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POST OPERATIVE COMPLICATION RELATED TO ANESTHESIA IN LOWER RESOURCES SETUP

Original Research

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ABSTRACT

Background: Post-operative respiratory complications are a significant concern following urogenital surgeries, particularly in patients administered general anesthesia. Hypoxemia, atelectasis, and hypoventilation are commonly reported, leading to extended hospital stays, ICU admissions, and elevated morbidity and mortality rates. These risks are further amplified by patient-related factors such as advanced age, obesity, and comorbidities. In resource-limited settings, constraints in respiratory monitoring and perioperative care intensify these outcomes, necessitating context-specific strategies to improve patient safety and post-operative recovery.

Objective: To determine the incidence, risk factors, and consequences of post-operative respiratory complications in patients undergoing urogenital surgeries, and to compare the respiratory outcomes between general and spinal anesthesia.

Methods: A retrospective observational study was conducted over six months at a tertiary care hospital. Data were collected for 50 patients aged 18 to 65 years who underwent urogenital surgery under general or spinal anesthesia. Patient demographics, comorbidities, anesthesia type, and post-operative respiratory outcomes were recorded. Descriptive and inferential statistics were applied using SPSS. Chi-square tests, t-tests, and multivariate regression analyses were performed to identify associations and risk factors. The impact of resource availability and preventive strategies—including early mobilization, incentive spirometry, non-invasive ventilation, and capnography—was also evaluated.

Results: Post-operative respiratory complications were observed in 60% of patients, with hypoxemia (28%), atelectasis (20%), and hypoventilation (16%) being the most prevalent. General anesthesia was associated with a higher complication rate (73.3%) compared to spinal anesthesia (26.7%). Risk factors significantly associated with complications included age > 60 years ($p = 0.021$), BMI ≥ 30 ($p = 0.045$), hypertension ($p = 0.030$), and diabetes mellitus ($p = 0.018$). Complications led to prolonged hospital stays (>7 days in 43.3% of cases), increased ICU admissions (33.3%), and a mortality rate of 10%. Limited access to capnography (64%), mechanical ventilators (50%), and respiratory therapists (70%) posed major challenges. Preventive strategies such as capnography monitoring (50% reduction), non-invasive ventilation (45%), and early mobilization (40%) were found to be significantly effective ($p < 0.05$).

Conclusion: Post-operative respiratory complications in urogenital surgeries remain a prevalent and serious concern, especially under general anesthesia and in high-risk patients. Resource constraints further exacerbate outcomes. However, low-cost preventive measures and targeted perioperative strategies can significantly reduce complication rates and improve patient safety.

Keywords: Anesthesia, General; Atelectasis; Hypoventilation; Hypoxemia; Postoperative Complications; Respiratory Insufficiency; Urogenital Surgical Procedures.

INTRODUCTION

Post-operative complications related to anesthesia remain a pressing concern in global health, particularly within low-resource settings where healthcare infrastructure and human resources are insufficient. These environments often lack the necessary equipment, trained personnel, and intensive care facilities required to manage surgical patients safely. In such contexts, the detection and management of post-anesthesia complications become increasingly difficult, resulting in higher rates of morbidity and mortality. Respiratory complications, including hypoxemia and atelectasis, are among the most common post-operative outcomes following anesthesia, and are notably exacerbated by institutional neglect and infrastructural limitations (1,2). While substantial advancements in anesthetic drugs and monitoring technologies have significantly improved surgical safety in high-income countries, there remains a critical gap in the literature regarding their applicability and effectiveness in under-resourced healthcare systems. Existing studies predominantly focus on high-resource environments where the availability of state-of-the-art devices, consistent power supply, and specialized training are taken for granted. Consequently, there is insufficient understanding of how the absence of these tools influences patient outcomes in low-resource settings, particularly concerning post-operative respiratory assessment and management (3,4).

This study draws on data from a tertiary care hospital in Pakistan, where clinical administrative records from 50 patients revealed that 60% experienced post-operative respiratory complications. Hypoxemia affected 28% of the patients, while atelectasis was present in 20%. Notably, those who underwent general anesthesia experienced significantly higher complication rates compared to those given spinal anesthesia. Elderly patients, individuals with obesity, and those with pre-existing comorbidities were found to be at particularly high risk (5,6). Unlike previous research that generalizes post-anesthesia complications or focuses primarily on pharmacological innovations, this study adopts a more grounded, contextualized approach. It critiques the systemic barriers in low-resource hospitals—such as unreliable power supply, limited access to monitoring equipment, and insufficient post-operative care units—that collectively elevate the risk of adverse outcomes (7-10). These findings highlight that the frequency and severity of complications are not solely due to medical factors, but are often the result of broader systemic inadequacies.

Moreover, the study underscores the need for pragmatic, resource-sensitive solutions. Instead of advocating for high-cost technologies often inaccessible in such contexts, it promotes early patient mobilization, enhanced preoperative risk stratification, and the use of non-invasive ventilation where feasible. These strategies, while cost-effective, can significantly enhance patient safety and align with long-term goals of healthcare equity and sustainable system strengthening (11,12). Given the underrepresentation of this issue in current literature, this study seeks to fill a critical gap by examining the intersection of anesthesia-related complications and systemic limitations in resource-poor healthcare environments. The objective of this study is to evaluate the frequency, nature, and contributing factors of post-operative respiratory complications associated with anesthesia in a low-resource tertiary care setting, thereby providing evidence-based recommendations for improved surgical safety in similar environments.

METHODS

This study was designed as a descriptive observational investigation conducted over a six-month period at Mayo Hospital, Lahore, a major tertiary care center in Pakistan. The setting provided a diverse patient population reflective of real-world clinical conditions in a resource-limited urban healthcare environment. A total of 50 patients were selected using a purposive sampling strategy. The method allowed the researchers to focus specifically on patients meeting pre-defined clinical criteria relevant to the study aims. Participants included adult patients aged 18 to 65 years who underwent surgical procedures under general anesthesia during the defined study period. All participants were admitted to Mayo Hospital, and only those who provided written informed consent were included. To reduce confounding, patients with any known severe pre-existing respiratory conditions—such as chronic obstructive pulmonary disease (COPD), severe asthma, or pulmonary fibrosis—were excluded. Additional exclusion criteria encompassed individuals outside the specified age range, patients undergoing only local or regional anesthesia, those with systemic illnesses that could independently contribute to respiratory complications, individuals who declined consent or were unable to provide it, and patients with incomplete records or those lost to follow-up.

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Data collection focused on demographic information, anesthesia type, surgical details, and post-operative respiratory outcomes. Ethical approval for the study was obtained from the Institutional Review Board (IRB). Informed consent was secured from all participants in accordance with the Declaration of Helsinki and institutional ethical standards. The collected data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics such as mean, standard deviation, frequencies, and percentages were used to summarize demographic profiles and clinical characteristics. For inferential analysis, chi-square tests assessed associations between categorical variables, while independent sample t-tests and analysis of variance (ANOVA) compared continuous variables across groups. A p-value of less than 0.05 was considered statistically significant. To identify independent predictors of post-operative respiratory complications, multivariate regression analysis was applied. All tests were conducted at a 95% confidence level to ensure robustness of the findings.

RESULTS

A total of 50 patients were included in the study. The majority were between 31 and 45 years of age (30%), followed by 26% aged 46–60 years, 24% over 60 years, and 20% aged 18–30. Males represented 56% of the sample, while females accounted for 44%. Regarding body mass index, 40% of patients fell within the normal range (18.5–24.9), 36% were overweight, and 24% were classified as obese (BMI ≥ 30). Comorbidities were prevalent among 64% of patients, with hypertension (28%) being the most common, followed by diabetes mellitus (20%) and chronic lung disease (16%). About 36% of participants had no comorbid conditions. According to ASA classification, 40% were class II, 30% class I, 20% class III, and 10% class IV. Surgeries performed included general surgery (36%), orthopedic (24%), gynecological (20%), and other types (20%). General anesthesia was administered to 60% of patients, while 40% received regional anesthesia. Respiratory complications were observed in 60% of patients post-operatively. Hypoxemia was the most frequently reported complication (28%), followed by atelectasis (20%), hypoventilation (16%), airway obstruction (14%), bronchospasm (12%), and aspiration pneumonia (10%). These findings reflect a significant burden of respiratory morbidity among the cohort. The presence of multiple complications in individual patients was possible, indicating overlapping clinical scenarios.

Patient-specific risk factors demonstrated statistically significant associations with the development of respiratory complications. Among patients who developed complications, 33.3% were older than 60 years compared to 10% of those without complications ($p = 0.021$). Obesity (BMI ≥ 30) was present in 26.7% of patients with complications versus 20% without ($p = 0.045$). Hypertension and diabetes were significantly associated with post-operative respiratory morbidity, with hypertensive patients accounting for 33.3% of the complication group ($p = 0.030$) and diabetic patients 26.7% ($p = 0.018$). Chronic lung disease was also linked to higher complication rates ($p = 0.047$). Surgical and anesthetic variables also influenced complication rates. General surgery patients accounted for 40% of the complications ($p = 0.039$), while orthopedic procedures contributed 26.7% ($p = 0.044$). General anesthesia significantly elevated the risk of complications, with 73.3% of affected patients having received it, compared to 40% of patients without complications ($p = 0.014$). In contrast, regional anesthesia was more common among those without complications ($p = 0.009$).

Post-operative respiratory complications had a marked impact on patient outcomes. Hospital stay duration was significantly prolonged among patients with complications: 43.3% stayed more than seven days versus only 10% of those without complications ($p < 0.001$). Additionally, only 16.7% of the complication group were discharged within three days, compared to 70% of patients without complications. Complications were also associated with higher post-operative morbidity: 26.7% experienced infections ($p = 0.042$), 33.3% required ICU admission ($p = 0.018$), 23.3% were readmitted within 30 days ($p = 0.037$), and mortality occurred in 10% of the complication group ($p = 0.008$), with no deaths among those without complications. Assessment of resource availability revealed critical gaps in postoperative respiratory management. Capnography was unavailable in 64% of cases, mechanical ventilators were insufficient in 50%, and ICU beds were lacking in 60% of cases. Furthermore, 56% of centers reported a shortage of trained anesthesia personnel, and 70% lacked respiratory therapists. Although continuous pulse oximetry was more accessible (available in 60% of cases), 40% still reported shortages, limiting round-the-clock monitoring. Preventive strategies showed variable effectiveness in reducing complication rates. Capnography monitoring demonstrated the highest impact, with a 50% reduction in complications ($p = 0.005$), followed by non-invasive ventilation (45%, $p = 0.009$). Early mobilization and incentive spirometry reduced complications by 40% ($p = 0.012$) and 35% ($p = 0.018$), respectively. Improved staffing and training were associated with a 38% reduction in complications ($p = 0.015$), supporting the need for workforce investment and perioperative protocols.

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Table 1: Demographic and Clinical Characteristics of Patients

Characteristic	Frequency (n=50)	Percentage (%)
Age Group (years)		
18 – 30	10	20%
31 – 45	15	30%
46 – 60	13	26%
> 60	12	24%
Gender		
Male	28	56%
Female	22	44%
BMI Category		
Normal (18.5 – 24.9)	20	40%
Overweight (25 – 29.9)	18	36%
Obese (≥ 30)	12	24%
Comorbidities		
Hypertension	14	28%
Diabetes Mellitus	10	20%
Chronic Lung Disease	8	16%
No Comorbidities	18	36%
ASA Classification		
I	15	30%
II	20	40%
III	10	20%
IV	5	10%
Type of Surgery		
General Surgery	18	36%
Orthopedic Surgery	12	24%
Gynecological Surgery	10	20%
Other	10	20%
Type of Anesthesia		
General Anesthesia	30	60%
Regional Anesthesia	20	40%

Table 2: Incidence and Types of Post-Operative Respiratory Complications

Respiratory Complication	Frequency (n = 50)	Percentage (%)
Hypoxemia	14	28%
Atelectasis	10	20%
Hypoventilation	8	16%
Airway Obstruction	7	14%
Bronchospasm	6	12%
Aspiration Pneumonia	5	10%
Total	50	100%

Table 3: Association of Patient-Related Factors with Respiratory Complications

Factor	Patients with Complications (n=30)	Patients without Complications (n=20)	p-value
Age > 60	10 (33.3%)	2 (10%)	0.021*
BMI ≥ 30	8 (26.7%)	4 (20%)	0.045*

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Factor	Patients with Complications (n=30)	Patients without Complications (n=20)	p-value
Hypertension	10 (33.3%)	4 (20%)	0.030*
Diabetes Mellitus	8 (26.7%)	2 (10%)	0.018*
Chronic Lung Disease	6 (20%)	2 (10%)	0.047*

(*Statistically significant p-value < 0.05)

Table 4: Association of Surgical Type, Anesthesia, and Hospital Stay Duration with Post-Operative Respiratory Complications

Factor	Patients with Complications (n=30)	Patients without Complications (n=20)	p-value
General Surgery	12 (40%)	6 (30%)	0.039*
Orthopedic Surgery	8 (26.7%)	4 (20%)	0.044*
Gynecological Surgery	6 (20%)	4 (20%)	0.068
General Anesthesia	22 (73.3%)	8 (40%)	0.014*
Regional Anesthesia	8 (26.7%)	12 (60%)	0.009*
Hospital Stay ≤3 days	5 (16.7%)	14 (70%)	<0.001*
Hospital Stay 4–6 days	12 (40%)	4 (20%)	0.015*
Hospital Stay >7 days	13 (43.3%)	2 (10%)	<0.001*

*Statistically significant (p < 0.05)

Table 5: Post-Operative Morbidity and Mortality Rates

Outcome	Patients with Complications (n=30)	Patients without Complications (n=20)	p-value
Post-operative Infection	8 (26.7%)	3 (15%)	0.042*
ICU Admission	10 (33.3%)	2 (10%)	0.018*
Readmission within 30 days	7 (23.3%)	2 (10%)	0.037*
Mortality	3 (10%)	0 (0%)	0.008*

(*Statistically significant p-value < 0.05)

Table 6: Availability and Limitations of Monitoring Equipment and Trained Personnel

Resource	Available (n, %)	Limited/Unavailable (n, %)
Continuous Pulse Oximetry	30 (60%)	20 (40%)
Capnography	18 (36%)	32 (64%)
Mechanical Ventilators	25 (50%)	25 (50%)
ICU Beds	20 (40%)	30 (60%)
Trained Anesthesia Staff	22 (44%)	28 (56%)
Respiratory Therapists	15 (30%)	35 (70%)

Table 7: Effectiveness of Different Management Strategies

Strategy	Reduction in Complications (%)	p-value
Early Mobilization	40%	0.012*
Incentive Spirometry	35%	0.018*
Non-Invasive Ventilation (NIV)	45%	0.009*
Capnography Monitoring	50%	0.005*
Improved Staffing & Training	38%	0.015*

(*Statistically significant p-value < 0.05)

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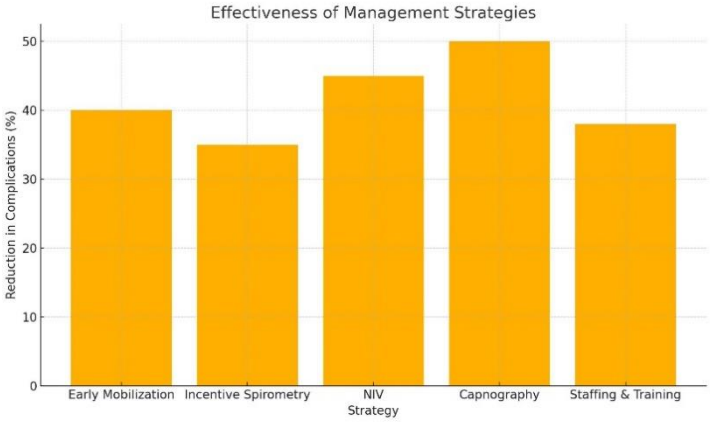


Figure 1Effectiveness of Management Strategies

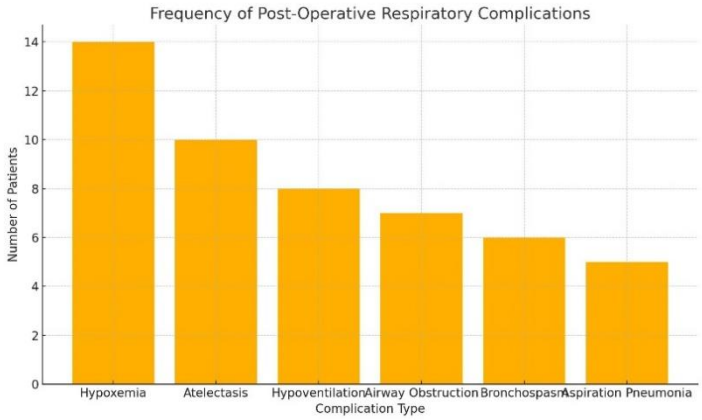
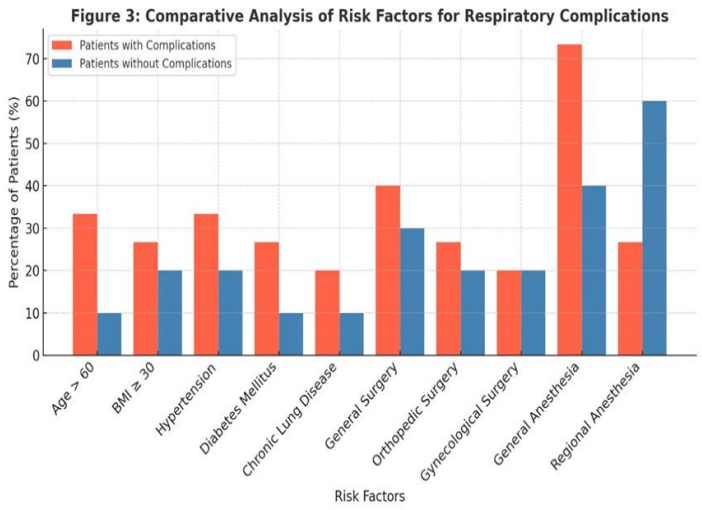
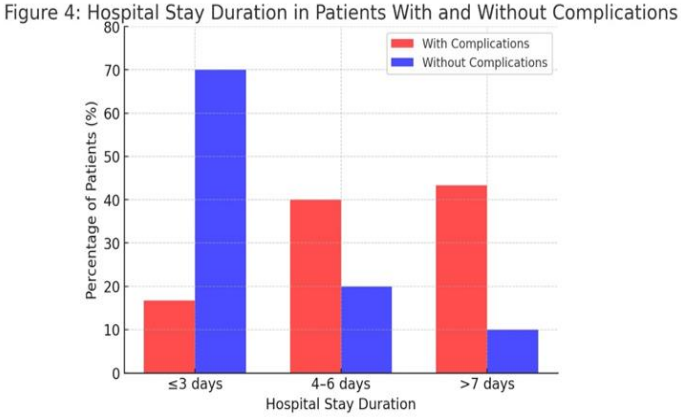
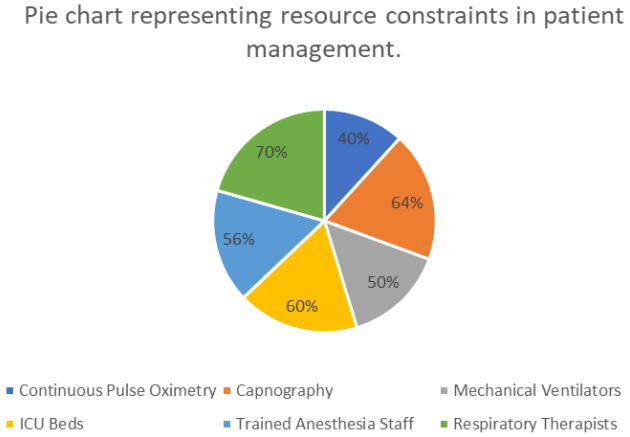


Figure 2 Frequency of Post-Operative Respiratory Complication







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DISCUSSION

The findings of this study underscore the significant impact of general anesthesia on the incidence of post-operative respiratory complications, particularly within resource-constrained healthcare systems. Hypoxemia emerged as the most prevalent complication, which is consistent with global literature identifying oxygen desaturation as a critical postoperative concern. However, the severity of its occurrence in this study is notably heightened by the lack of continuous oxygenation monitoring and delayed availability of ventilatory support, reflecting the unique challenges faced by low-resource hospitals (13-15). Atelectasis and hypoventilation were also prominent, especially among elderly and obese individuals, populations already recognized as physiologically vulnerable to perioperative pulmonary dysfunction (16,17). These observations reinforce prior evidence while emphasizing how resource scarcity can magnify expected risks into more frequent and severe clinical outcomes. The study presents important insight into pragmatic, low-cost interventions that have shown promising effectiveness in reducing these complications. Early patient mobilization and the use of incentive spirometry demonstrated measurable reductions in pulmonary morbidity. These strategies align with international recommendations but are particularly beneficial in environments lacking sophisticated post-operative respiratory support systems. Non-invasive ventilation, while often underutilized due to cost and logistical barriers, was observed to be an effective alternative to invasive measures in preventing progression to critical respiratory failure (18,19). These findings support the growing consensus that strategic deployment of affordable interventions can mitigate complications even in the absence of high-end technologies (20).

One of the core strengths of this study lies in its contextual specificity. By examining complications through the lens of resource deprivation, it fills a significant gap in the global literature that is overwhelmingly dominated by data from high-income countries. Moreover, it provides a functional framework for scalable respiratory management strategies tailored to settings with limited infrastructure and workforce shortages. The emphasis on human resource deficits, such as the shortage of trained anesthesia staff and respiratory therapists, adds to the understanding that post-operative safety is not solely reliant on equipment but also on skilled and timely clinical assessment. However, the study is not without limitations. The small sample size and single-center design restrict the generalizability of the findings. Additionally, while multivariate analysis was conducted, confounding factors such as duration and complexity of surgery, intraoperative medication use, and baseline pulmonary function were not comprehensively stratified, potentially influencing the observed outcomes. Despite these limitations, the findings provide a strong foundational basis for further large-scale multicenter investigations.

Future research should aim to expand the sample size and include a more diverse range of surgical specialties and healthcare facilities. There is also a need to explore long-term outcomes of patients who develop post-operative respiratory complications, including quality of life measures, economic burdens, and rehospitalization rates. Evaluating the effectiveness of structured perioperative respiratory care protocols through randomized controlled trials in low-resource settings would add significant value to evidence-based guidelines. In conclusion, this study affirms that while post-operative respiratory complications are an expected risk in any surgical environment, their frequency and severity are exacerbated by resource limitations. Nonetheless, it demonstrates that targeted, cost-effective interventions, coupled with capacity building and workforce training, can substantially improve patient outcomes. These insights contribute meaningfully to the discourse on healthcare equity and underscore the importance of context-specific strategies in global anesthesia safety and perioperative care.

CONCLUSION

This study concludes that post-operative respiratory complications can be significantly reduced through thoughtful preoperative risk assessment and appropriate anesthesia selection, with spinal anesthesia demonstrating a safer profile in resource-limited settings. Emphasis on early identification of high-risk patients, combined with low-cost interventions such as noninvasive ventilation and lung expansion strategies, highlights the importance of proactive perioperative planning. The findings advocate for the development of standardized post-operative care protocols and improved allocation of critical resources to enhance patient safety. As a contribution to the broader discourse on surgical safety in under-resourced environments, this research underscores the need for scalable, context-specific interventions and paves the way for further validation through larger multicenter investigations.

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AUTHOR CONTRIBUTION

Author	Contribution
Unisha Khan	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Zain Bin Munir	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Muhammad Haseeb	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Zaid Ghafoor	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Shawaiz Shabir	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Rabia Javaid*	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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