

SYNOPSIS

Dissertation Topic:

“A Comparative Study on Variance Between Estimated and Final Billing in Cardiology and General Surgery Departments at a Tertiary Care Hospital”

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TITLE

“A Comparative Study on Variance Between Estimated and Final Billing in Cardiology and General Surgery Departments at a Tertiary Care Hospital”

Introduction:

Accurate estimation of medical costs is a cornerstone of patient trust, transparency, and effective financial management in healthcare institutions. It plays a vital role in pre-treatment decision-making for patients and serves as a basis for financial planning, especially in settings where insurance or third-party administrators (TPAs) are involved. However, healthcare delivery is dynamic and often unpredictable, resulting in frequent variances between the initially estimated cost of treatment and the final billed amount at discharge. These discrepancies not only lead to dissatisfaction among patients and their families but can also damage institutional credibility, increase billing disputes, and strain administrative workflows.

Billing estimation in tertiary care hospitals, especially for high-volume and high-risk departments such as cardiology and general surgery, is a complex process influenced by multiple factors. These may include unplanned clinical interventions, patient response to treatment, procedural complexities, implant usage, additional diagnostics, medication adjustments, or length of stay variations. In some cases, such variances are justified and unavoidable. However, the absence of standardized estimation protocols or lack of coordination among clinical and billing teams may lead to inaccuracies that could have been anticipated or mitigated.

While various departments generate treatment estimates, few hospitals conduct a systematic analysis of the variance between estimated and actual billing and its contributing factors. This gap in internal financial auditing often conceals critical insights that could help optimize estimation practices, enhance patient communication, and streamline hospital financial operations. Moreover, departments with frequent high variance may benefit from tailored training or redefined estimation workflows.

In light of this, the present study aims to conduct a detailed comparison of estimation accuracy and reasons for billing variance in the departments of Cardiology and General Surgery in a tertiary care hospital. These two departments were selected based on their procedural intensity, volume of admissions, and financial impact. The study focuses not only on the percentage accuracy of estimates but also delves into the underlying clinical and operational reasons behind underbilling or overbilling.

By adopting a retrospective data-driven approach, the research intends to map out the frequency and patterns of variance, categorize variance ranges, and identify repeat causes—such as reduced length of stay (LOS), addition of implants, or change in planned procedures. The goal is to determine whether there is a statistically significant difference in estimation accuracy between the two departments and to recommend actionable strategies for improvement. Max Super Speciality Hospital, Shalimar Bagh, is a prominent tertiary care facility located in North Delhi, operating under the Max Healthcare group—one of India’s leading private healthcare providers. The hospital is accredited by the National Accreditation Board for Hospitals and Healthcare Providers (NABH) and the National Accreditation Board for Testing and Calibration Laboratories (NABL), reflecting its commitment to delivering high-quality, safe, and patient-centered care. It offers advanced diagnostic and therapeutic services across a wide range of specialties, including Cardiology, General and Laparoscopic Surgery, Neurosciences, Oncology, Orthopaedics, and Critical Care.

The hospital is known for its high patient load, state-of-the-art infrastructure, and an integrated approach to healthcare delivery. It caters to a diverse demographic, including cash-paying patients, those covered under insurance or third-party administrators (TPAs), and international patients seeking specialized medical services. With a focus on evidence-based practices, the hospital maintains digital systems for billing, estimation, and clinical documentation - making it well-positioned for data-driven quality improvement initiatives.

Given its multidisciplinary setup and significant procedural volume, Max Super Speciality Hospital, Shalimar Bagh serves as an ideal setting for evaluating operational challenges such as billing estimation variance. Its structured administrative processes, combined with real-time clinical dynamics, provide a practical and meaningful environment for conducting a retrospective study on financial accuracy, estimation transparency, and department-specific billing practices.

Review of Literature

Author (Year)	Study Location	Sample Size	Sampling Technique	Salient Features
Lim SL et al. (2022)	Malaysia	329 patients	Based on retrospective patient record review	Found that extended stays in ICU and CCU were major contributors to higher hospital costs.
Ong SC et al. (2022)	Malaysia	Multi-center	Data gathered from multiple hospital sites retrospectively	Revealed that treatment expenses for heart failure vary considerably across institutions.
Tupe D et al. (2024)	India	652 drugs	Comparative analysis of drug costs	Highlighted major differences in the pricing of medications used for heart failure treatment.
Prinja S et al. (2013)	India	12 surgeries	Detailed cost estimation using micro-costing methods	Showed that hospitals often spend more on surgical care than the reimbursement they receive.
Lesyuk W et al. (2018)	Global	35 studies	Literature-based systematic review	Concluded that inpatient care is the most expensive element in managing heart failure.
Health-e Blog (2022)	India	Not stated	Observational review of available data	Provided a comparison of open-heart surgery costs in public versus private hospitals.
Haidar A et al. (2024)	USA	4.7 million cases	Nationwide hospital billing data analysis	Found that cardiovascular procedures were among the most financially demanding hospitalizations.
Patel K et al. (2013)	USA	850 patients	Cross-sectional survey-based study	Linked billing dissatisfaction to poor communication between hospitals and patients.

Research Question

What are the major reasons for variance between estimated and final billed amounts in Cardiology and General Surgery departments, and how accurately are estimates being provided?

Objectives

The study specifically intends:

- To assess the variance between estimated and final billed amounts in Cardiology and General Surgery departments.
- To identify the major reasons contributing to variance in billing.
- To compare estimation accuracy between the two departments.
- To categorize types and frequencies of variance.
- To evaluate the proportion of accurate estimates (variance within $\pm 10\%$).

Hypothesis

Null Hypothesis (H_0): There is no significant difference in estimation accuracy between the cardiology and general surgery departments.

Alternative Hypothesis (H_1): There is a significant difference in estimation accuracy between the two departments.

Material and Methods

STUDY DESIGN:

Retrospective descriptive and comparative study using secondary hospital data.

SETTING:

Max Super Specialty Hospital, Shalimar Bagh, New Delhi

STUDY POPULATION:

Inclusion Criteria: All cash, TPA and International discharged patients from Cardiology and General Surgery departments between Jan–Mar 2025 with both estimated and final billing recorded.

Exclusion Criteria: EWS Patients, PSU Patients Incomplete records, non-surgical/diagnostic-only admissions, or patients with missing estimation data.

Study Tools: Microsoft Excel data of 567 discharged cases.

DURATION OF STUDY:

3 months (March to May 2025)

SAMPLE SIZE:

567 patients (Cardiology and General Surgery).

SAMPLING TECHNIQUE:

Purposive sampling of all eligible patients discharged during the selected period.

DATA COLLECTION PROCEDURE:

Data was extracted from hospital billing and estimation systems. Variables included estimated amount, final billed amount, reasons for variance, and department. Accuracy was defined based on whether the variance was within $\pm 10\%$.

OPERATIONAL DEFINITIONS:

Variance: Difference between estimated and final bill amount.

Accurate Estimate: Variance within $\pm 10\%$ of the estimated amount.

Reasons for Variance: Categorized as reduced LOS, procedural changes, implant usage, pharmacy/investigation cost deviations, etc.

Data Analysis Plan:

Software Used: Microsoft Excel 365

Descriptive Analysis: Mean, frequency, and percentage for variance categories.

Comparative Analysis: Accuracy percentage across departments.

Visualization: Pie charts and bar graphs to represent variance causes and departmental comparisons.

Ethical Considerations:

- Ethical clearance has been obtained from the hospital research committee
- No patient identifiers were used in the analysis.
- Data was anonymized and kept confidential.
- The study is based on retrospective secondary data and does not involve patient co contact.

Implications of Research:

This study will help hospital administrators improve estimation practices, reduce billing-related grievances, and enhance transparency in patient communication. Identifying department-specific challenges will also allow targeted training and standardization of estimation protocols.

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