consecutive non-probability sampling in a limited number of tertiary hospitals. The questionnaire also requires further psychometric validation, and residual confounding from workload, supervision, previous clinical experience, and institutional factors cannot be excluded. Future research should include a wider range of hospitals and medical colleges, compare curriculum models prospectively, combine self-assessment with supervisor ratings and objective hospital-quality indicators, and validate the instrument using methods such as confirmatory factor analysis. Procedural and statistical approaches to assessing and reducing common-method bias should also be incorporated [22].

## CONCLUSION

Undergraduate medical education factors were consistently associated with self-reported patient-care quality among junior doctors in tertiary care hospitals. Interprofessional learning, ethics and professionalism, teaching methods, and clinical exposure showed the most prominent associations in the adjusted

analysis. Strengthening these areas through competency-based learning, supervised clinical exposure, simulation, assessed communication and patient-safety training, and closer collaboration between medical colleges and teaching hospitals may improve graduates' preparedness and support safer, more patient-centred care. These findings should be confirmed in prospective multicentre studies using objective measures of clinical performance and patient outcomes.

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