

# Analysis of Caesarean Sections Using Robson's Ten-Group Classification System in a Tertiary Care Hospital: A Descriptive Study

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## Abstract

**Objective:** To evaluate the impact of subgroups and the frequency of cesarean sections using the Robson's Ten-Group Classification system at a tertiary care center in Lahore, Pakistan.

**Methodology:** This descriptive examination of a cross-section included all births that took place at Avicenna Hospital, Lahore, from July 1, 2024, to March 31, 2025. A total of 550 deliveries were classified according to the Robson ten-group classification system. Maternal demographics, obstetric characteristics, indications for caesarean sections, and the results for mothers and newborns were also recorded. Data were analyzed using SPSS version 26, and the results are presented as frequencies and percentages.

**Results:** Among 550 deliveries, 200 were caesarean sections, yielding an in general caesarean section (rate of 36.4% (200/550 deliveries)). The average maternal age of women having cesareans ( $29.3 \pm 5.4$  years). Robson ten-group classification system analysis showed that Robson ten-group classification system analysis showed that Group 4 (women who are multiparous but do not have a uterine scar, induced or pre-labor caesarean sections) comprised the largest segment of caesarean sections (cases (27.5%)), succeeded in contribution by Group 5 (Uterine scarred multiparous women) (27.0%) of all caesarean deliveries. Failed induction and failure to progress were the most common indications for these groups.

**Conclusion:** The application of Robson ten-group classification system demonstrated that multiparous women, particularly those in Groups 4 and 5, were significantly associated with higher rates of caesarean sections. Focused clinical audits and targeted obstetric interventions in these groups may help optimize caesarean section practices and reduce unnecessary procedures.

**Keywords:** Caesarean section, Obstetrics, Pregnancy Robson Ten-Group Classification System

## Introduction

Medically indicated caesarean section (CS) is a vital obstetric intervention that can

improve maternal and neonatal outcomes and safeguard both lives.<sup>1</sup> Examples of clinical indications for CS include fetal distress, placenta previa, obstructed labor, and other situations in which the risks associated with vaginal delivery are high. Through the use of prompt surgical intervention, CS minimizes the risks of maternal and neonatal morbidity and mortality from complications such as severe maternal hemorrhage, uterine rupture, or neonatal asphyxia. Furthermore, CS may improve long term health outcomes and enhance maternal psychosocial well-being by preventing trauma to the mother and baby, and ensuring a safer recovery. Global surveys indicate that the percentage of cesarean deliveries was 21.1% in 2021 and is predicted to rise to almost 29% in 2023.<sup>2</sup> This increase can be attributed to multiple factors, like the improvement of prenatal diagnoses, advancements of medical equipment, and refinements of clinical practices that prioritize the safety of the mother and baby. The increasing demand for cesarean sections is also attributed to maternal age, older first-time mothers, and the increased presence of comorbidities. Given the trend, it is concerning that the overutilization of cesarean sections may pose unwarranted surgical risks, prolonged recovery, and increased cost of care without any added value.

The disparity is still quite notable. While CS rates are at 8.2% for low-income countries and 24.2% for middle-income countries, depending on the location, there are quite complex cases of both under and over utilization.<sup>2</sup> In low-income countries, the underutilization of CS often contributes to readily preventable deaths of mothers and newborns due to the lack of access to emergency obstetric care and surgical services. Middle-income countries, on the other hand, face dual problems: disparate access, where some areas have over-utilization, and other areas have under-utilization, due to non-medical reasons such as provider payment incentives, cultural norms, and systemic healthcare inefficiencies. The dissimilarity of the zones reinforces the need for tailored strategies to address both availability and

the lessening of potential unnecessary caesarean sections. Pakistan faces alarming rates of caesarean births which appear to exceed the WHO optimal use guidelines based on national data from the Demographic and Health Survey.<sup>3,4</sup>The caesarean birth rate worldwide is ideally kept between 10-15% in order to limit the risks associated with having a caesarean. Anything beyond this risk threshold is without a doubt a medical overuse driven by patient wants, physician convenience, or socioeconomic factors. Such overuse would likely increase the risks of operative morbidity, prolonged admissions, and the strain on the healthcare system. The data

provided necessitate a systematic review on the assessment of caesarean birth procedures. In order to improve the outcomes of mothers and babies, the processes must be evidence based and effectively streamlined. Standardized clinical processes, enhanced provider education, and improved patient education will help align the use of cesareans with best practices, and will focus on increasing the safety and resource efficiency of caesarean practices.

### Methodology

This retrospective cross-sectional study was conducted using

**Table 1:** Robson’s Ten Group Classification System.<sup>5</sup>

Group	Description
1	First-time mothers having one fetus in cephalic position during the term <sup>a</sup> who go into labor naturally.
2	Women who are nulliparous and have one cephalic-term <sup>a</sup> pregnancy whose either induced or natural labor or scheduled for caesarean delivery.
3	Women who are multiparous yet lack previous uterine scar, carrying a single cephalic fetus at term <sup>a</sup> with spontaneous labor onset.
4	Women who are multiparous but no scarred uterus, utilizing a singleton cephalic-term <sup>a</sup> pregnancy, undergoing either induced labor or planned CS.
5	Women with one or more prior caesarean sections, carrying a single cephalic fetus at term <sup>a</sup> .
6	First-time mothers carrying a single fetus in breech presentation.
7	Women who are multiparous and breech presenting singleton pregnancy, including those with prior uterine surgery.
8	All women carrying twins or higher-order multiples, regardless of previous CS status.
9	Women with a singleton fetus in transverse or oblique lie, with or without a uterine scar.
10	All women delivering a single cephalic fetus before 37 weeks of gestation <sup>b</sup> , including those with previous CS.

a refers to at least 37 weeks of gestation at the time of delivery. b refers to a gestational age of less than 37 full weeks at the time of delivery.

delivery records from the Avicenna Hospital’s Department of Obstetrics & Gynecology, affiliated with Avicenna Medical College, Lahore, Pakistan. Every delivery occurring between July 1, 2024, and March 31, 2025, were eligible for inclusion, which included 550 deliveries. The ERB approval was obtained from the institution under reference number IRB-53/06/24/AVC on 20-04-2024. Women included in this study reported having given live birth or stillbirth at gestational weeks 24 or more.

All deliveries were categorized using Robson’s Ten-Group Classification System (RTGCS), which facilitated group classification and size calculations. Clinical breakdowns were restricted, however, to the 200 CS cases for the baseline maternal characteristics, the reasons for the operation, any complications intra- or post-operatively, and the outcomes for the neonates. Records for deliveries prior to 24 weeks gestation and the record sets without the necessary variables to construct a Robson group were eliminated from consideration in the study.

Using a structured proforma, the study acquired data from labor ward records, operating theatre registers, and the study period individual clinical records. Variables included maternal age, gravida, parity, prior abortions, and

gestational age at delivery, and obstetric and demographic characteristics, labor onset (pre- CS labor, spontaneous, induced, augmented), CS primary reason, maternal medical comorbidities/ complications, Apgar score, and other neonatal parameters. Source registers and the clinical team for the case were consulted to fill any gaps identified.

To analyze the data, SPSS version 26 was utilized. Continuous variables’ lowest and highest values are shown as mean ± standard deviation (SD). Frequencies (n) and percentages (%) are used to display categorical variables. Unless otherwise specified, percentages for baseline characteristics, indications, complications, and neonatal outcomes used the denominator of all caesarean sections. For the Robson analysis, the relative contribution to CS (%) used all CS as the denominator, and its absolute contribution to CS rate (%) used all deliveries (N=550) as the denominator. The size of each group (%) and the group CS rate (%) require the total number of deliveries within each Robson group; however, these totals were unavailable and therefore could not be calculated. As this was a descriptive institutional audit, no hypothesis testing was conducted a priori.

For the Robson analysis, the following measures were

defined (denominators shown in brackets): Group size (%) = (Robson group delivery count ÷ total deliveries [N=550]) × 100 (not computed in this analysis since group totals were not available) ; CS rate within group (%) = (number of CS in the Robson group ÷ number of deliveries in that group) × 100 (not computed in this analysis since group totals were not available); The total percentage of the CS rate is equal to the number of CS in the Robson group divided by the total number of deliveries (N = 550) times 100; In the Robson group, the number of CS divided by the total number of CS (N = 200) equals the relative contribution to all CS (%); Robson’s “relative contribution to all CS” and “group size (%)” percentages were computed with all deliveries as the denominator and were verified to add up to almost 100%.

Throughout the research period, there were 550 deliveries recorded, including 200 caesarean sections, yielding an overall CS rate of 36.4% (200/550). Unless otherwise specified, the results below describe women who underwent CS (N=200). The baseline maternal and obstetric characteristics of the CS cases are summarized in Table 2. The average age of mothers was 29.3 ± 5.4 years and the mean gestational age at delivery was 37.2 ± 1.7 weeks. Regarding labor status at the time of caesarean section, pre-labour caesarean section was the most common, accounting for 79 cases (39.5%). This was followed by caesarean section after spontaneous labour in 74 cases (37.0%). Caesarean sections performed after induced labour comprised 37 cases (18.5%), while 10 cases (5.0%) occurred following augmentation of labour.

**Results**

The minimum and maximum values of continuous variables

**Table 2.** Maternal characteristics and labor status among women undergoing caesarean section (N = 200)

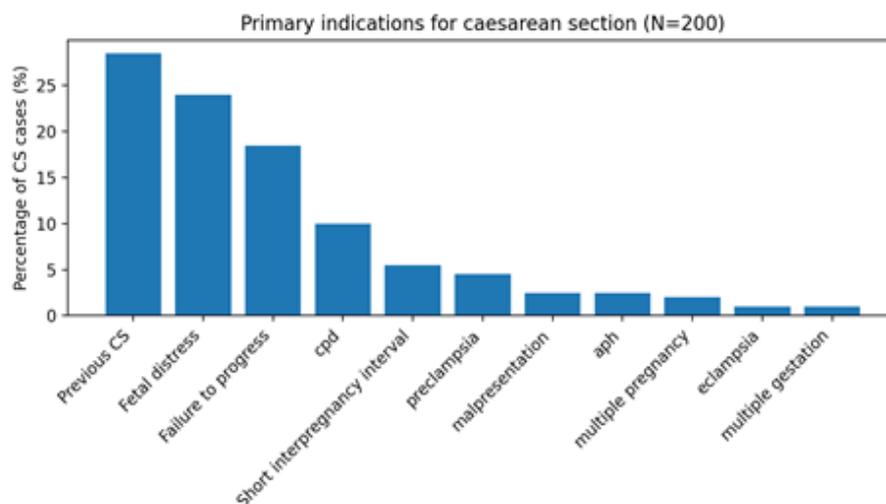
Characteristic	Value	Range / %
Age (years)	29.3 ± 5.4	17–39
Gravida	3.0 ± 1.7	1–9
Parity	1.8 ± 1.7	0–8
Previous abortions	0.3 ± 0.7	0–3
Gestational age (weeks)	37.2 ± 1.7	26–41
Pre-labour CS	79	39.5%
Spontaneous labour	74	37.0%
Induced labour	37	18.5%
Augmented labour	10	5.0%

are displayed as mean ± standard deviation (SD). Categorical variables are presented as n (%). Percentages for labor status were calculated using the total number of caesarean sections (N = 200) as the denominator.

section, fetal distress, and failure to progress, with other indications contributing to smaller proportions. Bars show the percentage of CS cases for each recorded primary indication, Percentages used N=200 as the denominator.

The primary indications for CS are listed in the figure (Figure 1). The most frequent indications were previous caesarean

The maternal comorbidities/complications recorded in the CS cases are shown in the figure (Figure 2). A substantial

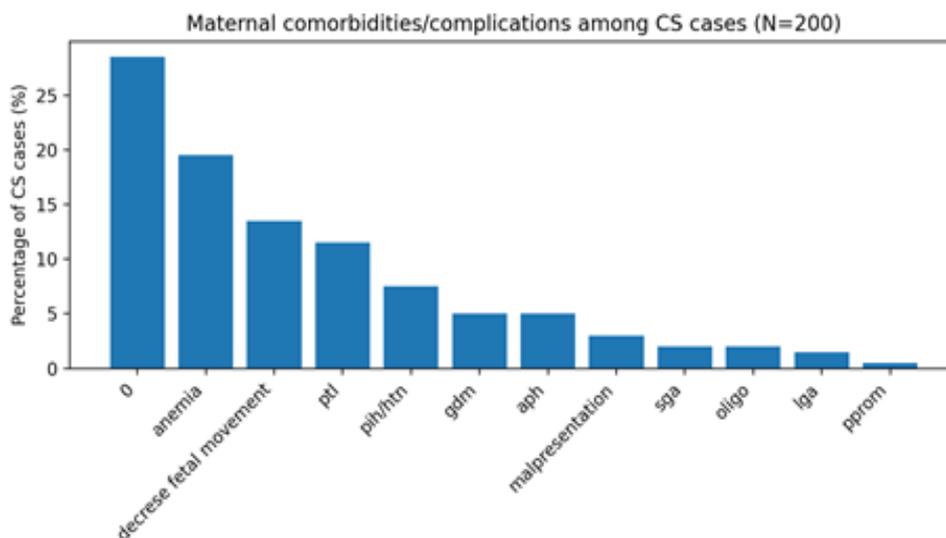


**Figure 1.** Primary indications for caesarean section among CS cases (N=200).

proportion had no recorded comorbidity/complication, while anemia and decreased fetal movement were among the most commonly recorded conditions. Each case was assigned a single primary comorbidity/complication category; therefore, the categories were mutually exclusive. Bars show

the percentage of CS cases in each primary comorbidity/complication category. Categories are mutually exclusive, and percentages use N=200 as the denominator.

Most neonates were viable at birth 196(98%), with a small



**Figure 2.** Maternal comorbidities among caesarean section cases (N=200).

proportion of them being stillbirths 3(1.5%). Apgar categories are reported in Table 3, with the majority achieving Apgar  $\geq 7$ , and smaller proportions with low Apgar or Apgar 0.

Values are presented as n (%). Percentages were calculated using N=200 caesarean sections as the denominator.

Values are presented as n (%). Percentages were calculated

**Table 3.** Indications for caesarean section, maternal comorbidities, and neonatal outcomes (N = 200)

Category	n	%
<b>Indications for caesarean section</b>		
Previous caesarean section	54	27.0
Fetal distress	48	24.0
Failure to progress	36	18.0
Other indications	62	31.0
<b>Maternal comorbidities</b>		
Anemia	42	21.0
Reduced fetal movements	26	13.0
No comorbidity	102	51.0
<b>Neonatal outcomes</b>		
Live birth	197	98.5
Stillbirth	3	1.5
<b>Apgar score at 5 minutes</b>		
$\geq 7$	191	95.5
$< 7$	6	3.0
0	3	1.5

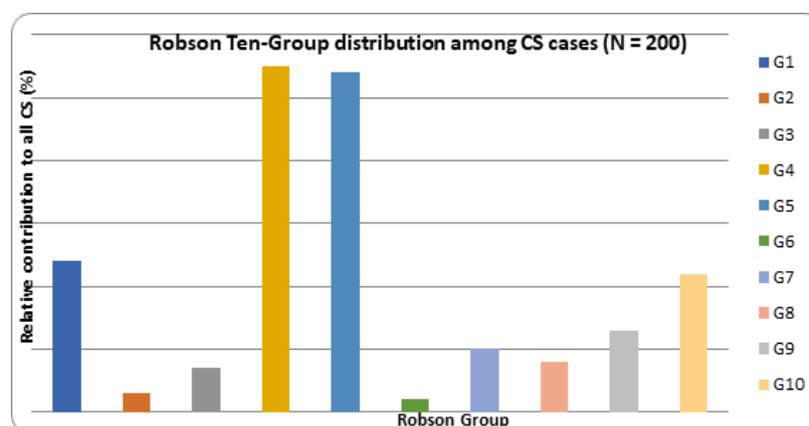
using N = 200 caesarean sections as the denominator. Indications for caesarean section are mutually exclusive and sum to 100%. Maternal comorbidity categories represent the most frequently recorded conditions and therefore do not sum to 100%. An Apgar score of 0 corresponds to stillbirths. NR = Not reported due to absence of total deliveries within

**Table 4.** Robson Ten-Group Classification of caesarean sections with relative contribution to total CS

Robson Group	Obstetric group (WHO definition) <sup>15</sup>	CS (n)	Group size (%)	CS rate within group (%)	Relative contribution to total CS (%)
1	Singular, cephalic, nulliparous, term, spontaneous labor	24	NR	NR	12.0
2	Term, induced, pre-labor, singleton, nulliparous, or cephalic CS	5	NR	NR	2.5
3	Singleton, cephalic, term, spontaneous labor, and multiparous (no scar)	7	NR	NR	3.5
4	Singular, cephalic, term, induced, or pre-labor CS, multiparous (no scar)	55	NR	NR	27.5
5	Multiparous, ≥1 previous CS, singleton, cephalic, term	54	NR	NR	27
6	Nulliparous, singleton breech	2	NR	NR	1.0
7	Singleton breech and multiparous (including prior CS)	10	NR	NR	5.0
8	Previous CS and several pregnancies	8	NR	NR	4.0
9	Transverse or oblique lie, singleton pregnancy	13	NR	NR	6.5
10	Singleton, cephalic, preterm (<37 weeks)	22	NR	NR	11
<b>Total</b>		<b>200</b>			<b>100</b>

each Robson group. Group size (%) = (N = 550) x 100 (number of women in each Robson group ÷ total deliveries). The CS rate within a group is calculated by multiplying the number of caesarean sections by the total number of women in the group by 100. Relative contribution to total CS (%) =

(group caesarean sections ÷ total [N = 200]) × 100. Because Robson group delivery totals were unavailable, NR = Not recorded. OB group definitions and reporting indicators follow the WHO Robson categorization implementation guideline.<sup>6</sup>



**Figure 3:** Relative contribution of RTGCS to all caesarean sections (N=200). Bars show the percentage of all CS accounted for by each Robson group (denominator: all CS, N=200).

## Discussion

This hospital-based audit applied the Robson Ten-Group Classification System to 550 deliveries at a tertiary care center and found that Groups 4 and 5 accounted for more than half of all caesarean sections, yielding an overall CS rate of 36.4%. Institutional audits of this type are critical because they not only quantify operative workload but also highlight the obstetric groups in which targeted interventions may reduce unnecessary CS. As a developing country, Pakistan is at 5th rank with a greater population rate, and according to the WHO with a 340/100,000 mortality rate.<sup>7</sup> The rising section rate may be attributed to complications such as breech presentation, placenta previa, and prior pregnancies. WHO cautions against the widespread assumption that surgical birth offers greater safety than vaginal delivery, a perception that has fueled rising rates of non-medically indicated procedures and heightened medico-legal anxiety among healthcare providers.<sup>6,7</sup> Other factors such as scarred uterus, induced labour, escalated utilization of postoperative antibacterial agents, and higher maternal illness and death can be optimized by regular antenatal visits.<sup>8</sup> Numerous efforts have been made to curb the increasing trend of c-sections by conducting various clinical audits and developing guidelines for the indications for c-sections but none of these strategies have been successful.<sup>9,10</sup>

Over time, CS rates in Pakistan have increased significantly, exceeding WHO guidelines as reported in the most recent demographic and health census. The necessity for rigorous institutional audits is underscored by the much higher rates that have been documented at tertiary care hospitals.<sup>11,12</sup>

This hospital-based audit reported a caesarean section rate of 36.4%, with 200 procedures performed out of 550 total deliveries. Baseline maternal traits and labor status are summarized in Table 2. Fetal discomfort, prior cesarean section, and lack of improvement were the most common indications for surgery, while anemia was the most frequent maternal comorbidity (Table 3). Neonatal outcomes were generally favorable, with the majority of neonates achieving an Apgar score  $\geq 7$  at five minutes (Table 3). Robson analysis showed that Groups 4 and 5 caused most of the workload related to cesarean sections (Table 4).

The RTGCS analyzed the distribution and individual contribution of the obstetric team members towards the total CS rate. The main contributors to the CS workload were Groups 4 and 5, followed by Groups 1 and 10. RTGCS provides a consistent and systematic approach to evaluating the CS rate and identifying focus groups that may be eligible for quality improvement interventions. When compared to other audits conducted using the RTGCS, it has been noted that there are often significant contributions from multiparous women, particularly those in Groups 4 and 5. This has been documented in numerous facility-based studies, particularly those where the clinicians faced challenges in managing the labor and repeat CS. It is reasonable to expect variation between institutions, and this is often the result of a variety of influences, including referral patterns, a case mix that includes higher risk pregnancies, the availability of safe labor induction, active labor monitoring, and institutional policies about the timing of repeat caesarean sections.<sup>13</sup> An audit from a tertiary teaching hospital in Northern Uganda

using the Robson classification also documented the ability to define the most contributing groups, and this could be used to inform quality improvement efforts in the USE of CS.<sup>14</sup> International experience adds depth to Robson's classification, showing it can do more than measure CS rates and assist in quality assessment and policy development. For instance, Robson strata have been used in population-based assessments to analyze and track certain postpartum complications, like postpartum hemorrhage, and to assess changes in obstetrician and obstetrician-gynecologist practice over time.<sup>8</sup> WHO recommends RTGCS as the standard for global CS auditing and suggests the regular use of Robson-based reporting to support intracountry comparisons and facility-based assessments.<sup>15,16</sup> From the perspective of institutional policy, the clustering of CS in Groups 4 and 5 underscores the prioritizable action areas. First, for women with a previous CS (Group 5), strengthening structured antenatal counselling and standardized eligibility assessment for trial of labor after caesarean (TOLAC/VBAC), where clinically appropriate and safely supported, may reduce repeat CS. Second, for Groups 1–4, refining induction protocols, standardizing labor progress assessment (including clear definitions of labor arrest), and strengthening fetal monitoring interpretation and response pathways may reduce potentially avoidable CS for fetal distress or failure to progress. Third, routine quarterly RTGCS audit with feedback to clinical teams can support continuous quality improvement and track the impact of implemented changes. Besides positive therapeutic indications, Caesarean section rates are also strongly influenced by institutional and broader health system factors. Recent Pakistan Demographic and Health Surveys reveal that the likelihood of having a caesarean delivery is higher in private maternal health care than in public. This implies that non-medical CS may be practiced when there are financial opportunities and loose regulatory frameworks.<sup>17</sup> In addition, the expanding field of studies in South Asia emphasizes health system components such as the patterns of provider practice, institutional practices, and resource limitations as critical in influencing CS decisions, in addition to individual clinical risk factors.<sup>18</sup>

## Limitations

This was a single-center audit over a limited duration, and detailed clinical analyses were performed for CS cases (N=200). In addition, because the totals for all deliveries in each Robson group were not available, we reported the Robson distribution among CS cases (relative contribution to CS) and absolute contribution to the overall CS rate, rather than the full WHO-style group size and within-group CS rates. Data were reliant on accurate medical records of a limited duration of nine months and a limited number of patients. The result's generalizability was limited because the investigation was only carried out in one tertiary facility; however, multicenter studies would be more conclusive, as they would manage a higher proportion of complex pregnancies. In addition, the general distribution of group contributions seems to stand in alignment with the existing literature in the field, contributing to the overall validity of the Robson classification system in any context. However, this particular study has a number of pertinent issues. First, the analysis did not go beyond the bounds of descriptive statistics to embrace the multivariable techniques required to pinpoint independent predictors of a cesarean section. Second, there is a potential for bias in the reliance on hospital

records and the records kept by the hospital which can lead to misclassification bias due to the absence of complete or inaccurate records.

The restricted application of the RTGCS to one particular institution, in this case, may limit the extent to which the findings can be extrapolated to the wider community, especially considering the exclusion of women who gave birth at home or in the private hospital setting. In addition, due to the fact that the neonatal outcomes were presented in a batch, this restricted the overall integration of the outcomes with the principal framework for analysis of the study, the RTGCS. It is accepted that the absence of neonatal outcomes by Robson group constitutes a significant gap in this study. More research of this type is required to articulate more precisely the relationship that exists between the patterns of cesarean delivery and the outcomes for infants in the various obstetric group.

### Conclusion

The use of the RTGCS showed that the two groups of multiparous women defined as Group 4 and Group 5 had the highest percentages of cesarean deliveries at 27.5% and 27.0%, respectively, which identifies the primary contributors to the total CS rate. With the most recent data highlighting the need for specific, immediate clinical measures, this includes the auditing of CS indications for Group 4, the advocacy of safe VBAC for Group 5, the adjustment of the CS for the less than ideal indications, and the improvement of the standards of care for the induction and augmentation. There is also a need for the government to facilitate the first steps towards a national RTGCS surveillance for the continued setting of benchmarks and the alignment of organizational practices for childbirth with the goals of health-optimizing policy.

**Authors' contributions:** FF contributed to study conception and design, data acquisition and interpretation, drafting of the manuscript, critical revisions, and formulation of the conclusion; GW provided overall supervision, contributed to study design, guided the literature review, and critically revised the manuscript for intellectual content; ZS contributed to supervisory oversight, reviewed the study methodology, and critically revised the manuscript; UZ contributed to study design and data collection and reviewed the manuscript; SGS contributed to data collection and assisted in manuscript review; MR contributed to data collection and assisted in manuscript review. All authors reviewed and approved the final version of the manuscript and agree to be accountable for all aspects of the work in accordance with ICMJE criteria.

**Conflict of interest:** The authors declare no conflicts of interest.

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**Data Availability Statement:** The data that support the findings of this study, apart from the data already presented in the Results section, are available from the corresponding author upon reasonable request.

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