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Editorial

# Global Contraction of Research Funding: Implications for Developing Countries

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Research has been a backbone of advancement in developed countries like United States of America (USA). In recent months, discussions in the scientific community have turned to the implications of substantial reductions in research funding in the United States (U.S.). Science News reported that about 5,300 grants from the National Institutes of Health and National Science Foundation were ended or suspended in 2025, drawing public demonstrations calling for restoration of funding.[1] The funding cuts caused widespread, profound disruption across the U.S. research system, affecting projects, people, and institutional operations simultaneously. A recent article in Chemical & Engineering News described the period as 'a huge rupture in everything,' documenting upheaval and staff layoffs across federal research agencies.[2] The result is significant proposed cuts and revised policies affecting grant allocations for both existing and future studies. These shifts have led not only to the suspension of numerous ongoing projects but also the cancellation of planned grants. Researchers are concerned about the sustainability of long-term biomedical, environmental, and technological research programs. This change in policy has disrupted many clinical trials and research initiatives, causing pause of hundreds of studies in different medical fields and impeded the flow of new medical data into the larger evidence base. Although the long-term outcomes of these budgetary adjustments remain uncertain, the immediate concerns raised by scientists and institutions speak to the centrality of sustained research support in maintaining a robust scientific ecosystem.

Although this change is unfolding within the United States, it will have repercussions far beyond its borders. The U.S. research enterprise has historically played a central role in global scientific collaboration. It has provided platform to several students from all over the world, shaping the knowledge networks and enabling cross-border partnerships. Moreover, it has provided foundational data and tools that researchers worldwide rely on and work to build upon. A recent article stated, “With the recent cuts to NIH (National Institutes of Health) funding, the fate of research projects, particularly those involving collaborations with researchers outside the U.S. has been thrown into question”. [3] Reductions in federal grant funding will not only affect the international collaborative networks, but will also hinder multi-institutional initiatives.The opportunities for early-career researchers, keen to engage in high-impact science, will be diminished and in the current era when world is a global village, contractions in one region's funding landscape can have indirect but meaningful consequences for scientific capacity and momentum elsewhere.

Pakistan is the country where research ecosystem faces severe structural and financial constraints. For years, students from this country, as well as from other devloping nations with limited grants and resources, have joined the research institutes in USA to pursue advanced research. Pakistan's investment in the field of research has historically been limited and it is relatively small when compared to the research-

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intensive developed countries. In addition to limited funding several other challenges such as lack of infrastructure and redundant advancement in the field of IT development have been reported.[4] These limitations discourage ambitious, long-term projects. All these challenges contribute to a cycle in which high-quality research is difficult to initiate and sustain, which in turn affects the ability of Pakistani scholars to compete for international recognition and collaboration. In the current situation, with reductions in research funding in major high-income settings, it will be furthermore challenging for global scientific participation. International collaborations will be reshaped by funding uncertainties, resulting in fewer opportunities for partnership and collaboration for the researchers in low-resource settings like Pakistan. The current situation compels the developing countries for proactive strategies to fortify their own research ecosystems.

Although recently a rising surge in research activity was reported by Hussain et al, reflecting a growing emphasis in the field of scientific inquiry and innovation in Pakistan[4,] there is a lot more to be done in this progressive field. A multi-layered approach might help to resolve the issue. It is essential and demand of this era that a resilient research ecosystem is built. This will require a sustained investment, systematic planning, and supportive infrastructure at national and institutional levels. The regulatory bodies should ensure transparent grant mechanisms and multi-year funding cycles. Moreover, a structured mentorship for early-career researchers, and investment in research training and ethics is essential. It is suggested that there should be regional collaborations and shared platforms by private and public sector institutes to help mitigate resource constraints.[5] With the recent shift in the funding landscapes, these efforts become crucial to ensure that developing countries like ours can adapt, innovate, and strengthen their scientific capacity despite external uncertainties. For Pakistan, the challenge lies in shaping internal frameworks that enable future generations of researchers to conduct sustained, impactful research.

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Original Article

# Medical Students' Attitude Towards Doctor-Patient Relationship at HITEC Institute of Medical Sciences Taxila: A Cross-Sectional Study

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## Abstract

**Background:** The doctor-patient relationship is fundamental to healthcare delivery, emphasizing communication, trust, and mutual respect.

**Objective:** To evaluate the attitudes of medical students at HITEC-Institute of Medical Sciences (HITEC-IMS) Taxila towards doctor-centered versus patient-centered care and to determine the association of attitude with age, gender, year of the study, residential status and parental occupation related to the medical field.

**Methodology:** This cross-sectional study was conducted over a six-month period after approval from the institutional review board and included 218 medical students. Patient-Practitioner Orientation Scale (PPOS) was used to assess participants' attitude. SPSS version 28 was used for data analysis. PPOS scores were calculated to determine students' orientation towards patient-centered or doctor-centered care. Chi-square test was used to determine association of attitude with demographic factors.

**Results:** The total number of students that returned the questionnaire were 186 making a response rate of 85.3%. The mean age was 22 ± 1.95 years; 45.7% were female and 54.3% male. Most students resided in urban areas (86%). The overall mean PPOS score was 3.5 ± 0.6, indicating a patient-centered attitude in 71.5% of students. Chi-square tests revealed significant differences in attitudes based on age (p-value = 0.014) and gender (p-value = 0.019), with younger students and female students demonstrating a stronger patient-centered orientation.

**Conclusion:** Most students at HITEC-IMS Taxila exhibited a patient-centered attitude, with higher scores among younger students and females. These findings highlight the need for educational strategies to enhance patient-centered care through communication skills training and empathy development throughout the curriculum.

**Key words:** Patient care, Attitude, Medical students

## Introduction

The doctor-patient relationship is a fundamental aspect of healthcare delivery, with communication, trust, and mutual respect serving as the cornerstone of effective medical practice. Choice, competence, communication, compassion, continuity, and no conflict of interest are the six Cs of a doctor-patient relationship. To keep this relationship going, all six Cs are necessary.[1] The relationship between the physician and the patient involves trust and vulnerability.[2] By entering this relationship, the doctor basically agrees to respect the patient's autonomy, as well as their right to confidentiality, ensu-

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ring optimal standards of healthcare and unwavering support for the patients.[2] World Health Organization describes patient-centered care as the extent to which healthcare services emphasize on meeting the needs and expectations of individuals, rather than solely handling the illness.[3] Effective communication between doctors and patients is vital in establishing a strong doctor-patient relationship. As they move from didactic study to clinical practice, medical students are vital in forming this bond.[4]

Several studies have highlighted the potential benefits of strong doctor-patient relationship. According to a recent study, good communication between patients and doctors increases the likelihood of treatment adherence and leads to improved health outcomes.[5] Recent studies have shed light on the shifting attitudes of medical students toward the doctor-patient relationship, highlighting the importance of empathy, communication skills, and cultural sensitivity in providing quality patient care. According to a recent study medical students who exhibit higher levels of empathy toward patients are more likely to establish a positive rapport and provide better clinical outcomes.[6] The evolving research has confirmed variations in medical students' attitudes toward the doctor-patient relationship across different countries. Researchers have utilized the "Patient Practitioner Orientation Scale (PPOS)", a widely validated and reliable tool to assess the attitude in different settings. Globally, patient-centered care is recognized as a cornerstone of high-quality healthcare, and its emphasis on specific ways to promote patient well-being and health promotion.[7,8] Studies conducted in different regions have demonstrated varying orientations toward patient-centered care, with medical students in Saudi Arabia, Sudan, and Brazil generally exhibiting supportive attitudes toward patient-centeredness, whereas research from an Indian medical school reported a greater inclination toward a doctor-centered approach.[9,10] Similarly, studies from Pakistan and Egypt have reported a greater inclination toward doctor-centered attitudes among medical students, highlighting regional variations in perspectives on patient-centered care and underscoring the need to further explore the factors influencing these differing orientations.[11,12]

Given these findings, it is fundamental to assess the medical students' perspective on the doctor-patient relationship. The current study was designed to evaluate the attitudes of medical students at HITEC-Institute of Medical Sciences (HITEC-IMS) Taxila towards doctor-centered versus patient-centered care and to determine the association of attitude with age, gender, year of the study, residential status and parental occupation related to the medical field. By delving into these attitudes early in their education, we can identify gaps, enhance training programs, and eventually expand the quality of care provided by future physicians.

## Methodology

A cross-sectional study was conducted at HITEC-IMS, Taxila, from March to November 2024 over a period of six months. The study population comprised undergraduate medical students enrolled at HITEC-IMS, Taxila. A convenience sampling technique was used for participant selection. The sample size was calculated using the RaoSoft cal-culator for an estimated population of 500 students, with a 95% confidence level, 5% margin of error, and an anticipated frequency of 50%. Based on these parameters, a total of 218 undergraduate medical students were included in the study. The total number of students that returned the questionnaire were 186 making a response rate of 85.3%.

### Ethical Consideration:

The ethical approval was taken by HITEC-IMS Institutional Review Board, project number: HITEC-IRB-37-2024, dated 29th April 2024. Informed written consent was obtained and the participants were assured about the confidentiality of their data.

**Inclusion Criteria:** MBBS students from all academic years were included, and participation was based on willingness to respond to the survey, without imposing additional restrictions based on attendance or academic performance.

**Exclusion Criteria:** Students who migrated from the other medical colleges within the last six months were excluded from the survey.

English version of a pre validated tool "Patient Practitioner Orientation Scale (PPOS)" with the addition of questions related to socio-demographic profile was used for the purpose of data collection to assess the medical students' attitude towards doctor patient relationships. It is a reliable and valid tool with Cronbach's α value of 0.67.[13] The

PPOS consists of 18 items, and all are in Likert-scale format. Each item has six options strongly disagree to strongly agree. These six options on the Likert scale are arranged in a manner that strongly disagrees is on the extreme left and is given 6 points. strongly agree on the extreme right side (1 point). Three items 9, and 13, & 17 are contrary phrased and therefore the scoring of the items is reversed. Thus, a high score characterized an orientation towards patient-centeredness. PPOS describes respondents' perspective on the doctor-patient relationship with respect to sharing and caring approach. Nine items of PPOS measure each dimension of doctor-patient relationship separately. Items no 1, 4, 5, 8, 9, 10, 12, 15, & 18 on PPOS measure the Sharing score. The items 2, 3, 6, 7, 11, 13, 14, 16, and 17 are categorized as caring on PPOS. PPOS mean score ranges from 1-6, where 1 indicates an inclination towards doctor centered approach and 6 indicates an inclination towards patient-centered approach. The mean score of all 18 items on the PPOS scale was calculated to determine the overall PPOS score. Mean scores of the sharing and caring domains were computed separately by calculating the mean of the nine items addressing each domain. PPOS scores ranged from 1 to 6, with higher scores indicating a more patient-centered orientation (Figure I). The sharing and caring subscales were analyzed separately to assess attitudes related to information sharing and empathetic care.[14] Data was collected through Google Forms. Google form links were shared in the WhatsApp groups of all the pre-clinical and clinical years of MBBS. The purpose of the study was stated in the Google forms and instructions for the exclusion and inclusion criteria were also mentioned in the form. Participation in the study was entirely voluntary. Participants were informed of their right to withdraw at any stage without any academic or personal consequences.

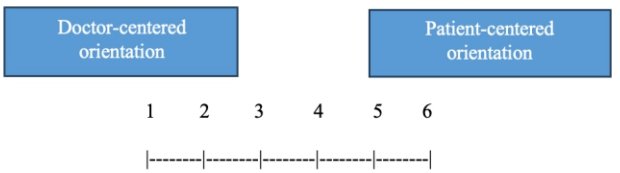



**Figure I:** *Interpretation of the Patient-Practitioner Orientation Scale (PPOS). The PPOS ranges from 1 to 6, with higher scores indicating a more patient-centered orientation.*

### Statistical analysis

Statistical Package for Social Sciences (SPSS) version 28 was used for data analysis. Frequency and percentages were calculated for the demographic variables. Normality of quantitative variables (age and attitude scores) was assessed by Shapiro wilk test. As the data were normally distributed, mean and standard deviation were used to summarize these variables. For statistical analysis, participants were categorized using a cutoff value of 3 (midpoint of the scale) into relatively patient-centered (>3) and doctor-centered (<3) orientations. This categorization was used for descriptive and comparative purposes. Chi-square test was used to determine association of attitude with demographic factors. A p-value of $< 0.05$ was considered statistically significant.

## Results

The study evaluated the attitudes of 186 medical students toward the doctor-patient relationship using the PPOS scale. The response rate was 85.3% (186/218).

**Table I:** *Mean Sharing, Caring and PPOS score of the participants (n=186)*

| Mean PPOS, Sharing and Caring score | Mean ± SD | Minimum | Maximum |
|---|---|---|---|
| Sharing subscale | 3.37 ± 0.81 | 1.56 | 5.33 |
| Caring subscale | 3.6 ± 0.70 | 2.11 | 5.33 |
| Overall PPOS score | 3.5 ± 0.6 | 1.83 | 5.06 |

*n = number of participants, Patient-Practitioner Orientation Scale (PPOS)*

The demographic distribution showed that 54.3% of participants were male and 45.7% were female. The mean age of participants was 22 ± 1.95 years. Most participants resided in urban areas (86%), while 14% were from rural areas. Regarding parental occupation, 40.9% belonged to the medical profession and 59.1% to other fields. Monthly parental income was less than 200,000 for 37.6% of participants, between 200,000 and 500,000 for 45.7%, and above 500,000 for 16.7%. The mean PPOS, sharing, and caring scores indicated a moderate patient-centered orientation (Table I).

The attitude assessment revealed that most of the participants had patient-centered attitudes (Figure II).

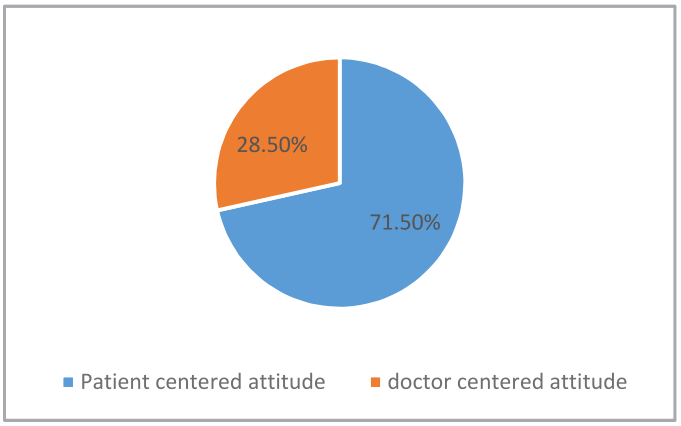



**Figure II:** *Attitude of students towards doctor patient relationship*

**Table II:** *Attitude in relation to demographics of medical students (n=186)*

| Demographic variable | n (%) | Doctor-centered attitude 53(28.4) | Patient-centered attitude 133(71.5) | p-value |
|---|---|---|---|---|
| **Age** | | | | |
| 18-20 | 43(23.1) | 7(16.3) | 36(83.7) | 0.014 |
| 21-23 | 111(59.6) | 31(27.9) | 80(72.1) | |
| >23 | 32(17.2) | 15(46.9) | 17(53.1) | |
| **Gender** | | | | |
| Male | 85(45.7) | 17(20) | 68(80) | 0.019 |
| Female | 101(54.3) | 36(35.6) | 65(64.4) | |
| **Residence** | | | | |
| Urban | 160(86) | 44(27.5) | 116(72.5) | 0.456 |
| Rural | 26(14) | 9(34.6) | 17(65.4) | |
| **Occupation of parents** | | | | |
| Related to health profession | 76(40.8) | 24(31.6) | 52(68.4) | 0.439 |
| Other professions | 110(59.1) | 29(26.4) | 81(73.5) | |
| **Year of study** | | | | |
| 1st year | 40(21.5) | 10(25) | 30(75) | 0.541 |
| 2nd year | 30(16.1%) | 6(20) | 24(80) | |
| 3rd year | 25(13.4%) | 8(32) | 17(68) | |
| 4th year | 48(25.8%) | 13(27.1) | 35(72.9) | |
| 5th year | 43(23.1%) | 16(37.2) | 27(62.8) | |

*n = number of participants, p-value calculated by Chi square test, p-value < 0.05 was considered statistically significant.*

Chi-square tests indicated statistically significant differences in attitudes based on age (p-value = 0.014) and gender (p-value = 0.019). Most students in the 1st, 2nd, and 4th years exhibited a patient-centered attitude, whereas a slight increase in doctor-centered attitudes was observed among 3rd and 5th year students; however, this difference was not statistically significant (Table II). When the scores were compared across different groups, including parents' occupation, year of study, and residence, no statistically significant differences were observed.

## Discussion

This study conducted in Taxila, Pakistan, aimed to assess the attitudes of medical students towards the doctor-patient relationship using the Patient Practitioner Orientation Scale (PPOS). The findings revealed that a significant majority, 71.5%, of the students exhibited patient-centered attitudes achieving a mean PPOS score of 3.51. These findings suggest that the medical curriculum at this institution effectively promote patient-centered care among the students. The attitudes observed in this study align with several international studies,[7, 9, 11, 15] showing a higher mean PPOS score. This signifies a strong inclination towards patient-centered attitude. The sharing subscale scores of this study (3.37 ± 0.8) were comparable with other reference studies.[11,15] The current study showed moderately higher scores in the sharing domain, indicating that students tend to involve patients in discussions about their care. However, when compared with studies from Canada, Sudan, and Saudi Arabia, the sharing scores were relatively lower. This difference may be attributed to variations in communication training, teaching methods, and healthcare environments across institutions.[7,9,15] The caring subscale score in the present study (3.6 ± 0.70) was comparable to that reported in other studies, with only slight variations. This indicates that participants demonstrated a positive orientation toward understanding and addressing patients' emotional needs.[7,9,11,15]

A study conducted at Alfaisal University, Riyadh, Saudi Arabia, assessed the attitudes of third-year MBBS students toward the doctor-patient relationship.[9] The study demonstrated a highly patient-centered sharing and caring attitude. The overall PPOS mean score was 4.0 ± 1.5, while the sharing and caring mean scores were 4.2 ± 1.5 and 3.8 ± 1.4, respectively, which were comparatively higher than those observed in the present study. This difference may be attributed to the fact that the Riyadh study focused on third-year students who were entering their clinical years. Moreover, no association was found with demographic variables in that study, possibly due to the small sample size and inclusion of students from the same academic year. In contrast, the present study showed a significant association of doctor-patient attitude with gender and age. Another study

conducted among medical students at Fayoum Medical School, Egypt, showed findings contradictory to our study.[12] The average PPOS score among Fayoum students was 2.71 ± 0.66, with considerable variability in scores across the sample. These students demonstrated a doctor-centered attitude. However, results from an Indian medical school study showed minor differences compared with the present study.[10] This study reported greater emphasis on the caring domain (3.68 ± 0.61) than the sharing domain (3.02 ± 0.58), with an overall mean PPOS score of 3.35 ± 0.50.[10] This variation in the results may be due to differences in educational emphasis, communication training, or cultural factors.

The current study examined the association between various demographic variables to understand their influence on medical students' attitudes toward the doctor-patient relationship and the analysis indicated a significant association with age. Younger students, particularly those aged 18-20 years, demonstrated a higher mean PPOS score compared to their older peers. This was further backed up by similar studies carried out in Canada and Italy which also showed significant association of doctor-patient relationship with age.[7,16] Moreover, gender differences were prominent in the current study, with female participants showing significantly higher patient-centered attitudes. This aligns with several international studies using the Patient-Practitioner Orientation Scale (PPOS), which have consistently shown higher patient-centered scores among females, particularly in the "caring" domain.[15,16,17,18] A similar research carried out at Federal Medical and Dental College, Islamabad, and Rawalpindi Medical University, Rawalpindi, Pakistan showed similar results. The female participants showed a much higher patient centered attitude compared to their male counter parts.[17] While the underlying reasons remain multifactorial, differences in socialization patterns and communication styles have been proposed as possible explanations for this observed variation.[19,20]

The current study found no significant differences in attitudes based on parental occupation. This suggests that the professional background of the student's parents does not significantly influence their attitudes toward the doctor-patient relationship as reported in previous studies.[11,12,21] Similarly the year of study did not significantly impact the students' attitudes toward the doctor-patient relationship comparable to previous research.[7] This consistency suggests that the inclination towards patient-centered care is established early in medical training and remains stable throughout the educational journey.[17] Early introduction of students to patient-centered principles and continuous reinforcement could explain this stability. In contrast few other studies have reported a significant association between the year of study and students' attitudes towards the doctor-patient relationship. These studies showed that senior medical students, having more clinical exposure, exhibited a more patient-centered approach compared to junior students.[11,15,18] The lack of a significant association in our study could be due to several factors, such as differences in curriculum structure, clinical exposure, and teaching methods. Further research is needed to explore how different educational strategies affect the development of patient-centered attitudes across academic years.

## Conclusion

This study revealed that majority of the medical students prefer a patient-centered approach, with significant variations based on age and gender. Younger students and female students demonstrated stronger patient-centered attitudes. These findings highlight the need for educational strategies to enhance patient-centered care through communication skills training and empathy development throughout the curriculum.

## Limitations and Recommendations:

As a single centered cross-sectional study using convenience sampling, the findings may have limited generalizability and are subject to selection bias. The study did not account for academic performance or attendance, which may influence students' attitudes and could be considered in future research. The cross-sectional design precludes causal inference, and self-reported attitudes may be influenced by social desirability bias. Future research employing longitudinal designs, multicenter sampling, and probabilistic recruitment methods is recommended to enhance generalizability and allow for a more robust examination of changes in patient-centered attitudes over time.

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## Authors Contribution

All authors have critically reviewed, proofread, and approved the final version of the manuscript and accept responsibility for the integrity and accuracy of the work. Each author has contributed substantially in accordance with the ICMJE authorship guidelines.

**AB:** Concept, design, supervision, revision of the manu-script

**RS &AM:** Drafting, interpretation, writeup and revision

**MR & BA:** Literature search, data collection and analy-sis, writeup

**AA:** Writeup, interpretation and final review of the manuscript

Original Article

# Assessing the Effectiveness of Oral Steroid Treatment in Patients of Nasal Polyposis, Scheduled for Surgery: A Prospective Single-Arm Interventional Study

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## Abstract

**Background:** Nasal polyposis is a chronic inflammatory condition of the nasal mucosa characterized by benign polyps. Corticosteroids are the mainstay of treatment due to their anti-inflammatory effects, especially in patients awaiting surgery.

**Objective:** The objective of this study was to study the effectiveness of oral steroids by comparing the pre-medication and post-medication symptoms in patients of nasal polyposis scheduled for surgery.

**Methodology:** A prospective study was conducted in the ENT outpatient department of a tertiary care hospital after approval by the Institutional review board and included 196 patients diagnosed with nasal polyposis awaiting surgery. Participants received oral prednisolone at a dose of 1 mg/kg for 7-10 days with gradual tapering. Symptom severity and quality of life were assessed before and after the treatment using the Sino-Nasal Outcome Test-22 (SNOT-22). Statistical analysis was performed by SPSS version 26 to compare pre and post-medication scores.

**Results:** Significant improvement was observed after treatment in nasal symptoms including congestion, sneezing, rhinorrhea, and postnasal discharge, as well as systemic and sleep related complaints. The proportion of the patients reporting moderate to severe nasal obstruction decreased markedly after treatment. The mean SNOT-22 score reduced from $63.71 \pm 15.87$ before treatment to $40.72 \pm 9.20$ after the therapy, demonstrating a statistically significant improvement ($p\text{-value} < 0.001$)

**Conclusion:** Short term oral steroid therapy effectively reduced symptoms severity and improved quality of life in patients with nasal polyposis prior to surgery, supporting its use as an important preoperative management strategy.

**Key words:** Nasal polyps, Rhinosinusitis, SNOT 22, Prednisolone

## Introduction

Nasal polyposis is a chronic inflammatory condition characterized by growth of polyps (benign non-neoplastic pedunculated outgrowths) in nasal cavity and sinuses. It significantly impacts quality of life and is associated with persistent nasal obstruction and anosmia. Recent studies confirm the central role of type 2 inflammation in its pathophysiology.[1,2] Despite its prevalence, the underlying pathophysiology remains incompletely understood and effective long-term management strategies are limited. Steroid therapy has been a mainstay in the treatment of nasal polyposis due to its potent anti-inflammatory properties. Corticosteroids, whether admi-

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nistered topically or systemically, are considered the mainstay of medical management for nasal polyps.[3] They have been shown to have a therapeutic effect on the symptoms of nasal polyposis and can help reduce the underlying inflammation that contributes to the polyps formation.[4] Additionally, oral steroid therapy, either alone or in combination with intranasal steroids, can lead to improvements in symptoms such as hyposmia, polyp size, and nasal airflow in patients with nasal polyposis.[5] Furthermore, studies have shown that the use of nasal steroids in combination with other agents like oxymetazoline can be more effective in improving symptoms such as blocked nose, hyposmia, and polyp size compared to nasal steroids alone.[6]

In 2023, a double-blind randomized control trial study enrolled 139 patients with Chronic Rhinosinusitis with Nasal Polyps (CRSwNP) and concluded that short-term oral steroids were effective for rapid symptoms and polyp reduction in chronic rhinosinusitis with nasal polyposis, suitable as initial or pre-surgical therapy.[7] Existing literature indicates that short-term oral steroid therapy in patients with nasal polyposis results in early improvement in hyposmia, a symptom that significantly affects quality of life.[8] Similarly, another study has recommended a short course of oral steroids as initial therapy in patients with chronic rhinosinusitis with nasal polyps.[9] In summary, the previous literature strongly supports the use of systemic steroid as a fundamental component in the management of nasal polyposis. However, although oral steroids are commonly given before surgery in patients with CRSwNP, patients do not respond the same way, and there is limited local data about how much real improvement they get and how it helps in planning surgery. The primary aim of this research was to study the effectiveness of oral steroids by comparing the pre-medication and post-medication symptoms in patients of nasal polyposis scheduled for surgery, while also contributing to the growing body of evidence on steroid therapy in this population. Understanding the effect of steroid treatment on nasal polyposis is essential for optimizing patient care and developing therapeutic approaches.

## Methodology

The study was conducted in the ENT outpatient department of Ghurki Trust Teaching Hospital (GTTH), Lahore over a period of one year. Non-probability sampling technique was used. The sample size was calculated using the WHO formula for estimating a proportion in a large population ($n = Z^2p(1-p)/d^2$) with a 95% confidence level (Z=1.96), expected prevalence of chronic rhinosinusitis of 12%[10] and 5% margin of error, of 5%, yielding a minimum required sample size of 162 participants. To account for potential dropouts and incomplete responses, the sample size was inflated by approximately 20%; therefore, all 196 eligible patients presenting to the OPD during the study period were included in the final analysis.

**Ethical Consideration:** Institutional review board (IRB) approval was obtained prior to the initiation of the study (Letter No; LMDC / L-ORIC-27-2025, Dated: 28 January 2025). Participants were assured of confidentiality, and data were collected after obtaining informed consent from all eligible patients.

**Inclusion criteria:** All the patients of nasal polyposis presenting to ENT outpatient department of GTTH who are scheduled for surgery were included in the study. Nasal polyps are benign, pedunculated mucosal growths originating within the nasal cavity or paranasal sinuses.

**Exclusion Criteria:** Patients of nasal polyposis who were not scheduled for surgery or patients having infections were excluded. A complete baseline investigation was done to rule out ongoing infections.

A pre-medication SNOT 22 form was filled by patients before starting the oral steroid treatment with prednisolone 1mg/Kg adjusted based upon the patient's age, weight and comorbidities for 7-10 days. The medication was tapered off gradually. Following the medication, a complete post-medication assessment was done. Post-medication SNOT 22 form was also filled by the patient. Sino Nasal Outcome Test 22 is a universally used patient reported questionnaire that measures the quality of life and severity of symptoms of chronic rhino sinusitis with nasal polyposis and demonstrates high internal consistency, with Cronbach's alpha reported as >0.80 across all domains.[11,12] The possible range of total SNOT 22 form score is between 0 to 110. Patients were categorized into mild (0-20), moderate(>20-50), and severe (>50) disease groups based on their SNOT-22 scores, in accordance with previously published criteria. This categorization was adapted from the scoring and assessment approach described by previous studies, where SNOT-22 was utilized as a validated tool for assessing symptom severity and clinical outcomes in chronic rhinosinusitis.[13,14]

**Statistical Analysis:** All data were entered and analyzed using Statistical Package for Social Sciences (SPSS) version 26. Normality of the data was tested using Shapiro Wilk test. Mean and Standard deviation were

calculated for quantitative variables while frequencies and percentages were constructed for qualitative variables. Paired t test was used to compare pre- and post-medication SNOT 22 form scores.

## Results

In our study, a total of 196 patients were included. Among these majority, 100(56.1%) were males, while 96(43.9%) were females. Pre- and post-medication frequency and percentage of patients with different symptoms is provided in Table I and II respectively. Overall, a significant reduction in symptom severity was observed following treatment, with fewer patients reporting to severe symptoms across all domains. Nasal blockage/congestion, one of the most severe baseline symptoms (74.4%), showed marked improvement, decreasing to 45.4% post-treatment. Similarly, the need to blow the nose decreased from 58.7% to 16.4%. Other nasal symptoms, including sneezing, rhinorrhea, and postnasal discharge, also improved substantially.

Systemic symptoms such as dizziness and fatigue demonstrated significant improvement, with moderate to severe dizziness declining from 41.4% to 1.5%. Sleep-related and psychological symptoms also showed notable improvement, with reductions observed in sleep disturbances, fatigue, and emotional distress. Overall, post-treatment assessments indicated a consistent and clinically meaningful improvement in symptom burden. The mean post-medication SNOT 22 score showed a significant reduction (p-value < 0.001) as shown in Table III.

Figure I demonstrates the distribution of SNOT-22 severity categories before treatment, while Figure II shows post-treatment mean scores for snoring. Prior to medication, most patients were in the moderate to severe categories, whereas after treatment, a majority shifted to the mild category and no patients remained in the severe group, indicating significant improvement in symptom burden.

**Table I:** *Pre-medication Frequency and percentage of patients with different symptoms*

| Pre-Medication | No problem n (%) | Very mild problem n (%) | Mild or slight problem n (%) | Moderate problem n (%) | Severe problem n (%) | Problem as bad as it can be n (%) |
|---|---|---|---|---|---|---|
| Need to Blow Nose | 28 (14.3%) | 21 (10.7%) | 32 (16.3%) | 47 (24.0%) | 43 (21.9%) | 25 (12.8%) |
| Sneezing | 24 (12.2%) | 31 (15.8%) | 39 (19.9%) | 48 (24.5%) | 36 (18.4%) | 18 (9.2%) |
| Runny Nose | 28 (14.3%) | 24 (12.2%) | 43 (21.9%) | 46 (23.5%) | 39 (19.9%) | 16 (8.2%) |
| Cough | 94 (48.0%) | 24 (12.2%) | 30 (15.3%) | 26 (13.3%) | 18 (9.2%) | 4 (2.0%) |
| Postnasal Discharge | 11 (5.6%) | 10 (5.1%) | 32 (16.3%) | 62 (31.6%) | 51 (26.0%) | 30 (15.3%) |
| Thick Nasal Discharge | 12 (6.1%) | 16 (8.2%) | 34 (17.3%) | 58 (29.6%) | 46 (23.5%) | 30 (15.3%) |
| Ear Fullness | 45 (23.0%) | 25 (12.8%) | 51 (26.0%) | 42 (21.4%) | 20 (10.2%) | 13 (6.6%) |
| Dizziness | 77 (39.3%) | 30 (15.3%) | 50 (25.5%) | 27 (13.8%) | 8 (4.1%) | 4 (2.0%) |
| Ear Pain/Pressure | 71 (36.2%) | 30 (15.3%) | 48 (24.5%) | 32 (16.3%) | 11 (5.6%) | 4 (2.0%) |
| Facial Pain/Pressure | 67 (34.2%) | 18 (9.2%) | 47 (24.0%) | 41 (20.9%) | 13 (6.6%) | 10 (5.1%) |
| Difficulty Falling Asleep | 60 (30.6%) | 41 (20.9%) | 37 (18.9%) | 33 (16.8%) | 16 (8.2%) | 9 (4.6%) |
| Waking Up at Night | 60 (30.6%) | 34 (17.3%) | 42 (21.4%) | 26 (13.3%) | 24(12.2%) | 10 (5.1%) |
| Lack of a Good Night's Sleep | 63 (32.1%) | 39 (19.9%) | 39 (19.9%) | 24 (12.2%) | 23 (11.7%) | 8 (4.1%) |
| Waking Up Tired | 56 (28.6%) | 40 (20.4%) | 42 (21.4%) | 36 (18.4%) | 17 (8.7%) | 5 (2.6%) |
| Fatigue During the Day | 54 (27.6%) | 34 (17.3%) | 49 (25.0%) | 39 (19.9%) | 15 (7.7%) | 5 (2.6%) |
| Reduced Productivity | 51(26.0) | 34(17.3) | 60 (30.6) | 43 (21.9) | 6 (3.1) | 2 (1.0) |
| Reduced Concentration | 52 (26.5%) | 34 (17.3%) | 64 (32.7%) | 31 (15.8%) | 12 (6.1%) | 3 (1.5%) |
| Frustrated/Restless/Irritable | 32 (16.3%) | 38 (19.4%) | 64 (32.7%) | 34 (17.3%) | 19 (9.7%) | 9 (4.6%) |
| Sad | 50 (25.5%) | 36 (18.4%) | 59 (30.1%) | 37 (18.9%) | 8 (4.1%) | 6 (3.1%) |
| Embarrassed | 50 (25.5%) | 29 (14.8%) | 44 (22.4%) | 51 (26.0%) | 14 (7.1%) | 8 (4.1%) |
| Sense of Taste/Smell | 26 (13.3%) | 18 (9.2%) | 36 (18.4%) | 51 (26.0%) | 40 (20.4%) | 25 (12.8%) |
| Blockage/Congestion of Nose | 5 (2.6%) | 1 (0.5%) | 14 (7.1%) | 30 (15.3%) | 83 (42.3%) | 63 (32.1%) |

*n: number of participants*

**Table II:** *Post-medication Frequency and percentage of patients with different symptoms*

| Post-Medication | No problem n (%) | Very mild problem n (%) | Mild or slight problem n (%) | Moderate problem n (%) | Severe problem n (%) | Problem as bad as it can be n (%) |
|---|---|---|---|---|---|---|
| Need to Blow Nose | 56 (28.6) | 43 (21.9) | 64 (32.7) | 26 (13.3) | 6 (3.1) | 1 (0.5) |
| Sneezing | 74 (37.8) | 48 (24.5) | 56 (28.6) | 17 (8.7) | 1 (0.5) | - |
| Runny Nose | 69 (35.2) | 60 (30.6) | 54 (27.6) | 10 (5.1) | 1(0.5) | 2 (1.9) |
| Cough | 124 (63.3) | 40 (20.4) | 26 (13.3) | 6 (3.1) | - | - |
| Post Nasal Discharge | 26 (13.3) | 58 (29.6) | 66 (33.7) | 41 (20.9) | 5 (2.6) | - |
| Thick Nasal Discharge | 32 (16.3) | 55 (28.1) | 71 (36.2) | 29 (14.8) | 8 (4.1) | 1 (0.5) |
| Ear Fullness | 91 (46.4) | 61 (31.1) | 29 (14.8) | 13 (6.6) | 2 (1.0) | - |
| Dizziness | 115 (58.7) | 54 (32.7) | 14 (7.1) | 3 (1.5) | - | - |
| Ear Pain/Pressure | 112 (57.1) | 55 (28.1) | 27 (13.8) | 2 (1.0) | - | - |
| Facial Pain/Pressure | 100 (51.0) | 51 (26.0) | 41 (20.9) | 4 (2.0) | - | - |
| Difficulty Falling Asleep | 112 (57.1) | 45 (23.0) | 29 (14.8) | 9 (4.6) | 1 (0.5) | |
| Waking Up at Night | 110 (56.1) | 58 (29.6) | 22 (11.2) | 4 (2.0) | 2 (1.0) | - |
| Lack of a Good Night's Sleep | 116 (59.2) | 43 (21.9) | 30 (15.3) | 5 (2.6) | 2 (1.0) | - |
| Waking Up Tired | 106 (54.1) | 60 (30.6) | 26 (13.3) | 4 (2.0) | - | - |
| Fatigue During the Day | 103 (52.6) | 63 (32.1) | 23 (11.7) | 7 (3.6) | - | - |
| Reduced Productivity | 99 (50.5) | 72 (36.7) | 18 (9.2) | 5 (2.6) | 1 (0.5) | 1 (0.5) |
| Reduced Concentration | 104 (53.1) | 62 (31.6) | 22 (11.2) | 7 (3.6) | 1 (0.5) | |
| Frustrated/Restless/Irritable | 82 (41.8) | 70 (35.7) | 28 (14.3) | 12 (6.1) | 4 (2.0) | |
| Sad | 88 (44.9) | 71 (36.2) | 28 (14.3) | 9 (4.6) | - | - |
| Embarrassed | 98 (50.0) | 46 (23.5) | 37 (18.9) | 12 (6.1) | 2 (1.0) | 1 (0.5) |
| Sense of Taste/Smell | 51 (26.0) | 37 (18.9) | 69 (35.2) | 29 (14.8) | 7 (3.6) | 3 (1.5) |
| Blockage/Congestion of Nose | 18(9.2) | 32(16.3) | 57(29.1) | 68(34.7) | 18(9.2) | 3(1.5) |

*n: number of participants*

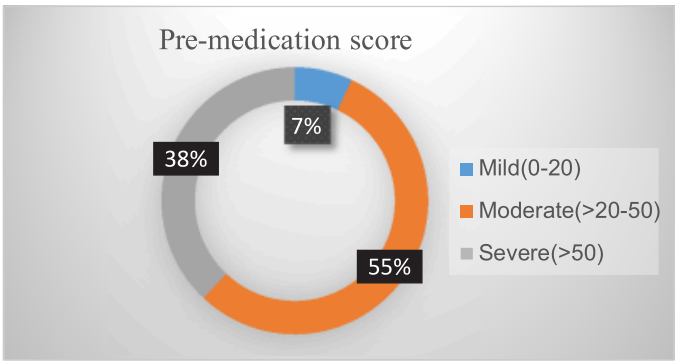



**Figure I:** *Distribution of patients in mild, moderate severe categories before medication*

**Table III:** *Comparison of pre-& post-medication SNOT 22 score*

| Medication | Mean ± SD | p-value | 95% CI |
|---|---|---|---|
| Pre-medication score | 63.71± 15.87 | <0.001 | 20.77–25.21 |
| Post-medication score | 40.72 ± 9.20 | | |

*Mean SD: Mean standard deviation, p-value calculated by paired t test, p-value < 0.05 considered significant, 95% CI: 95% Confidence Interval*

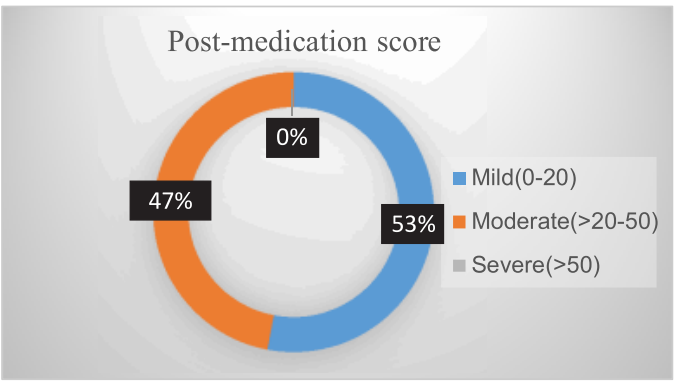



**Figure II:** *Distribution of patients in mild, moderate severe categories after medication*

## Discussion:

The present study demonstrated a significant improvement in symptom burden following short-term oral corticosteroid therapy, as reflected by a marked reduction in total SNOT-22 scores. Improvements were observed across nasal, systemic, sleep-related, and psychological domains, indicating a broad impact on patient

quality of life. Our results align with existing evidence demonstrating that short-term oral corticosteroid therapy significantly improves sinonasal symptoms in patients with chronic rhinosinusitis with nasal polyps, supporting its role in medical management.[15] In 2021 a study was conducted which showed decrease in the number of eosinophils and decreased fibrosis in the nasal polyp's tissue in CRSwNP patients who were given short course of systemic prednisolone.[16] Another observational study concluded that combined therapy with oral prednisolone and fluticasone propionate nasal spray for 3 weeks is very effective in reducing the symptoms of chronic rhinosinusitis along with decrease in nasal secretions, edema and polyp size. Similarly, use of oral corticosteroids has been recommended for the management of chronic rhinosinusitis with nasal polyps, particularly in the perioperative period, which is consistent with the present study in which oral steroids were used in pre-surgical patients.[17,18] This practice is supported in the literature, with other studies showing that short-course adjunct oral corticosteroid therapy improves symptom severity, reduces polyp size, and enhances CT sinus findings in patients with chronic rhinosinusitis with nasal polyps.[19] Although these studies together attest to the therapeutic value of oral steroids, our study specifically focuses on patients under waiting for surgery, providing a focused view on symptom relief within this subgroup. In the current study, the number of patients classified as mild, moderate, and severe according to SNOT 22 scores decreased substantially after oral steroid treatment, reflecting a marked improvement in symptom severity across all categories. These findings are consistent with a previous research that reported significant reductions in SNOT 22 scores in chronic rhinosinusitis patients treated with systemic steroids, demonstrating that oral corticosteroids alone can effectively improve patient-reported symptom burden.[20] Together, these results reinforce the efficacy of steroid therapy in alleviating disease severity and highlight the value of SNOT 22 as a reliable tool for monitoring treatment response.

## Conclusion:

In summary, this trial reaffirms the use of oral steroids as a potent short-term treatment for symptom burden reduction in patients with nasal polyposis undergoing surgery, supported by meaningful SNOT-22 score reductions, but also highlights the necessity for further studies. Larger controlled trials need to be carried out to validate these results, assess long-term effectiveness, and establish the intervention's influence on surgical outcomes.

## Limitations and Recommendations

The main limitations of the study include the use of convenience sampling, its cross-sectional observational design, and the short-term duration of treatment assessment. Future studies with a longer follow-up period and inclusion of a control group to better evaluate the sustained effects of oral steroid therapy on nasal polyposis. Lastly, although symptom relief is encouraging, the study does not investigate the effect on surgical outcomes e.g., ease of operation, complication rate, or post-operative recovery thus leaving a knowledge gap regarding the complete pre-surgical benefit of this intervention.

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## Authors Contribution

All authors have approved the final version of the manuscript and are responsible for its integrity.

**AAU & SZ:** Concept, design, data interpretation and revision of the manuscript

**AS & HY:** write manuscript, data collection, analysis and interpretation of results and revisions

**TS:** Literature review, data collection, writeup and revision of the manuscript

Original Article

# Comparison of Personality Types of Medical, Dental and Allied Health Students at a Private College in Pakistan using the Five-Factor Model

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## Abstract

**Background:** The Five-Factor Model (FFM) describes personality across five domains and has been linked to academic performance, stress perception, and career selection. Given these associations, it is important to explore how personality traits differ across key demographic variables in medical and allied health student populations.

**Objectives:** To compare mean personality trait scores across gender, residential status, academic year, and degree program among medical, dental, and allied health students.

**Methodology:** A cross-sectional study was conducted at CMH Lahore Medical College & Institute of Dentistry from January-May 2023. A total of 384 students enrolled in MBBS, BDS, DPT, and MIT programs completed the Big Five Inventory (BFI-44). Independent sample t-tests were used to compare personality scores across gender and residential status, while one-way ANOVA was applied to evaluate differences across academic years and degree programs. Post hoc Dunnett tests were conducted where appropriate. A p-value $< 0.05$ was considered statistically significant.

**Results:** Significant differences were observed across gender and residential status. Males demonstrated higher emotional stability, surgency/extraversion, and imagination (p-value $< 0.05$). Day scholars scored higher in agreeableness (p-value = 0.006), whereas hostel boarders had higher emotional stability (p-value = 0.019). No significant differences were found across degree programs. Conscientiousness differed significantly across academic years (p-value = 0.015), with second-year students scoring higher than first-year students.

**Conclusion:** The findings indicate that personality traits vary with gender, living environment, and early academic transition, highlighting the importance of recognizing personality differences to better tailor mentoring and educational strategies within medical and allied health education.

**Keywords:** Personality, Students, Medical, Allied Health Personnel, Personality Inventory

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## Introduction

The Five Factor Model is a suggested grouping or taxonomy of personality traits into five 'domains': extraversion, agreeableness, conscientiousness, emotional stability and intellect (or imagination). The model's five 'domains' have been found to represent

most personality traits and the model is found to be a comprehensive method of detailing an individual's personality traits.[1] These personality traits have been found to have strong correlations with an individual's academic abilities, among other parameters. For instance, a study conducted in 2022 reported that the combined effect of cognitive ability and personality traits accounted for 27.8% of the variance in academic performance. Notably, Conscientiousness (often referred to as Factor IV in Big Five models) demonstrated exceptional predictive power, maintaining its influence even when controlling for cognitive ability, and accounting for a significant 28% of the total explained variance in academic performance.[2]

Personality is also a significant factor in vocational decision-making, as reported by a recent study that specifically highlighted a systematic link between individual personality profiles and chosen academic majors, underscoring an early and strong connection between personality and career pathways.[3] Personality plays a significant role in shaping how individuals perceive and experience psychological stress.[4] When examining stress under different conceptual frameworks, only neuroticism, agreeableness, and conscientiousness were linked to increased exposure to stressors.[4] Moreover, associations between the Big Five personality traits and preferred learning approaches have been reported, particularly linking agreeableness and conscientiousness with collaborative and project-based learning preferences.[5] Additionally, strong associations have been reported between the five-factor model and emotional intelligence, with neuroticism emerging as the strongest individual predictor.[6]

In the field of healthcare, the role of personality has been highlighted in a study linking Big Five personality traits with clinical workplace performance among final-year medical students. The findings showed that extraversion and conscientiousness were positively associated with greater trainee autonomy, indicating a reduced need for supervision in clinical tasks.[7] A longitudinal study following medical students from Year 1 to Year 6 reported small changes in personality traits during training, with slight decreases in neuroticism and conscientiousness and an increase in agreeableness. Most of these changes were observed during the preclinical years (Years 1-3).[8] In addition, changes in residential status may influence personality, primarily through effects on emotional stability.[9] Furthermore, personality and cognitive intelligence have previously been used to predict career paths.[10] The objective of the current study was to compare mean personality trait scores across gender, residential status, academic year, and degree program among medical, dental, and allied health students. There are previous comparisons between fields, especially Bachelor of Dental Surgery (BDS) and Bachelor of Medicine Bachelor of Surgery (MBBS), which show a uniform mean variation of factors between the students of the two disciplines,[11] and this study intends to expand on these by including the Allied Health Sciences students of Medical Imaging Technology (MIT) and Doctor of Physiotherapy (DPT). We hypothesized that personality trait scores would differ significantly across gender and residential status, given documented biological and environmental influences on personality, while differences across degree programs were expected to be minimal given the shared institutional context.

## Methodology

This was a cross-sectional analytical study, conducted at CMH Lahore Medical College and Institute of Dentistry, Lahore, Pakistan, a private medical institution. Data were collected over a period of five months, from January to May 2023. The sample size was calculated using the World Health Organization (WHO) formula for estimation of proportions in a finite population:

$$n = Z^2 \times p\,(1 - p) / d^2$$

where Z=1.96 at 95% confidence level, p=50% (assumed in the absence of prior local prevalence data), and d = 5% margin of error. The calculated sample size was adjusted using finite population correction based on the total number of eligible students enrolled in the institution. Sampling was performed using a non-probability convenience sampling technique. Students who met the eligibility criteria and consented to participate were included until the required sample size was achieved. A total of 384 completed responses were included in the final analysis, representing a response rate of approximately 91.0% (384 of approximately 422 students approached).

**Ethical Consideration:** Ethical approval was obtained from the Institutional Review Board (IRB) of CMH Lahore Medical College (Case No. 735/ERC/ CMH/ LMC, dated 26-01-2023). Informed written consent was obtained from all study participants prior to data collection. Confidentiality of participant information was ensured throughout the study; no identifying information was recorded, and data were used solely for

research purposes.

**Inclusion Criteria:** Students enrolled in MBBS, BDS, DPT, and MIT programs at CMH Lahore Medical College, who provided informed written consent and filled out the questionnaire.

**Exclusion Criteria:** House officers and graduates were not included. Moreover, students who did not provide consent and those with incomplete or improperly filled questionnaires were excluded.

Data were collected using a structured, self-administered questionnaire. The instrument consisted of two components. First a demographic section including age, gender, residential status, academic year, and degree program. Respondents were additionally asked whether the program they were currently enrolled in was their first choice. Second section included The Big Five Inventory (BFI-44), a standardized, open-access instrument developed by John, Donahue, and Kentle (1991).[12] It consists of 44 items assessed on a 5-point Likert scale and measures five personality domains: Extraversion (Surgency), Agreeableness, Conscientiousness, Emotional Stability (Neuroticism reversed), and Intellect/ Imagination (Openness). BFI-40 trait scores were computed by averaging item responses for each of the five domains after reverse-coding negatively keyed items, in accordance with standard scoring procedures. Resulting scale scores ranged from 1 to 5, with higher values indicating greater expression of the trait. For analytical purposes, trait scores were subsequently standardized (z-scored), yielding values centered around the sample mean, with negative scores indicating below-average levels relative to the study population. The instrument has demonstrated established internal consistency and construct validity across diverse populations.[12] Internal consistency of the BFI-44 in the present sample, assessed using Cronbach's alpha, yielded values ranging from 0.61 to 0.79 across the five subscales, consistent with prior validation studies.

### Statistical Analysis

Data were entered and analyzed using the Statistical Package for Social Sciences (SPSS) version 28 (IBM Corp., Armonk, NY, USA). Shapiro Wilk test was used to check the distribution of the data. Descriptive statistics were calculated for all demographic variables. Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were summarized as frequencies and percentages. Independent sample t-test was applied to compare mean personality trait scores between genders and between residential status groups (day scholars vs. hostel boarders). One-way Analysis of Variance (ANOVA) was used to compare mean personality scores across different academic years and degree programs. Post hoc Dunnett tests were applied where statistically appropriate. A p-value of less than 0.05 was considered statistically significant. Given that multiple traits were tested across several demographic groups, there is an inherent risk of Type I error; uncorrected p-values are reported alongside effect sizes to aid interpretation in this exploratory study.

## Results

A total of 384 students participated in this study. Majority of the respondents were female (71.9%) and day scholars (59.9%). Most were enrolled in the MBBS degree program (56.5%), followed by the DPT program (17.2%), BDS (14.8%), and MIT (11.5%). The largest proportion of respondents were second-year students (29.7%), followed by third year (24.0%) and first-year (23.7%) students. A detailed frequency distribution is provided in Table I.

Independent samples t-tests were conducted to examine differences in the Five Factor personality trait scores between male and female students (Table II). Males scored significantly higher than females on emotional stability, surgency/extraversion, and intellect/ imagination. Males also recorded higher the mean scores on conscientiousness and agreeableness were also higher

**Table 1:** *Frequency Distribution of Respondents*

| Variable | Category | Frequency | Percentage (%) |
|---|---|---|---|
| **Degree Program** | BDS | 57 | 14.8 |
| | DPT | 66 | 17.2 |
| | MBBS | 217 | 56.5 |
| | MIT | 44 | 11.5 |
| **Year of Study** | First Year | 91 | 23.7 |
| **Year of Study** | Second Year | 114 | 29.7 |
| | Third Year | 92 | 24.0 |
| | Fourth Year | 39 | 10.2 |
| | Final Year | 48 | 12.5 |
| **Gender** | Male | 108 | 28.1 |
| | Female | 276 | 71.9 |
| **Residential Status** | Day Scholar | 230 | 59.9 |
| | Hostelites / Boarder | 154 | 40.1 |
| **Total** | | 384 | 100.0 |

as compared to females; however, these differences did not reach statistical significance.

Independent samples t-tests were also used to compare Five Factor scores between day scholars and hostelites (Table III). Day scholars had a significantly higher mean agreeableness score, while hostelites had a significantly higher mean emotional stability score. No significant differences were found for surgency, conscientiousness, or intellect/imagination

No statistically significant differences were found for any of the five traits across the four healthcare degree programs as shown in Table IV. A one-way ANOVA was conducted to examine diffe-rences in personality trait scores across academic years (Table V). A significant difference was found for conscientiousness. Post hoc Dunnett's test revealed that

**Table II:** *Comparison of Personality Trait Scores by gender*

| Trait | Male Mean±SD | Female Mean±SD | t | do | p-value |
|---|---|---|---|---|---|
| Surgency | -0.82±7.41 | -2.67±6.94 | 2.296 | 382 | 0.022* |
| Agree-ableness | 5.37 ± 4.67 | 4.54 ± 4.29 | 1.670 | 382 | 0.096 |
| Conscien-tiousness | 2.75 ± 5.17 | 2.39 ± 5.03 | 0.623 | 382 | 0.534 |
| Emotional Stability | -17.41 ± 7.60 | -21.59 ± 6.81 | 5.235 | 382 | <0.001* |
| Intellect/ Imagination | 17.82 ± 6.18 | 15.97 ± 5.14 | 2.767 | 168.018 | 0.006* |

*p-value calculated by independent sample t test,*statistically significant at p-value < 0.05. SD: standard deviation. Levene's test for equality of variances was applied; ds=168.018 for Intellect/ Imagination indicates unequal variances assumed. Cohen's d: Surgency = 0.26; Agreeableness = 0.19; Conscien-tiousness = 0.07; Emotional Stability = 0.59; Intellect/ Imagination = 0.34.*

**Table III:** *Comparison of Personality Trait Scores by gender*

| Trait | Day Scholars Mean ± SD | Hostelites Mean±SD | t | def. | p-value |
|---|---|---|---|---|---|
| Surgency | -2.09 ±7.14 | -2.24±7.08 | 0.207 | 382 | 0.836 |
| Agree-ableness | 5.28 ± 4.34 | 4.01±4.42 | 2.778 | 382 | 0.006* |
| Conscien-tiousness | 2.50 ± 5.34 | 2.47±4.66 | 0.057 | 382 | 0.954 |
| Emotional Stability | -21.13 ± 7.54 | -19.35 ± 6.75 | -2.357 | 382 | 0.019* |
| Intellect/ Imagination | 16.92 ± 5.35 | 15.86 ± 5.69 | 1.856 | 382 | 0.064 |

*p-value calculated by Independent Sample t-test, *Statistically significant at p-value < 0.05. SD: standard deviation. Cohen's d: Agreeableness = 0.29; Emotional Stability = 0.25.*

**Table IV:** *Personality Trait Scores across Degree Programs*

| Trait | BDS Mean ± SD | DPT Mean ± SD | MBBS Mean ± SD | MIT Mean ± SD | F | p-value |
|---|---|---|---|---|---|---|
| Surgency | -1.47 ± 7.16 | -2.73 ± 6.99 | -2.07 ± 7.48 | -2.52 ± 5.25 | 0.364 | 0.779 |
| Agreeableness | 4.67 ± 4.33 | 4.38 ± 3.87 | 5.09 ± 4.65 | 3.93 ± 4.05 | 1.088 | 0.354 |
| Conscientiousness | 1.98 ± 4.76 | 3.38 ± 4.89 | 2.62 ± 5.32 | 1.20 ± 4.16 | 1.869 | 0.134 |
| Emotional Stability | -22.26 ± 7.89 | -21.35 ± 6.70 | -19.66 ± 7.40 | -20.34 ± 6.24 | 2.395 | 0.068 |
| Intellect/Imagination | 15.60 ± 3.93 | 16.79 ± 4.96 | 16.94 ± 6.08 | 14.98 ± 4.70 | 2.187 | 0.089 |

*F-statistics and p-values obtained using one-way ANOVA with df = (3,380).p-value < 0.05 considered statistically significant, SD: standard deviation. No statistically significant differences were observed across degree programs. Partial $\eta^2$ (effect size) was negligible: Surgency = 0.003; Agreeableness = 0.009; Conscientiousness = 0.015; Emotional Stability = 0.019; Intellect/Imagination = 0.017*

**Table V:** *Comparison of Personality Trait Scores by Year of Study*

| Trait | 1st Year Mean ± SD | 2nd Year Mean ± SD | 3rd Year Mean ± SD | 4th Year Mean ± SD | Final Year Mean ± SD | F | p-value |
|---|---|---|---|---|---|---|---|
| Surgency | -2.69 ± 6.85 | -2.14 ± 6.52 | -1.30 ± 7.38 | -1.21 ± 7.89 | -3.52 ± 7.70 | 1.077 | 0.368 |
| Agreeableness | 4.85 ± 4.04 | 4.20 ± 4.02 | 5.20 ± 4.73 | 5.64 ± 4.98 | 4.46 ± 4.83 | 1.135 | 0.340 |
| Conscientiousness | 3.52 ± 4.95 | 1.67 ± 4.80 | 2.11 ± 4.96 | 4.18 ± 4.95 | 1.88 ± 5.72 | 3.145 | 0.015* |
| Emotional Stability | -20.40 ± 6.66 | -20.75 ± 7.13 | -20.15 ± 7.30 | -18.74 ± 6.04 | -21.52 ± 9.38 | 0.879 | 0.477 |
| Intellect/Imagination | 16.25 ± 5.06 | 15.58 ± 5.12 | 16.95 ± 5.66 | 17.28 ± 5.89 | 17.60 ± 6.37 | 1.686 | 0.152 |

*Mean ± SD: Mean ± standard deviation .p-value calculated by One-way ANOVA. df; degree of freedom (Between Groups) = 4, df (Within Groups) = 379 for all traits.*significant p-value < 0.05. Post hoc Dunnett's test: Conscientiousness was significantly higher in 1st year compared to 2nd year students (p-value = 0.016). Partial $\eta^2$: Conscientiousness = 0.032 (small effect); all other traits < 0.02.*

first-year students had significantly higher conscientiousness scores than second-year students. No other pairwise comparison reached significance. No significant differences were found across years of study for surgency, agreeableness, emotional stability, or intellect/ imagination.

## Discussion

This study compared personality trait scores across gender, residential status, academic year, and degree program among medical and allied health students using the Five-Factor Model. The findings revealed significant differences by gender and residential status, while degree program showed no significant variation. Firstly, the study results indicate significant gender differences in certain personality traits among medical students. Males demonstrated higher mean scores in emotional stability, surgency/extraversion, and imagination than their female counterparts. While the differences in conscientiousness and agreeableness were not statistically significant, the trend suggests potential variations in how males and females express specific personality dimensions within the medical student population. Some studies have reported similar trends, highlighting higher levels of emotional stability and extraversion among male medical students compared to females, and how higher extraversion and emotional stability in males have been associated with better academic outcomes.[13] However, other studies report that females score higher in conscientiousness and extraversion.[14] Additionally, in contrast to our results, previous studies showed that females tend to score higher on emotional stability measures compared to males, indicating greater emotional resilience and lower levels of neuroticism.[15] These inconsistencies across studies likely reflect differences in cultural context, sample characteristics, and measurement approaches, and caution against drawing broad gender-based generalizations.

Regarding residential status, hostel boarders scored higher in emotional stability while day scholars scored higher in agreeableness. The greater emotional stability among boarders may be associated with adaptation to communal living, where navigating shared spaces and peer relationships over time may build resilience. Individuals with higher emotional stability are less vulnerable to developing mood and anxiety disorders, highlighting the protective effects of emotional resilience.[16] Contrary to our study, some research has shown that hostelites are more vulnerable to emotional disturbances because of the multifaceted pressure presented by hostel life.[17] The higher agreeableness among day scholars may reflect the continued influence of family environment and home-based social norms. Agreeableness has been linked to more cooperative interpersonal behavior and stronger social support networks.[18,19]

No significant differences were found across degree programs, which was unexpected given that Shehzad et al. previously found higher agreeableness in BDS students and higher emotional instability in MBBS students in Khyber Pakhtunkhwa.[11] The absence of such differences in our sample may reflect institutional or regional factors and warrants further investigation. Conscientiousness scores were significantly higher among first-year students compared with second-year students. Although higher scores were also observed in fourth-year students, this difference was not statistically significant. This pattern may reflect strong initial motivation at entry into medical school and a possible re-emergence of goal-directed behavior in later years. Consistent with findings by Lievens F et al., the importance of conscientiousness may increase as students' progress through medical training, particularly in relation to academic and clinical performance.[20] Longitudinal studies tracking students across all years would help clarify whether this is a stable shift or a transient response to initial academic pressures. Strengths of this study include its relatively large sample size for a single-institution study, the inclusion of four distinct degree programs, use of the validated BFI-44 instrument, and the examination of personality differences among allied health students in a Pakistani medical college context, a population that remains understudied in the personality literature. These findings have practical implications for medical educators. Awareness of personality variation across gender, year of study, and living situation can inform more targeted mentoring, pastoral support, and teaching approaches. An environment that accommodates diverse personality profiles is likely to support both student wellbeing and professional development. Specifically, mentoring programs could be tailored to account for gender-based differences in emotional stability, and residential support services might leverage the higher agreeableness seen in day scholars. The observed decline in conscientiousness from first to second year warrants attention, and early identification of students who may be at risk of reduced academic self-regulation during this transition could help inform timely pastoral interventions.

## Conclusion

This study demonstrates that personality traits among medical and allied health students vary significantly with gender, residential status, and academic progression. Males displayed higher emotional stability, surgency, and imagination, while day scholars were more agreeable and hostel boarders more emotionally stable. Although degree programs showed no major differences, the increase in conscientiousness from first to second year suggests early adaptation to academic demands. These findings highlight the value of recognizing diverse personality profiles within medical education to better tailor student support, mentorship, and learning strategies.

## Limitations & Recommendations

This study has several limitations. Its cross-sectional design prevents assessment of causal relationships or personality changes over time. Personality data were collected through self-report measures, which are subject to response biases, including social desirability and inaccurate self-perception. Additionally, the study was conducted at a single private medical institution in Pakistan, which may limit the generalizability of findings to other regions or educational environments. Although the sample included multiple degree programs, unequal group sizes may have reduced the power to detect smaller between-group differences. The Five-Factor Model, while comprehensive, captures broad personality domains and may overlook finer nuances relevant to medical education. Furthermore, the use of non-probability convenience sampling introduces potential selection bias, as students who chose to participate may differ systematically from those who did not. With multiple personality traits tested across several demographic groups, there is an increased risk of Type I error; results should therefore be interpreted cautiously given the exploratory nature of this study. Future longitudinal, multi-institutional studies incorporating additional psychosocial variables, such as academic stress, family environment, and extracurricular involvement, may provide a more complete understanding of personality development across the medical training continuum.

**Conflict of Interest:** None

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## Authors Contribution

All authors have read and approved the final manuscript and agree to be accountable for all aspects of the work.

**ASJ, AA & MUR:** Conceived the study idea, designed the study, conducted data acquisition, performed data analysis and interpretation, drafted the manuscript, and critically revised the manuscript for intellectual content.

**MT & MRM:** Contributed to manuscript drafting and critical revision of the manuscript.

**HSK:** Supervised the study, contributed to study design and manuscript revision, and provided final approval of the version to be published.

Original Article

# Comparison of Port Site Infection Between Disposable Plastic and Metallic Ports in Total Laparoscopic Hysterectomy: A Single Center Retrospective Cohort Study

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## Abstract

**Background:** Laparoscopic surgery has revolutionized gynecological procedures by offering a minimally invasive approach, faster recovery, and reduced postoperative pain.

**Objective:** To compare the incidence of Port Site Infection (PSI) in patients undergoing Total Laparoscopic Hysterectomy (TLH) using disposable plastic ports versus reusable metallic ports at a private tertiary care hospital.

**Methodology:** It was a retrospective cohort study held at the Department of Gynae Endoscopy & Obstetrics following ethical approval. Retrospective data was collected from 2010 to 2025. Women who underwent total laparoscopic hysterectomy at the institution within the defined study period were enrolled. All the data was processed by SPSS 28.0. Quantitative variables were presented as mean ± SD. Qualitative variables were presented as frequencies and percentages. Comparisons between groups were performed using Fisher's exact test, with a p-value ≤ 0.05 considered statistically significant.

**Results:** A total of 24 patients were included in the study. The mean age was 50.4 ± 4.1 years in Group A and 48.9 ± 6.5 years in Group B, with a mean BMI of 28.4 ± 12.5 kg/m². All patients in both groups had positive PSI. No significant differences were observed in demographic or clinical parameters between the groups. However, wound debridement was more frequent in the disposable port group, showing a statistically significant difference (p-value = 0.05).

**Conclusion:** Port-site infections occurred in both plastic and metallic port groups, with no statistically significant difference between them. These findings indicated that port material alone may not be a major independent determinant of infection risk.

**Key words:** Surgical wound Infection, Laparoscopy, Hysterectomy

## Introduction

Laparoscopic surgery has become the acknowledged standard of care for many procedures in the modern world. Due to the rapid improvement of technology and the skill of surgeons, almost all major surgical procedures that were previously only possible using open techniques may now be performed laparoscopically.[1] The rapid advancement of laparoscopic hysterectomy has a profound effect, particularly in gynaecology. New pathways could be investigated with the introduction of laparoscopy for hysterectomy, urogynecological procedures, and oncological surgery, including lymphadenectomy in different physiological compartments.

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As a result, it became widely accepted in urology, surgery, and gynaecology among other fields.[2] This minimal access surgery (MAS) has caused a drastic shift in the approach to modern surgery, by limiting the access related morbidities. It involved making tiny skin incisions away from the surgical site to implant reusable metallic or disposable plastic trocars.[3] Better aesthetics, less pain, early ambulation and hospital discharge with an early return to work, and a reduction in the patient's financial load have all contributed to its growing popularity.[4]

In total laparoscopic hysterectomy (TLH) the complete operation, including vault closure and suspension, is performed laparoscopically.[5] Laparoscopic assisted vaginal hysterectomy (LAVH) begins with a laparoscopic procedure, which is followed by a vaginal phase and a final laparoscopic phase. LAVH is the more common technique despite this clear inefficiency since most gynecologist regard TLH to be technically difficult and need lengthy operating durations. However, LAVH is less likely to be successful than TLH or abdominal hysterectomy in many women, such as those with a narrow pubic angle, tiny vagina, or high immobile uterus.[4]

Nevertheless, laparoscopic surgery carries several avoidable risks, with port-site infection being the most frequent complication, which not only concerns patients due to the possibility of persistent infection but may also lead to loss of confidence in the operating surgeon, thereby diminishing its overall benefits.[6] The risk of port site infection may vary depending on the type of material of the port, sterilization efficacy, tissue trauma during insertion, and cost-effectiveness.[7,8] There is limited comparative data from low-middle-income countries regarding the incidence of port site infection (PSI) between metallic and disposable plastic port types in TLH. The current project was planned to compare the incidence of port site infection in patients undergoing TLH using disposable plastic port versus reusable metallic port at a private hospital-Karachi. Therefore, this study filled that gap and guided clinical practice by providing evidence-based recommendations.

## Methodology

It was a single-center retrospective cohort study conducted at the Department of Gynae Endoscopy & Obstetrics, Patel Hospital (tertiary care hospital), Karachi. It collected retrospective data from 2010 to 2025 as sample. Purposive sampling technique was used and women who underwent total laparoscopic hysterectomy at the institution within the defined study period were enrolled.

**Ethical consideration:** The study was approved by the ethical review board (Reference No. PH/IRB/2025/036, Dated: 21/08/2025). Informed written consent was obtained from the participants, and the confidentiality of their data was clearly explained.

**Inclusion criteria:** It included women aged 25–65 years who provided consent for elective total laparoscopic hysterectomy and had complete surgical and follow-up records available.

**Exclusion criteria:** Patients with prior history of pre-existing infection, immune-compromised status, incomplete medical record, follow-up loss and those undergoing emergency procedure were excluded.[8]

All participants were divided into two groups as Group-A (TLH using disposable plastic ports) and Group-B (TLH using reusable metallic ports). Data was extracted from hospital records, operative notes, and post-operative follow-up logs using a pre-designed data collection form. Variables recorded were demographic parameters (age, BMI, parity), type of port used, PSI and its post-operative management and outcomes. Port-site infection was defined according to standard surgical site infection criteria, including the presence of local signs of inflammation such as erythema, induration, tenderness, and/or purulent discharge at the port site.[9]

**Statistical Analysis:**

All the data was processed by Statistical Package for Social Sciences (SPSS) v28.0. Normality was checked by Shapiro Wilk test. Quantitative vari-ables like age, BMI and parity were presented as mean ± SD. Frequency (n) and percentages (%) were calcula-ted for qualitative variables. Descriptive statistics summarized baseline characteristics. Evaluation among groups was performed using Fisher's exact test to compare infection rates. A p-value of $\leq 0.05$ was considered statistically significant.

## Results

A total of 24 patients were included in the study. The mean age of patients was 50.4 ± 4.1 years in Group A (disposable plastic ports) and 48.9 ± 6.5 years in Group B (reusable metallic ports). The mean body mass index (BMI) of the study population was 28.4 ± 12.5 kg/m². Demographic characteristics of the patients are presented in Table I. No statistically significant differences were observed between the two groups with respect to marital status (p-value = 0.53) or presence of comor-

**Table I:** *Demographic Parameters of involved Patients (n=24)*

| Parameters | Categories | Group-A (Disposable plastic ports) | Group-B (Reusable Metallic ports) | p-value |
|---|---|---|---|---|
| | | Frequency (%) | Frequency (%) | |
| Marital Status | Yes | 7(77.80) | 14(93.30) | 0.53 |
| | No | 2(22.20) | 1(6.70) | |
| Comorbidities | Yes | 5(55.60) | 9(60.00) | 0.26 |
| | No | 4(44.40) | 6(40.00) | |
| Type of comorbidity | DM | 2(40.00) | 2(22.20) | 0.83 |
| | HTN | 3(60.00) | 5(55.60) | |
| | Hypothyroidism | 0(0.00) | 2(22.20) | |
| | Others | 0(00.00) | 0(0.00) | |
| | No | 7(77.80) | 15(100.00) | |

*p-value 0.05 considered statistically significant; p-value calculated by Fisher Exact Test; n: number of participants Diabetes Mellitus: DM, Hypertension: HTN*

bidities (p-value = 0.26). Similarly, the distribution of types of comorbidities, including diabetes mellitus, hypertension, and hypothyroidism, was comparable between the groups (p-value = 0.83).

Clinical parameters are summarized in Table II. All patients in both groups had positive PSI (100%), and therefore no statistical comparison was applicable for this variable. No significant differences were observed between the groups in terms of antibiotic prophylaxis (p-value = 0.57) and local infiltration (p-value = 0.57). However, a statistically significant difference was observed in wound debridement, which was more frequent in Group A compared to Group B (22.2% vs 0.0%, p-value = 0.05).

**Table II:** *Clinical Parameters of involved Patients (n=24)*

| Parameters | Categories | Group-A (disposable plastic ports) | Group-B (Reusable Metallic ports) | p-value |
|---|---|---|---|---|
| | | Frequency (%) | Frequency (%) | |
| PSI | Yes | 9(100.00) | 15(100.00) | ** |
| | No | 0(0.00) | 0(0.00) | |
| Antibiotics Prophylaxis | Yes | 8(88.90) | 12(80.00) | 0.57 |
| | No | 1(11.10) | 3(20.00) | |
| Local Infiltration | Yes | 2(22.20) | 2(13.30) | 0.57 |
| | No | 7(77.80) | 13(86.70) | |
| Wound debridement | Yes | 2(22.20) | 0(0.00) | 0.05* |
| | No | 7(77.80) | 15(100.00) | |

*p-value calculated by Fisher Exact Test, *p-value 0.05 considered significant, n=number of participants; ** No statistical test was applied as all participants in both groups had identical outcomes (100% PSI positive); hence, p-value is not applicable, Port Site Infection: PSI*

## Discussion

The present study evaluated the comparison of port site infection (PSI) between disposable plastic and metallic ports in total laparoscopic hysterectomy. The results demonstrated that the frequency of co-morbid conditions was comparable between Group A (55.6%) and Group B (60%), with no statistically significant difference (p-value = 0.83), thus indicating that baseline patient characteristics were similar across both groups. Co-morbidities such as diabetes mellitus (DM) and hypertension (HTN) are well-established risk factors for impaired wound healing and increased susceptibility to surgical site infections (SSI), as highlighted in previous studies. In the current study, HTN was the most common co-morbidity observed in both groups, followed by DM, while hypothyroidism was only reported in Group B. Previous studies have consistently reported that patients with DM have a significantly higher risk of SSI and poorer outcomes due to immune dysfunction and microvascular impairment.[10,11] Specifically, predictive models for SSI frequently include DM as a key risk factor.[12] Hypertension often coexists with DM; although its independent effect on SSI is less clear, it has been associated with poorer recovery, particularly when combined with other comorbidities.[13,14] Although hypothyroidism was less well studied in the context of acute SSI but it has been associated with longer-term complications such as impaired overall healing and increased infection risk in surgical populations.[15] Overall, the similar distribution of comorbidities between groups in this study aligns with existing literature, suggesting that while these factors influence infection risk, they did not contribute to differences between groups in the present analysis.

Notably, all participants in both groups were PSI positive (100%), resulting in a lack of variability in the outcome measure. Consequently, no statistical test (Chi-square or Fisher's exact test) could be applied, and the p-value was not applicable. This uniform distribution limited the ability to establish any comparative association between the type of port used and the occurrence of PSI. However, it also highlighted the need to carefully interpret these findings in the context of study design and

sample characteristics. Variability in the definitions of postoperative surgical infections across studies may influence reported infection rates and limit direct comparison of findings.[16] Some studies have not comprehensively defined SSI thus led to variability in reported incidence rates. Recent evidence emphasized that standardized definitions and consistent diagnostic criteria were essential for accurately comparing postoperative outcomes and ensuring reproducibility of results.[16]

Although antibiotic prophylaxis remained a cornerstone in preventing SSIs according to previous studies, but recent evidence highlighted the importance of appropriate timing and stewardship rather than prolonged use. A previous study has reported that the timing of antibiotic administration (preoperative vs extended perioperative regimens) did not significantly change SSI rates in general surgery patients, aligning with our finding of non-significant group differences.[17] Other studies on antibiotic prophylaxis also emphasized tailored use based on local microbial profile and resistance patterns rather than prolonged postoperative antibiotics.[18,19]

In the present study, the use of local infiltration was observed in a small proportion of patients, with 22.2% in Group A and 13.3% in Group B, while most patients in both groups did not receive local infiltration. This indicates a relatively limited and comparable utilization of this technique across the study groups. Existing literature predominantly focused on the role of local infiltration in postoperative pain control rather than infection prevention. For instance, studies in orthopedic surgery have demonstrated that local infiltration techniques are effective in reducing postoperative pain; however, they do not significantly influence wound infection rates or length of hospital stay.[20] These findings were consistent with the observations of the present study, where no clear association could be established between local infiltration and port site infection (PSI). The lack of significant variation in its use between groups, combined with evidence from previous studies, suggests that local infiltration may have minimal direct impact on infection-related outcomes. Therefore, while local infiltration remains a valuable modality for postoperative analgesia, its role in influencing infection-related outcomes appears limited. In the present study, no significant association was observed between local infiltration and port-site infection, suggesting that it may not be a major contributing factor in the development of PSI following total laparoscopic hysterectomy.

A significantly higher proportion of patients in Group A required wound debridement compared to Group B (22.2% vs. 0%, $p = 0.05$). This may reflect differences in local tissue response, surgical handling, or port characteristics influencing wound healing. Previous studies have shown that tissue trauma, contamination, and impaired healing are key factors necessitating debridement.[21] However, the small sample size warrants cautious interpretation. Another study on port-site infections in laparoscopic surgery reported that wound complications such as infection, necrosis, and delayed healing may require interventions like drainage and debridement to promote proper healing. The study emphasized that inadequate sterilization, tissue trauma, and microbial contamination are key contributors to such complications.[22]

## Conclusion

Port-site infections were observed with both disposable plastic and metallic ports, suggesting that port material alone may not be the primary determinant of infection risk. No significant difference in infection occurrence was observed between the groups. These findings highlight the importance of adhering to strict aseptic techniques, including operating theatre sterility, proper instrument reprocessing and sterilization, and meticulous skin preparation and draping, to minimize infection risk in laparoscopic procedures.

## Limitations and Recommendations

This was a single center study with limited number of patients and financial constraints. Further prospective studies with larger sample sizes and multicenter involvement are warranted to validate these findings and explore port site infection during total laparoscopic hysterectomy.

**Conflict of Interest:** None
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## Authors Contribution

All authors have approved the final version and are responsible for the integrity of the study.

**ZA:** Literature search, data collection and review

**SS:** Conceptualization, literature search, review and revision

**AB &TL:** Data collection and analysis, writeup and revision

Original Article

# Comparison of Teaching Aids and Learning Styles in Anatomy: A Cross-Sectional Study Among Medical and Dental Students

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## Abstract

**Background:** Anatomy education has evolved significantly, incorporating multimodal teaching approaches to balance traditional cadaveric dissections with emerging technological tools.

**Objective:** To assess students' perceptions regarding the effectiveness of anatomical teaching aids and tools like anatomage table, plastic models and cadaveric specimens in facilitating their learning and to explore students' perspectives on their preferred learning styles.

**Methodology:** This cross-sectional study was conducted via a questionnaire distributed among first- and second-year MBBS students and first-year BDS students at Azra Naheed Medical and Dental College. All data was processed using SPSS v26.0. Descriptive statistics including mean and standard deviation were calculated for effectiveness rating scores. One-way ANOVA test was used to compare effectiveness rating scores of anatomical learning resources for soft tissue across different learning styles. P-value ≤ 0.05 was considered significant.

**Results:** Plastic models were the most highly rated learning resource for both soft tissue and bone anatomy, with most participants rating them as Excellent (52.1% for soft tissue, 51.1% for bone) and Good (37.9% for soft tissue, 40.5% for bone). Similarly, plastic models were the preferred time-saving resource, while anatomage was perceived as less efficient than other methods. The most preferred learning style was Reading/Writing (41.1%), followed by Visual (24.7%), Kinesthetic (24.2%), and Auditory (10.0%).

**Conclusion:** It was concluded that plastic models were perceived as the most effective resource for anatomy learning, primarily due to their time efficiency and ease of use. Reading/writing was identified as the predominant learning style among students, highlighting the importance of aligning teaching strategies with learner preferences.

**Key words:** Anatomy, Learning, Students, Perception

## Introduction

Teaching anatomy has changed significantly to accommodate a variety of student-specific learning styles and to stay up with technological advancements. More progressive methods that promote active learning are in competition with traditional instructive methods that promote a more passive learning style. Traditional techniques of teaching anatomy, such as cadaveric dissections and prosections, have grown more challenging because of a shortage of donated bodies, growing safety concerns, and high costs.[1,2] Furthermore, tertiary anatomy courses have steadily moved away from rote memorizing and toward comprehension of the material, which is fueled by concept-based, problem-solving methodo-

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logies.[3,4] These developments have been complemented by dynamic technological advancements that have improved the quality and accessibility of medical imaging methods, models, and simulations.[3] As a result, mixed, or multimodal, learning methodologies have been used, giving pupils access to a range of conventional and innovative sources of information. Traditional dissections and didactic lectures are frequently supplemented (and occasionally replaced) by commercial models, computer simulations, clay modeling, body painting, and other living anatomy teaching techniques.[5,6]

The anatomage creates a 3-dimensional (3-D) reconstruction of the various human body components by combining software with stereoscopic pictures of the entire body. To enable virtual dissection and reconstruction of the human body, these pictures were obtained from two cadavers, have been frozen and divided into pieces.[5] The anatomage has proven to be an effective tool in teaching anatomy, as it provides students with hands-on experience without the need for a cadaver. This shift towards alternative learning tools is part of a broader discussion in anatomy education, with some research exploring if models and simulations can replace cadavers altogether.[7]

Given the variability in available resources and institutional constraints across medical schools, there is a need to evaluate and adapt anatomy teaching methods to ensure effective learning. Furthermore, understanding students' preferred learning styles is essential for informed curriculum remodeling and optimization of teaching strategies. In-order to compare teaching aids and learning styles in anatomy, the current study was planned with aims to assess students' perceptions regarding the effectiveness of anatomical teaching aids and tools like anatomage table, plastic models and cadaveric specimens in facilitating their learning and to explore students' perspectives on their preferred learning styles. The results of this study will add to present literature regarding preferred learning style among students in curriculum remodeling.

## Methodology

This was a cross-sectional study conducted over a period of six months at Azra Naheed Medical and Dental College. The sample size of 190 was calculated by assuming the proportion of preferred learning style is equal to 40% with a confidence level equal to 95% and a margin of error equal to 7%.[3]

**Ethical consideration:** The study was approved by the ethical review board (Reference No. FRB/BMS/13/ 03/ 2025, Dated: 13-03-2025). Informed written consent was obtained from the participants, and the confidentiality of their data was clearly explained.

Data was collected by a questionnaire that was distributed among first- and second-year MBBS students, as well as first-year BDS students at Azra Naheed Medical and Dental College. Non-probability convenience sampling technique was used. Plastic models, specimens and anatomage were used as learning tools for anatomy (soft tissue and bones). The questionnaire consisted of 25 questions, pertaining to the comparison, benefits and drawbacks of different teaching aids: blackboard, PowerPoint, overhead projectors and video animation. The questions were styled in multiple-choice format, with two sections based on the 04-point Likert Scale. In the first section their perception regarding these aids was categorized as unsure, fair, good and excellent in form of marks from 0-3 as used in other studies previously.[8,9] On the other hand, in the second section, learning style was categorized into Reading/ Writing, Visual, Kinesthetic and Auditory.[10] Learning styles were given a score from 1-4 according to preference by students. Score of 4 was regarded as excellent while 1 was marked as unsure. A pilot study was conducted to check the reliability and Cronbach alpha revealed a value of 0.79.

**Inclusion Criteria:** All willing male and female first- and second-year MBBS students, as well as first-year BDS students, were included.

**Exclusion Criteria:** Students who were unwilling or not interested in providing their feedback were excluded.

**Statistical Analysis:**

Statistical Package for Social Sciences (SPSS) version 26 was used for statistical analysis. Mean and standard deviation were calculated for effectiveness ratings score. Normality of the data was checked by Shapiro Wilk test. A one-way ANOVA test was used to compare the effectiveness ratings score of anatomical learning resources for soft tissue across different learning styles. Frequency and percentage were given for gender, predominant learning style and responses to the perceived effectiveness of anatomical learning Resources. A p-value of $\leq 0.05$ was taken as statistically significant.

## Results

The study sample consisted of 190 participants, with a nearly equal gender distribution. There were 96 (50.5%) male and 94 (49.5%) female students. The most preferred learning style was Reading/Writing, followed by Visual, Kinesthetic, and Auditory as shown in Figure I.

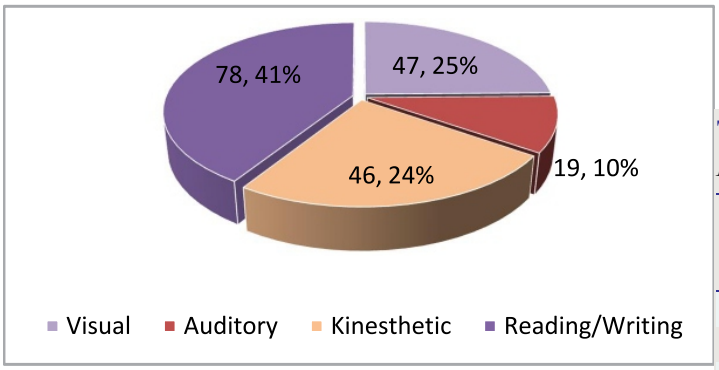



**Figure-I:** *Frequency Distribution of Predominant Learning Style*

The results indicated that plastic models were the most highly rated learning resource for both soft tissue and bone anatomy, with most of the participants rating them as Excellent and Good as shown by Table I. Specimens received more varied responses, with Excellent ratings of 36.8% for both soft tissue and bone, while a significant proportion rated them as Fair. Anatomage models, however, received the lowest ratings, with the highest percentage of participants rating them as Fair (40.0% for soft tissue, 35.3% for bone), and only 22.6% (soft tissue) and 25.3% (bone) rating them as Excellent. A small proportion of participants were Unsure about Anatomage (4.7% for soft tissue, 3.7% for bone), whereas none were uncertain about plastic models or specimens for bone anatomy. Overall, plastic models were perceived as the most effective resource, followed by specimens, while Anatomage was rated less favorably, particularly for soft tissue learning.

**Table I:** *Frequency Distribution of Perceived Effectiveness of Anatomical Learning*

| | Medium you think clears your concepts | Unsure n (%) | Fair n (%) | Good n (%) | Excellent n (%) |
|---|---|---|---|---|---|
| Soft Tissue | Plastic Models | 0 (0.0) | 19(10.0) | 72 (37.9) | 99 (52.1) |
| | Specimens | 6 (3.2) | 53(27.9) | 61 (32.1) | 70 (36.8) |
| | Anatomage | 9 (4.7) | 76(40.0) | 62 (32.6) | 43 (22.6) |
| Bone | Plastic Models | 0 (0.0) | 16(8.4) | 77 (40.5) | 97 (51.1) |
| | Specimens | 0 (0.0) | 57(30.0) | 63 (33.2) | 70 (36.8) |
| | Anatomage | 7 (3.7) | 67(35.3) | 68 (35.8) | 48 (25.3) |

*n: number of participants*

Plastic models were perceived as the most time-saving medium for learning anatomy, with most of the participants rating them as Excellent (63.2%) and Good (29.5%), while very few rated them as Fair (6.8%) or were Unsure (0.5%) as presented in Table II. Specimens, on the other hand, received more mixed ratings, with the highest proportion rating them as Good (37.4%), followed by Fair (33.7%) and Excellent (25.3%), indicating moderate effectiveness. Anatomage models had the lowest proportion of Excellent ratings (16.3%), with a significant percentage of participants rating them as Fair (39.5%) or Good (41.1%), and a small proportion (3.2%) expressing uncertainty. Overall, plastic models were the preferred time-saving resource, while Anatomage was perceived as less efficient compared to other methods.

**Table II:** *Frequency Distribution of Perceived Time Efficiency of Anatomical Learning*

| Time-Saving Medium for Learning Anatomy | Unsure n (%) | Fair n (%) | Good n (%) | Excellent n (%) |
|---|---|---|---|---|
| Plastic Models | 1 (0.5) | 13 (6.8) | 56 (29.5) | 120 (63.2) |
| Specimens | 7 (3.7) | 64 (33.7) | 71 (37.4) | 48 (25.3) |
| Anatomage | 6 (3.2) | 75 (39.5) | 78 (41.1) | 31 (16.3) |

*n: number of participants*

Significant variations were observed in the perceived

**Table III:** *Effectiveness of Anatomical Learning Resources for Soft Tissue Across Different Learning Styles*

| Soft Tissue | Learning Style | Mean ± SD | p-value |
|---|---|---|---|
| Plastic models | Visual | 2.7 ± 0.5 | 0.000* |
| | Auditory | 2.1 ± 0.8 | |
| | Kinesthetic | 2.1 ± 0.7 | |
| | Reading/writing | 2.5 ± 0.6 | |
| Specimens | Visual | 2.1 ± 0.7 | 0.002* |
| | Auditory | 2.2 ± 0.8 | |
| | Kinesthetic | 2.4 ± 0.8 | |
| | Reading/writing | 1.8 ± 0.9 | |
| Anatomage | Visual | 1.8 ± 0.9 | 0.589 |
| | Auditory | 1.7 ± 0.9 | |
| | Kinesthetic | 1.8 ± 0.8 | |
| | Reading/writing | 1.6 ± 0.9 | |

**p-value ≤ 0.05 statistically significant; p-value calculated by one way ANOVA, SD= Standard Deviation.*

effectiveness of different anatomical learning resources across learning styles (Table III). Plastic models for soft tissue were rated the highest overall, with visual learners showing the strongest preference and kinesthetic learners giving the lowest rating. Specimens for soft tissue had a lower overall rating, with kinesthetic learners rating them the highest and reading/writing learners the lowest. In contrast, Anatomage for soft tissue received the lowest ratings, with no significant variation across learning styles.

**Table IV:** *Effectiveness of Anatomical Learning Resources for Bone Across Different Learning Styles*

| Bone | Learning Style | Mean ± SD | p-value |
|---|---|---|---|
| **Plastic models** | Visual | 2.7 ± 0.5 | 0.000* |
| | Auditory | 2.3 ± 0.8 | |
| | Kinesthetic | 2.1 ± 0.7 | |
| | Reading/writing | 2.5 ± 0.6 | |
| **Specimens** | Visual | 2.1 ± 0.7 | 0.008* |
| | Auditory | 2.2 ± 0.8 | |
| | Kinesthetic | 2.4 ± 0.8 | |
| | Reading/writing | 1.9 ± 0.8 | |
| **Anatomage** | Visual | 1.9 ± 0.9 | 0.627 |
| | Auditory | 1.8 ± 0.8 | |
| | Kinesthetic | 1.9 ± 0.8 | |
| | Reading/writing | 1.7 ± 0.9 | |

**p-value ≤ 0.05 statistically significant; p-value calculated by one way ANOVA, SD= Standard Deviation.*

**Table V:** *Perceived Time-Saving Effectiveness of Anatomical Learning Resources Across Different Learning Styles*

| Time-Saving Medium for Learning Anatomy | Learning Style | Mean ± SD | p-value |
|---|---|---|---|
| **Plastic models** | Visual | 2.7 ± 0.6 | 0.057 |
| | Auditory | 2.5 ± 0.5 | |
| | Kinesthetic | 2.3 ± 0.8 | |
| | Reading/writing | 2.6 ± 0.6 | |
| **Specimens** | Visual | 1.8 ± 0.8 | 0.001* |
| | Auditory | 2.1 ± 0.8 | |
| | Kinesthetic | 2.2 ± 0.8 | |
| | Reading/writing | 1.6 ± 0.9 | |
| **Anatomage** | Visual | 1.8 ± 0.8 | 0.158 |
| | Auditory | 1.7 ± 0.6 | |
| | Kinesthetic | 1.9 ± 0.7 | |
| | Reading/writing | 1.6 ± 0.8 | |

**p-value ≤ 0.05 statistically significant; p-value calculated by one way ANOVA, SD= Standard Deviation.*

Table IV shows that plastic models were rated highest for bone anatomy, followed by specimens, while Anatomage received the lowest ratings. Significant differences were observed across learning styles for plastic models and specimens, whereas no significant variation was noted for Anatomage.

For general learning and time-saving methods, plastic models were rated the highest, with visual learners giving the strongest preference and kinesthetic learners rating them the lowest but the results were not significant (Table V). Specimens received comparatively lower ratings, although kinesthetic learners rated them higher than other groups, with a significant difference across learning styles. In contrast, Anatomage received the lowest ratings overall, with no significant variation across learning styles. Overall, plastic models emerged as the most effective learning resource across all categories, followed by specimens, while Anatomage had the lowest ratings and no significant preference among learners.

## Discussion

A comprehensive understanding of anatomy is essential for the practice of medicine therefore, it should not rely solely on a single teaching modality. This study evaluated different tools in relation to students preferred learning styles and it also dressed the student's perception on different teaching styles. Results of present study indicated that plastic models were the most highly rated learning resource for both soft tissue and bone anatomy, with the majority of participants rating them as Excellent and Good. Paradoxically, previous studies have demonstrated that cadaveric dissection has historically remained a fundamental method for teaching anatomy in medical schools world-wide.[7,11] Students have expressed a strong belief that engaging in cadaveric dissection enhances their under-standing of anatomy and fosters greater respect for the human body.[8] Furthermore, other anatomists have emphasized that cadaveric dissection cannot be replaced, although it can be effectively augmented with additional teaching tools to enhance anatomical learning..[9,12] However, in contrast to studies favoring cadaveric dissection, the present findings highlighting the effectiveness of plastic models are supported by previous research demonstrating that students taught using plastic models achieved significantly higher scores compared to those taught through cadaveric dissection.[13] It was reported that plastic models improved concept clarity, structured learning, repeated access and exam performance as these models provide a clear, tangible representation

of anatomical structures, which likely enhances understanding and retention. In the current study, visual learners rated plastic models highest, supporting the idea that visual representation is key to grasping complex spatial relationships in anatomy. Moreover, plastic anatomical models may demonstrate improved learning outcomes in certain contexts due to their ability to facilitate tactile and repetitive hands-on interaction, allowing students to repeatedly explore structures without the limitations associated with cadaver availability. Additionally, models provide clear, standardized visualization of anatomical relationships, which can reduce cognitive overload for novice learners and enhance spatial understanding. This combination of tactile engagement and simplified representation can, in some settings, lead to better short-term comprehension compared to cadaver-based learning.[14]

However, previous studies have reported that anatomical models were perceived as less useful in achieving intended learning objectives, with students demonstrating a preference for cadaver-based learning.[15,16] In contrast, advancements in digital technology have introduced three-dimensional (3D) anatomical models and texture mapping, which can effectively represent the morphological attributes of human tissues and structures. These tools are particularly valuable in visualizing complex anatomical relationships that are difficult to appreciate through conventional methods, thereby enhancing the effectiveness of anatomy instruction. Traditional anatomical models were initially introduced to compensate for the limited availability of cadaveric specimens.[17,18] Despite these advancements, the Anatomage table received comparatively lower ratings from students in the present study. This may be attributed to several factors, including limited training, lack of familiarity, reduced accessibility, and the high cost associated with the technology, making it less feasible for widespread institutional use.

The present study showed that most preferred learning style was Reading/Writing, followed by Visual, Kinesthetic and Auditory. Similarly, previous studies on learning anatomy by different styles have reported that reading/writing was the priority of the students on any teaching tools followed by visual while auditory styles was least preferred.[15,19,20] These findings provide valuable insight for educators to better under-stand students' learning needs and adapt their teaching strategies accordingly. In terms of time efficiency, plastic models received the highest ratings, while specimens had mixed results and the Anatomage table lagged. The observation that visual learners consistently rated plastic models highest in both effectiveness and time-saving measures suggests that this method aligns well with the predominant learning style within the study population.[21] Plastic models were widely adopted because they are easy to handle, require minimal setup, and allow rapid repetition of learning tasks as reported by one study.[22] These features directly translate into higher time efficiency ratings by students. A previous study showed that plastinated specimens improved performance and clinical understanding. However, they involve handling complexity, preparation time, and limited availability. Consequently, they are less time-efficient and more variable in student preference.[23]

Overall, these findings suggest that plastic models remain the most effective and adaptable teaching tool for a majority of students, making them a strong candidate for continued and expanded use in the curriculum. Specimens, while less universally favored, still hold value for kinesthetic learners, supporting their continued inclusion alongside other resources. The comparatively lower ratings for the Anatomage table indicate that, despite its technological advantages, it may require improved integration, adequate training, or complementary instructional strategies to enhance its educational effectiveness.[15,24]

## Conclusion

Plastic models were perceived as the most effective resource for anatomy learning, primarily due to their time efficiency and ease of use. Reading/writing was identified as the predominant learning style among students, highlighting the importance of aligning teaching strategies with learner preferences.

## Limitations and Recommendations

This study has certain limitations. This was a single center study and cross-sectional design was used which limits the ability to establish causal relationships. Additionally, the use of convenience sampling may introduce selection bias and limit the representativeness of the study population, thereby affecting the generalizability of the findings.

Curriculum remodeling efforts should prioritize a balanced, multimodal approach that integrates traditional models and specimens with newer technologies like the Anatomage table but only if the technology can be adapted to better meet student learning needs. Further

research may be necessary to explore how the Anatomage table can be enhanced or paired with other methods to improve its effectiveness, particularly for visual and kinesthetic learners. By aligning teaching strategies with students' preferred learning styles, medical education can become more engaging, efficient, and effective, ultimately fostering a deeper understanding of anatomy.

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## Authors Contribution

All authors have approved the final revision of the manuscript and take responsibility for the integrity of the study.

**AI & RT:** Conceptualization of Project, Data interpre-tation, writeup and revision of the manuscript

**ZH, AS, RT:** Literature search, Data Collection, analysis and article writeup and revision

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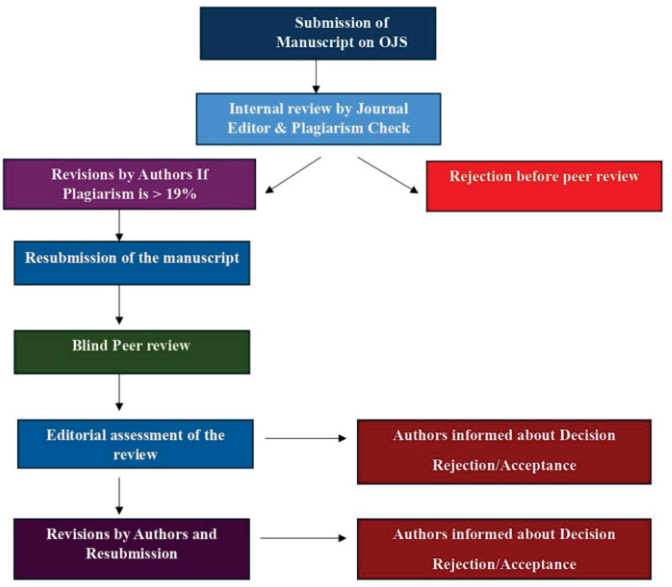
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