

Understanding Patterns and Factors Influencing ICU Readmissions: A Retrospective Analysis in the Context of the COVID-19 Pandemic

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Abstract: ***Introduction:** This retrospective study investigates ICU readmissions within the unique context of the COVID-19 pandemic. Focusing on the ICU setting at a tertiary care hospital during the peak of the pandemic's second wave, the research aims to identify factors influencing readmission rates and their implications. **Methods:** Utilizing a quantitative approach and a purposive sampling technique, the study analyzes data from ICU readmissions over a six-month period. A structured proforma and checklist were used for data collection, capturing baseline variables, incidence rates, and factors contributing to readmissions. The sample comprised patients readmitted within 48 hours of discharge, above 18 years, excluding those terminally ill or undergoing planned surgeries. **Results:** Of the 926 shifts out from ICU, 40 patients (4.31%) were readmitted. Predominantly male (72.5%), COVID-19-positive (60%), and aged 18-40 years (57.5%), the readmissions were primarily due to respiratory disorders (82.5%). While initial SOFA scores during shift out were low (60% with scores 0-6), scores above 14 on readmission indicated deterioration. Desaturation (60%) and hypotension (30.5%) were common reasons for readmission. **Discussion:** Comparison with existing studies reveals similarities in readmission rates but underscores the unique impact of the pandemic. Financial constraints, delayed decisions, and inadequate follow-up care contributed to readmissions. Higher SOFA scores on readmission aligned with studies linking elevated scores to mortality risk. The study emphasizes the role of early warning score documentation and identifies specific causes like postoperative monitoring and inadequate follow-up care. **Conclusion:** Despite limitations, the study provides insights into ICU readmissions during the pandemic, emphasizing the need for tailored strategies. Stringent discharge criteria, timely monitoring, and comprehensive support systems are crucial. The findings contribute to ongoing discussions on optimizing patient care and call for prospective research to validate these observations.*

Keywords: ICU Readmissions, COVID-19 Pandemic, SOFA, ICU

1. Introduction

The pressure to optimize hospital performance and resource allocation has propelled readmission rates to the Intensive Care Unit (ICU) to the forefront of healthcare quality metrics. While early discharge can free up critical beds and reduce costs, it can also trigger a cascade of negative consequences if not managed carefully. It is a complex interplay between efficient discharge and patient safety. It is important to explore the factors contributing to ICU readmission and highlighting strategies for mitigating its detrimental impact.

Early discharge from the ICU, often driven by incentives for shorter stays, can come at the expense of patient well-being. Inadequate assessment and planning before transitioning to lower acuity settings can lead to missed diagnoses, suboptimal treatment plans, and delayed recognition of potentially life-threatening physiological changes. This can manifest as complications like medication errors, worsening of the original disease process, and development of sepsis syndromes.¹⁻³ Moreover, prematurely discharging patients who are not fully stabilized increases the risk of readmission with a potentially worsened condition, leading to a vicious cycle of increased morbidity, mortality, prolonged ICU stays, and inflated healthcare costs.^{4,5}

Certain patient conditions are particularly susceptible to ICU readmission. Hypoxic respiratory failure, upper gastrointestinal bleeding, neurological impairment, and sepsis are among the most common culprits, often requiring immediate re-admission for advanced intervention.³ Additionally, patients with multiple comorbidities or high illness scores are inherently more vulnerable to readmission due to their complex care needs and increased susceptibility to complications.²

Understanding the factors contributing to ICU readmission is crucial for developing effective interventions. Implementing robust assessment protocols and discharge planning strategies that consider patient-specific needs and risks can significantly reduce the likelihood of readmission. Matching patients to the most appropriate post-ICU care environment based on their individual circumstances and ensuring clear communication between ICU and lower acuity providers are also essential components of a comprehensive readmission prevention strategy.^{4,6}

This study aims to assess the incidence of readmission to ICU and its contributing factors among critically ill patients in a tertiary care hospital.

2. Methodology

This retrospective descriptive study utilized patient records from the Intensive Care Unit (ICU) of St. John's Medical College Hospital in Bangalore, India. The hospital is a 1350-bed specialty tertiary care center, with the data specifically collected from the MICU, SICU, and RICU, encompassing a total of 59 beds. A purposive sampling technique was employed to select a sample of all patients readmitted to the ICU between January 2021 and June 2021 (6 months). Inclusion criteria required patients to be readmitted within 48 hours of discharge and above 18 years of age. Terminal illness and readmission due to planned surgical procedures were excluded. Readmission was defined as the admission of a patient to ICU from an ITU or ward who had been previously admitted to ICU during the hospital stay within 48 hours of transfer from the ICU.

Two instruments were used for data collection:

1) Structured proforma: This form collected baseline demographic and clinical characteristics of readmitted patients.

2) Checklist: This tool identified potential factors contributing to readmission, covering areas such as medication errors, discharge planning, and missed diagnoses.

Prior to data collection, permissions were obtained from the hospital administration and the Institutional Ethical Committee (IEC). Monthly records of ICU readmissions were tracked throughout the 6-month study period. The investigator reviewed medical records of readmitted patients using the checklist to identify contributing factors.

Tool Validity:

To ensure the validity and reliability of the data collection instruments, the following steps were taken:

- Content Validity: The proforma and checklist were evaluated by 13 experts (10 physicians and 3 nursing professionals) for content validity. Revisions were made based on their feedback.
- Inter-Rater Reliability: A pilot study involving 6 patients tested the consistency of the checklist across different reviewers. The inter-rater reliability coefficient was found to be 0.72, indicating satisfactory agreement.

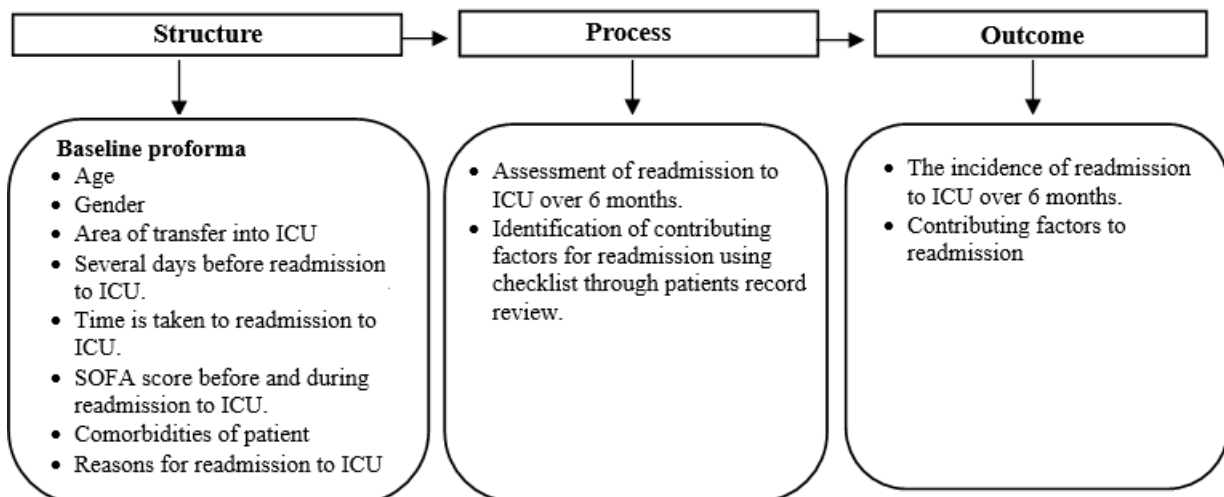


Figure 1: The study process

Statistical Analysis

All data was entered in a spreadsheet. Data cleaning and validation procedures preceded the analyses to ensure data accuracy. Descriptive statistics such as frequencies, percentages, and measures of central tendency were employed to summarize baseline variables, patient demographics, and key study parameters.

3. Results

The readmission rate in the ICU over 6 months among total transfers out of ICU being 926 in which 40 were readmitted, was 4.31%. A majority of readmitted patients were relatively young, with over 57% falling below 40 years old. Additionally, males constituted a dominant group, accounting for almost 73% of the sample. Interestingly, almost 73% of the patients were initially admitted to the Intermediate Care Unit (ITU) before requiring ICU readmission.80% of patients were readmitted within just

three days of discharge.65% of patients requiring readmission within 24 hours of leaving the unit. (Table 1)

Table 1: Baseline characteristics

Variables	Frequency	Percentage (%)
Age		
<40	23	57.5
>40	17	42.5
Gender		
Male	29	72.5
Female	11	27.5
Area of Transfer-In		
Ward	11	27.5
ITU	29	72.9
Total No Days in ICU Before Readmission		
1-3 Days	32	80
4-6 Days	8	20
Time of Readmission After Shift Out From ICU		
0-24 Hours	26	65
24-48 Hours	14	35

The primary causes of readmission, respiratory disorders emerged as the leading cause, affecting over 82% of patients. A significant portion of patients (30%) had no documented comorbidities. Pre-readmission SOFA scores, a marker of organ dysfunction, were generally low, with 60% categorized as normal. However, a shift towards higher SOFA scores during readmission was observed. (Table 2)

Table 2: Analysis of factors for readmission

Variables	Frequency	Percentage (%)
Cause of Readmission		
Respiratory disorder	33	82.5
Renal disorder	1	2.5
Cardiac disorder	5	12.5
MODS	1	2.5
Co-Morbidity		
Renal disorder	6	15
Endocrine disorder	11	27.5
Cardiac disorder	11	27.5
Nil	12	30
SOFA score before shift out from ICU		
0-6	24	60
7-14	14	35
>15	2	5
SOFA score during readmission to ICU		
0-6	5	12
7-14	14	35
>15	21	52
Reason for readmission to ICU		
Desaturation	24	60
Low GCS	3	7.5
Low urine output	1	2.5
Hypotension	12	30.5

Progression of illness was the dominant factor in ICU readmissions, affecting 85% of cases. Inadequate follow-up care contributed to 45% of readmissions. Lack of early warning score documentation played a role in 67.5% of readmissions. The other factors are listed in Figure 2.

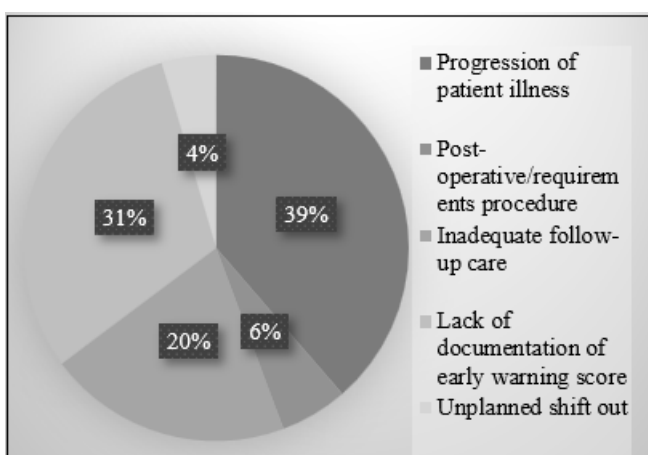


Figure 2: Causes for readmissions in ICU

4. Discussion

The current study, conducted within the ICU setting of SJMCH during the peak of the second wave of the COVID-19 pandemic, sheds light on several aspects of readmission dynamics and associated factors.

In our study, the readmission rate of 4.31% aligns with findings from a study involving surgical ICU patients, where 13.4% required readmission during the same hospitalization, often associated with sepsis syndromes and higher SOFA scores.⁷ Notably, our institution employs a stringent discharge criterion, ensuring patients are hemodynamically stable and intermediary care facilities are available, potentially contributing to the comparatively lower readmission rate.

The demographic distribution in our study, with 57.5% belonging to the age group of 18-40 years and a predominance of males (72.5%), mirrors patterns observed in related studies.^{1, 2} COVID-19-positive cases constituted a significant portion, contributing to the higher readmission rates, often necessitated by desaturation and respiratory complications.

The temporal aspects of readmission revealed that a majority (80%) of subjects had 1-3 days of ICU stay before readmission, and 65% were readmitted within 0-24 hours of shifting out. Respiratory disorders, predominantly associated with the COVID-19 pandemic, were the primary cause of readmission (82.5%). The shift out process prioritizes hemodynamic stability and clinical improvement, reflected in initial SOFA scores of 0-6 for 60% of patients. However, on readmission, 52% exhibited scores exceeding 14, indicating the impact of multi-organ dysfunction or inflammatory processes during hospitalization.⁸

The association between higher SOFA scores on readmission and increased mortality risk aligns with existing literature.⁷⁻⁸ Desaturation (60%) and hypotension (30.5%) were frequent reasons for readmission, necessitating interventions like mechanical ventilation and adrenaline infusion.

Financial constraints and delayed decision-making by family members were identified as factors contributing to inadequate follow-up care in 45% of cases, leading to clinical deterioration and higher SOFA scores on readmission. Lack of early warning score documentation in 67.5% of cases highlights the importance of timely monitoring and documentation for assessing health deterioration. Transfer-outs (10%) for critical cases were expedited during rounds to accommodate more critically ill subjects during the pandemic, reflecting the adaptive response to resource constraints.

Comparatively, our findings align with the global incidence of ICU readmission ranging from 4% to 14% due to poor outcomes and increased costs.⁸ In our study, 85% of readmissions were attributed to the progression of illness, accentuated by the unpredictability of treatment response during the uncertain prognosis of the COVID-19 second wave. Postoperative monitoring after major cranial surgeries (12.5%) and inadequate follow-up care (45%) contributed to the remaining cases.

The study has several limitations that warrant consideration. Firstly, the research was confined to a single-center setting within the ICU of SJMCH, potentially limiting the generalizability of findings to broader healthcare contexts. Its retrospective design relies on existing records,

introducing possible biases associated with incomplete or inaccurate documentation. The data collection period coincided with the peak of the COVID-19 pandemic, raising concerns about the generalizability of results to non-pandemic periods and other patient populations. Financial constraints contributing to inadequate follow-up care were identified, but the study did not extensively explore the socioeconomic context of patients. The specific criteria for patient discharge, despite being mentioned as stringent, were not detailed. The inclusion of transfer-outs as a category and the potential impact on patient outcomes merit further investigation. Additionally, the study primarily focused on factors leading to readmission, lacking in-depth exploration of patient outcomes post-readmission. While efforts were made to ensure the validity and reliability of data collection tools, variations in interpretations among healthcare professionals may introduce subjective elements. The study's external validity is also limited by the absence of direct comparisons with external institutions or different pandemic phases. Lastly, the use of purposive sampling may introduce selection bias, potentially affecting the study's external validity. Acknowledging these limitations is crucial for interpreting the study's findings and guiding future research efforts to enhance the comprehensiveness and applicability of results.

5. Conclusion

The study provides key insights into ICU readmissions at a tertiary care centre during the COVID-19 peak. The stringent discharge criteria appear effective in minimizing readmissions, particularly during a pandemic where patient stability is paramount. Timely monitoring and documentation of early warning scores prove crucial in mitigating readmissions.

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