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"THE EXIT EQUATION: A TIME-MOTION STUDY OF PATIENT DISCHARGE PROCESS DELAYS IN A TERTIARY CARE HOSPITAL IN INDIA"

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ABSTRACT:

Efficient patient discharge processes are essential for improving hospital throughput, optimizing bed utilization, reducing patient dissatisfaction, and enhancing operational efficiency. However, discharge delays remain a persistent challenge in many hospitals due to administrative, clinical, and coordination-related bottlenecks. This study aimed to evaluate the discharge process in a tertiary care multispecialty hospital in India using a time-motion observational approach. A total of 35 planned inpatient discharges were studied over a two-month period. Time was tracked across multiple discharge stages including nursing clearance, laboratory clearance, radiology clearance, pharmacy processing, billing, insurance approval, and final patient exit. Results revealed that 62.85% of discharges required more than six hours for completion. Nursing clearance showed the highest average internal delay, while billing and insurance approvals were major contributors to prolonged discharge turnaround time. Laboratory clearance demonstrated high variability due to occasional outlier delays. The study identified poor interdepartmental communication, delayed documentation, insurance dependencies, and inadequate advance discharge planning as key root causes. Recommendations include implementation of digital discharge dashboards, pre-discharge planning protocols, dedicated discharge coordinators, and automated alerts. Improving discharge efficiency can significantly enhance patient satisfaction, bed turnover, and hospital productivity.

Keywords: discharge delay, hospital operations, patient flow, billing delay, insurance approval, healthcare management, time-motion study

1. INTRODUCTION:

The discharge of hospitalized patients is one of the most critical operational processes in healthcare institutions. While admission and treatment often receive greater administrative focus, discharge processes strongly influence patient satisfaction, hospital occupancy rates, emergency room congestion, and overall care continuity.

An efficient discharge system ensures timely bed availability for incoming patients, minimizes waiting time for families, reduces crowding, and improves patient experience. Conversely, delays in discharge

may lead to unnecessary bed occupancy, reduced turnover efficiency, delayed admissions, staff dissatisfaction, and negative public perception.

In Indian tertiary hospitals, discharge processes are often complex due to multiple approval layers involving physicians, nursing staff, pharmacy, diagnostics, billing, and third-party insurance administrators. Manual coordination among departments often increases turnaround time.

This study examines the patient discharge workflow in a tertiary care hospital in India through structured time tracking. It aims to identify delay points, quantify turnaround time, and recommend evidence-based improvements.

2. LITERATURE REVIEW:

Previous studies globally have shown discharge delays to be associated with:

- Poor communication between clinical and administrative teams
- Delayed discharge summaries
- Insurance authorization lag
- Pharmacy medication reconciliation issues
- Pending diagnostic reports
- Lack of transport or family readiness
- Inadequate discharge planning at admission stage

Studies by Hendy (2012) and El-Eid (2015) found that process redesign and Six Sigma interventions reduced discharge turnaround significantly.

Indian hospital studies have reported discharge times ranging from 3 to 7 hours, especially where insurance approvals are involved. Billing and summary generation remain common bottlenecks.

However, limited Indian research exists on real-time stepwise discharge tracking in private multispecialty hospitals.

3. RESEARCH GAP:

The following gaps were identified:

1. Limited phase-wise time tracking of discharge workflow
2. Lack of department-specific delay attribution
3. Few Indian hospital studies with observational time-motion methodology
4. Under-reporting of insurance-related delays
5. Minimal integration of patient experience and operational outcomes

4. OBJECTIVES OF THE STUDY:

General Objective

To assess the efficiency of inpatient discharge processes in a tertiary care hospital.

Specific Objectives

1. To measure total discharge turnaround time
2. To identify departments causing maximum delays
3. To compare delays across stages of discharge
4. To recommend strategies for reducing discharge time

5. METHODOLOGY:

Research Design : Descriptive observational study using time-motion analysis.
Study Duration : Two months.
Study Setting : A tertiary care multispecialty hospital in Western India.
Sample Size : 35 planned inpatient discharge cases.

Inclusion Criteria

- Planned discharges
- Insurance and self-pay cases
- Medical and surgical patients

Exclusion Criteria

- Emergency discharges
- Transfers
- LAMA cases

Tools Used

- Observation checklist
- Stopwatch/mobile timer
- Excel for analysis

Workflow Tracked

1. Doctor marks discharge
2. Nursing clearance begins
3. Lab/pharmacy/radiology clearance
4. Billing preparation
5. Insurance submission
6. Approval receipt
7. Final billing
8. Gate pass
9. Bed vacated

6. PROCEDURE:

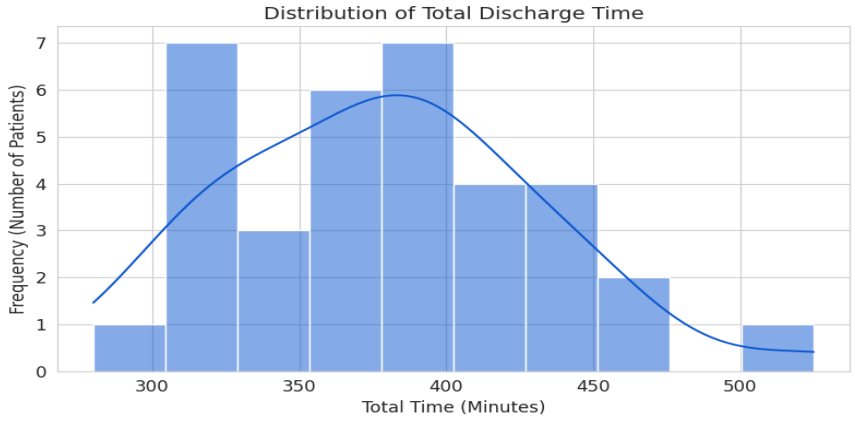
The project was conducted over a span of two months. The hospital designated the subject of time tracking concerning the discharge process. The execution of the work proceeded as follows:
• Observation Phase – During the initial days, each department participating in the discharge process was observed to gain insights into the workflow.
• Time Tracking Phase – After becoming acquainted with the process, timing measurements commenced for each stage of the discharge.
• Discharge Workflow:
• Step 1: The doctor marks the discharge summary.
• Step 2: Nursing clearance initiates. Time tracking commenced from this juncture.
• Step 3: Clearances are obtained from Radiology, Pharmacy, and Laboratory.
• Step 4: The file is forwarded to the Billing Department to prepare the provisional bill.
• Step 5: The provisional bill is presented to the patient and sent to the insurance company (if applicable).
• Step 6: Awaiting insurance approval.
• Step 7: Upon receipt of approval, the final bill is generated.
• Step 8: The final bill is delivered to the patient.
• Step 9: The patient settles any outstanding balance (if insurance does not cover 100%).
• Step 10: The billing department issues a provisional gate pass.
• Step 11: Nursing provides the final gate pass**.**
• Step 12: The patient vacates the bed.
• All timings for the aforementioned steps were recorded manually for each patient to ascertain the total duration from the initiation of nursing clearance to the final vacating of the bed.

7.DATA ANALYSIS AND DISCUSSION

Throughout my two-month aposting. I examined 35 cases of planned discharges covered by insurance. For each case, I monitored the duration of each phase of the discharge process, from the start to the patient's final exit, in order to evaluate departmental efficiency and pinpoint possible areas for enhancement. The data below illustrates the time required for this particular step in the process.

1] Overall Discharge Process Time (Total Time)

Key Observation: The **average total discharge time is approximately 6 hours and 19 minutes** (≈ 379 minutes). The distribution, as shown in the previous histogram, is generally bell-shaped (normal), indicating consistent process execution across most patients.



- DESCRIPTION:

1. Overall Shape

The distribution is **slightly right-skewed**, meaning:

- Most patients finish discharge between **320–420 minutes**.
- A few take much longer (up to **520 minutes**), creating a right tail.

2. Central Cluster

The majority of patients fall within **350–420 minutes**, representing the **typical and consistent discharge workflow**.

3. Variability

- Lowest times: **280–300 minutes**
- Highesttimes: **500–520 minutes**
  Most values lie in the **middle range**, showing moderate variation.

4. Outliers

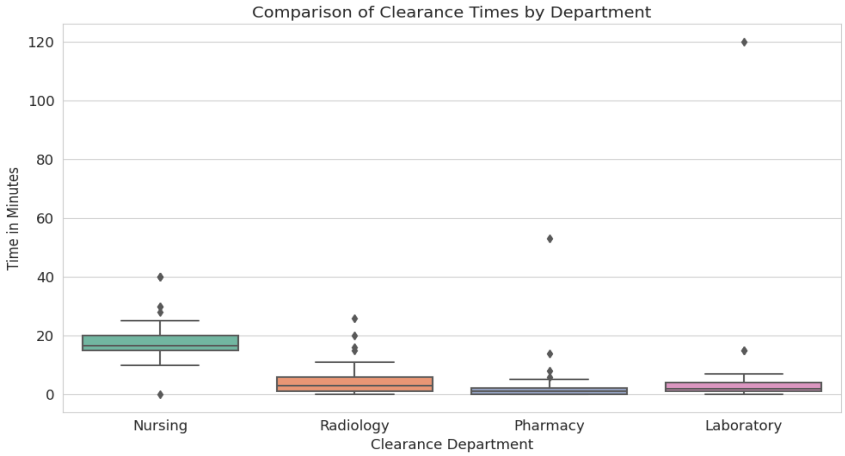
Patients taking **over 450 minutes** are outliers, possibly due to:

- Longer medical review
- Billing delays
- Pharmacy or clearance delays

2. Quantitative Comparative Analysis (Crosstab)

The descriptive statistics below serve as the quantitative crosstab, summarizing the clearance time distribution for each department. All times are reported in minutes.

Department	Count	Mean Time (min)	Median (min)	Min (min)	Max (min)
Nursing	41	**18.44**	**16**	**0**	**40**
Radiology	41	**4.80**	**3**	**0**	**26**
Pharmacy	41	**2.98**	**1**	**0**	**53**
Laboratory	41	**7.02**	**2**	**0**	**120**

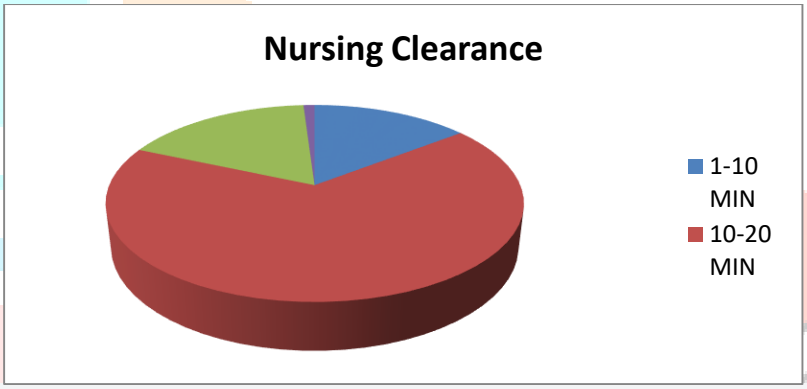


DESCRIPTION:

- **Slowest Department: Nursing Clearance** has the highest average and median time, with a typical duration of **16.5 minutes**. This suggests nursing clearance is the step with the longest consistent process time.
- **Fastest Department: Pharmacy Clearance** has the fastest typical (median) time at **1.0 minute**.
- **Highest Variability/Outliers: Laboratory Clearance** shows the highest standard deviation (18.84 min) and the highest maximum time (120.0 min, or 2 hours). This indicates that while the typical lab clearance is fast (median 2.0 min), a few patients experience **major delays (outliers)** in this area.

3] TIME TAKEN BY NURSING CLEARANCE ONCE DISCHARGE MARKED

SR NO	TIME	TOTAL	PERCENTAGE
1	1-10 MIN	5	14.28%
2	10-20 MIN	23	65.71%
3	20-30 MIN	6	17.14%
4	<1 HOUR	1	2.87%



DESCRIPTION: This chart illustrates the duration taken by nursing personnel to finalize clearance once a patient's discharge is recorded. The information is divided into four time intervals: 1–10 minutes, 10–20 minutes, 20–30 minutes, and over 30 minutes. The majority of cases (65.71%) were resolved within 10–20 minutes, followed by 1–10 minutes (14.28%) and 20–30 minutes (17.14%), with only a minor fraction (2.87%) exceeding 30 minutes. The pie chart visually depicts the distribution of these cases.

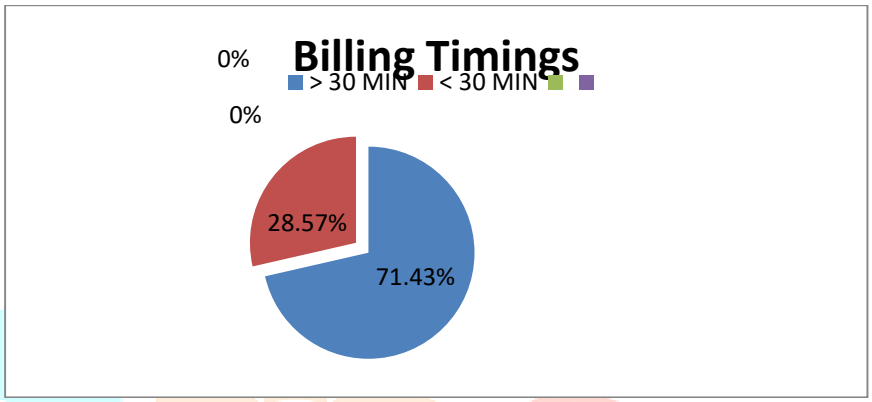
4] TOTAL TIME TAKEN BY PHARMACY, LABORATORY, RADIOLOGY CLEARANCE

SR NO	TIME	TOTAL	PERCENTAGE
1	1-15 MIN	25	71.42%
2	15-30 MIN	8	22.85%
3	<1 HOUR	2	5.7%

DESCRIPTION: This chart illustrates the total duration required for pharmacy, laboratory, and radiology clearance during the discharge process. The information is categorized into three time frames: 1–15 minutes, 15–30 minutes, and over 1 hour. A significant portion of clearances (71.42%) was finalized within 1–15 minutes, followed by 15–30 minutes (22.85%), with only 5.7% exceeding 1 hour. The bar graph effectively emphasizes that the majority of cases are within the shortest time frame, reflecting overall efficiency in this phase of the process.

6]TIME TAKEN BY BILLING DEPARTMENT FOR BILL HANDOVER TO PATIENT

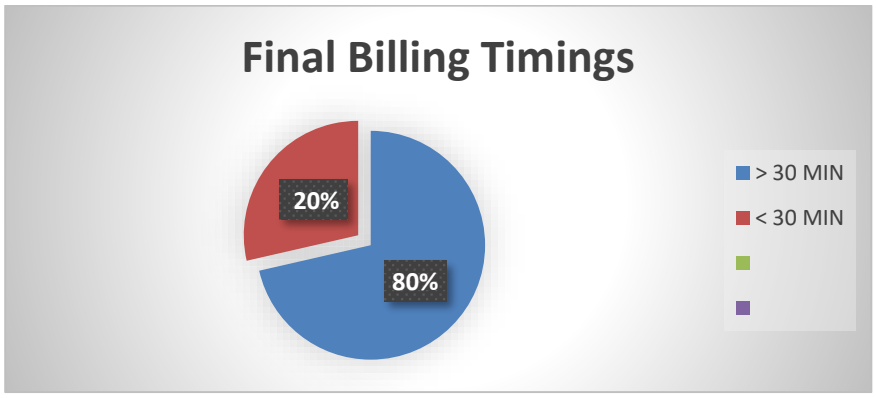
SR NO	TIME	TOTAL	PERCENTAGE
1	<30 MINS	25	71.43%
2	>30 MINS	10	28.57%



DESCRIPTION: This chart illustrates the duration required by the billing department to provide bills to patients. It features two time categories: under 30 minutes and over 30 minutes. A significant portion of cases (71.43%) were finalized in less than 30 minutes, whereas 28.57% exceeded this time frame. The pie chart effectively highlights that a majority of patients received their bills promptly, reflecting strong billing efficiency.

7] TIME TAKEN BY BILLING DEPARTMENT FOR MAKING FINAL BILL ONCE INSURANCE APPROVAL COMES

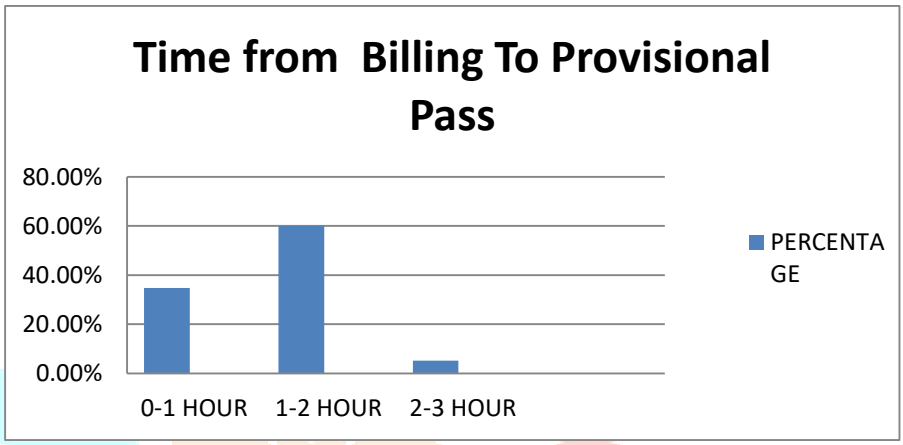
SR NO	TIME	TOTAL	PERCENTAGE
1	1-30 MINS	28	80%
2	1 HOUR	7	20%



DESCRIPTION: The time it takes the billing department to create the final bill following insurance approval is displayed in this chart. The data is separated into two groups: one hour and one to thirty minutes. While 20% of instances took an hour to complete, the majority (80%) were finished in 30 minutes. The pie chart shows that most billing procedures are completed promptly following insurance clearance, demonstrating effective communication between the insurance and billing departments.

8] TOTAL TIME BETWEEN FINAL BILLING TO PROVISIONAL PASS

SR NO	TIME	TOTAL	PERCENTAGE
1	0-1 HOUR	12	34.80%
2	1-2 HOUR	21	60%
3	>2 HOUR	2	5.20%



DESCRIPTION: The complete amount of time between the provisional pass's issuing and final billing is shown in this chart. Three categories—0–1 hours, 1–2 hours, and more than 2 hours—are used to group the data. The majority of cases (60.8%) were finished in one to two hours, 34.8% in less than an hour, and only 5.2% in more than two hours. The bar graph highlights that even while most are finished in two hours, there is still opportunity to boost the percentage finished in less than an hour for increased productivity.

TOTAL TIME TAKEN BY HOSPITAL FOR DISCHARGE PROCESS OF PATIENT

SR NO	TIME	TOTAL	PERCENTAGE
1	1-6 HOUR	13	37.14%
2	>6 HOUR	22	62.85%

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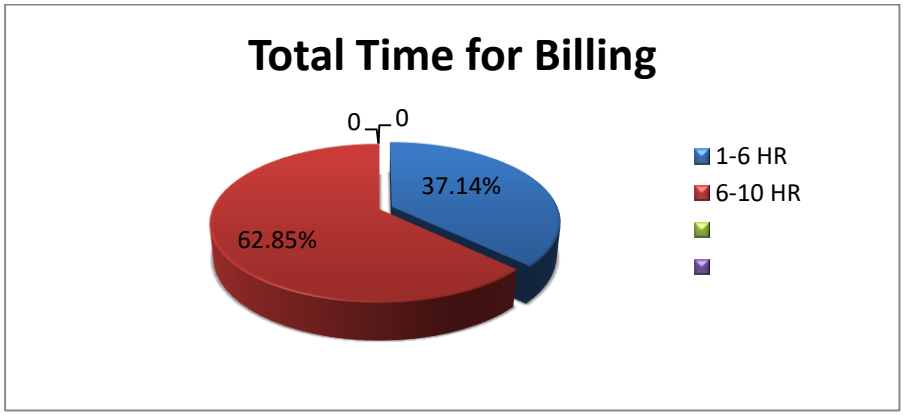

DESCRIPTION: The hospital's overall time spent on patient discharge is displayed in this pie chart. Two time categories—1–6 hours and more than 6 hours—are visually compared in a pie chart. According to the accompanying table, 22 instances (62.86%) required more than 6 hours to complete the discharge process, whereas 13 cases (37.14%) were released in 1–6 hours. The graphic highlights the fact that most discharges took more than six hours.

CONTRIBUTION TO THE HOST ORGANIZATION

1. Mapped the entire discharge process in detail, clarifying the locations of potential bottlenecks.
2. Identified reasons for delays by department (nursing, pharmacy, radiology, billing, insurance), providing actionable insights.
3. Created data-driven benchmarks for average discharge times that the hospital can utilize for internal audits.
4. Emphasized the importance of early planning (preparing discharge summaries and medications a day in advance) to minimize last-minute delays.
5. Recommended areas for improvement such as:
- Appointing a discharge coordinator or case manager to enhance communication.
- Implementing a digital/electronic discharge checklist for quicker interdepartmental clearance.
- Improving coordination between consultants and the insurance desk for planned discharges.
6. Increased staff awareness regarding how minor delays in their departments affect overall patient flow and satisfaction.
7. Provided management with evidence to consider policy adjustments (such as establishing a target discharge time of less than 4 hours).
8. Contributed both academically and operationally by merging real-time data collection with practical recommendations.

CONCLUSION:

FINAL CONCLUSION

- The total discharge time distribution is **slightly right-skewed**, indicating that while most patients complete the process within a reasonable time, a few experience **significant delays**.
- Most patients finish discharge between **350–420 minutes**, forming the central and most consistent cluster of the workflow.
- **Nursing Clearance** is the **slowest and most time-consuming** step, with the highest median time (≈16.5 minutes), making it a key area for improvement.
- **Pharmacy Clearance** is the **fastest** step, with a median time of **1 minute**, showing excellent process efficiency.
- **Laboratory Clearance** has the **highest variability**, with occasional long delays (up to 120 minutes), indicating inconsistent performance and the presence of outliers.
- Overall discharge times range from **280–520 minutes**, showing **moderate variability**, with most values concentrated in the middle range.
- Patients requiring **more than 450 minutes** for discharge are considered **outliers**, likely due to delays in:
    - Medical review
    - Billing
    - Pharmacy or clearance processes
- Reducing variability in Lab clearance and optimizing Nursing clearance could significantly improve the **overall discharge time**.

A] REASONS FOR NURSING CLEARANCE DELAYS

1. Doctors often take time to prepare the discharge summary, particularly for insured patients.
2. In cases of unplanned discharge, the return of medicines necessitates processing refunds.
3. There is often a delay in doctors issuing discharge medicines, which are frequently not prepared the day before.
4. Doctors may delay confirming discharge for planned cases.
5. There can be delays in billing confirmation for package patients and medicines at the time of discharge.
6. Confirmation regarding medicines is sometimes required from patient relatives before clearance can be granted.
7. Occasionally, clearance in the system is marked by doctors from other departments, leading to further delays.

2] REASONS FOR RADIOLOGY CLEARANCE DELAYS

1. There are issues with managing the patient waiting area.
2. Payment confirmation for PET scans from the help desk is often delayed, frequently requiring follow-up calls.
3. Procedures like 2D Echo, X-ray, and MRI require cross-confirmation.
4. Doctors may delay order cancellations.
5. Staffing levels are often insufficient.
6. Delays occur when the call center sends patients without prior coordination.
7. A centralized billing area can lead to additional waiting times.
8. Cross-confirmation of multiple radiology reports from technicians is necessary, including verifying the exact number of scans ordered by doctors, which is often followed by cancellations from billing before clearance can be issued.

3] PHARMACY CLEARANCE DELAY

1. There are limited running items available.
2. Occasionally, patients return medicines during discharge.
3. Staffing is limited by shifts.

4] REASONS FOR LABORATORY CLEARANCE DELAYS

1. Doctors may delay order cancellations.
2. There is often poor communication between doctors and staff.
3. Staffing levels are frequently insufficient.
4. Untrained staff members may interfere with processes.
5. Patients may interrupt with basic inquiries about tests.
6. Email addresses may not be recorded by counter desk staff, or when they are, they are often incorrect.
7. Inadequate cleaning of washrooms leads to repeated complaints from patients.
8. High workloads on Saturdays are due to a large number of package patients.

KEY INSIGHTS AND CONTRIBUTIONS

1. The discharge process is complex and requires significant time, involving multiple departments such as nursing, pharmacy, billing, radiology, insurance, and consultant approvals.
2. Delays in nursing clearance frequently arise from outstanding discharge summaries, late preparation of discharge medications, issues with medicine refunds/refusals, and untimely confirmations from consultants.
3. Delays in radiology clearance are associated with ineffective management of waiting areas, problems with payment confirmations, the necessity for several cross-confirmations, and delays in order cancellations.
4. Pharmacy-related delays stem from last-minute changes to prescriptions, returns of medications, and dependencies on insurance approvals.

5. The billing and insurance processes greatly extend discharge times due to the need for verification, clarification of packages, and slow communication with Third Party Administrators (TPAs).
6. Gaps in communication between departments increase the time required at each clearance stage.
7. The involvement of patient relatives (e.g., confirming medications, organizing documents) also creates dependencies that hinder the process.
8. In many cases observed, the average discharge time surpassed 6 hours, indicating inefficiencies when compared to international best practices.
9. The patient experience is negatively impacted as families may view delays as a sign of negligence, even when they are medically unnecessary.
10. The turnover of hospital beds is compromised, resulting in delayed admissions for new patients and increased pressure on resources.

RECOMMENDATIONS

Nursing Clearance:
Create an App for Tracking Discharges.
Draft discharge summaries a day in advance (send reminder alerts 24 hours prior to doctors).
Verify packages and discharge medications ahead of time.

Laboratory Clearance:
Track results via SMS.
Enhance communication between doctors and the lab.
Offer training sessions for staff.
Accurately document patient information.
Regularly sanitize workspaces.

Pharmacy Clearance:
Maintain an adequate supply of essential medications.
Establish a Fast Track Pharmacy Counter specifically for the return of discharge medications.

FUTURE SCOPE OF THE STUDY

- **Expand the sample size and study duration**
  Future work can include a larger patient population across multiple months or years to improve the reliability and generalizability of the discharge time patterns.
- **Include more departments and sub-processes**
  Additional stages such as billing, insurance approval, consultant rounds, transport services, and pharmacy stock delays can be analyzed to create a more complete discharge workflow map.
- **Integrate real-time process monitoring**
  Introducing digital time-tracking tools or RFID-based systems can provide more accurate timestamps and deeper insights into departmental bottlenecks.
- **Compare discharge times across different hospital units**
  A detailed comparison between ICU, general ward, emergency, and specialty wards can reveal unit-specific challenges.
- **Assess the impact of staffing levels**
  Future studies may analyze how nurse availability, workload, and shift patterns affect clearance time, especially because nursing showed the longest consistent delay.
- **Evaluate interventions to reduce delays**
  Pilot studies could test workflow improvements, such as parallel processing, automated clearance systems, or standardized discharge checklists, and measure their impact.

- **Patient-centered outcome assessment**
  Adding patient satisfaction, post-discharge complications, and readmission rates will help understand how clearance times influence clinical outcomes.
- **Predictive modeling and AI-based forecasting**
  Machine learning models can be built to predict discharge delays and identify high-risk patient groups or high-delay time windows.
- **Benchmarking with other hospitals**
  Comparative studies across multiple hospitals or healthcare systems can help establish standard discharge time benchmarks and best practices.
- **Cost-effectiveness analysis**
  Future studies may evaluate the financial impact of delays in laboratory, nursing, and pharmacy clearance on hospital operations and overall patient flow efficiency.

SUMMARY OF SIP (The Exit Equation – Study on Discharge Process Time Tracking)

This Summer Internship Project was conducted at Sahyadri Super Speciality Hospital, Shastri Nagar (Nagar Road), Pune, aiming to assess the efficiency of the patient discharge process and identify departmental delays impacting overall hospital operations and patient satisfaction.

The study examined the entire workflow—from when a consultant marks a discharge to when the patient leaves the bed. A time-motion study was performed on 35 planned discharges involving insurance, tracking each clearance stage such as nursing, pharmacy, radiology, lab, billing, and insurance.

Key Observations:

- The discharge process involves multiple steps and relies heavily on coordination between departments.
- 62.85% of discharges took over 6 hours, highlighting significant inefficiencies.
- Nursing clearance usually required 10–30 minutes but was often delayed because discharge summaries and medications were not prepared in advance.
- Pharmacy, lab, and radiology processes were relatively quick (mostly within 1–15 minutes), though delays occurred due to returns, cancellations, and verification issues.
- Billing and insurance approvals were the main bottlenecks, mainly due to verification procedures, TPA approvals, and lack of timely communication.
- Dependence on patient relatives for confirmation, documentation, and clearance also caused delays.

Major Findings:
Delays in the discharge process were mainly caused by:
- Late preparation of discharge summaries and medications.
- Delays in insurance approvals and lengthy billing procedures.
- Poor communication among consultants, departments, and staff.
- Insufficient staff availability during busy periods.
- **Issues related to pharmacy returns and interdepartmental clearances**.

- These delays directly affected:
- Bed turnover times
- Operational efficiency
- Patient satisfaction
- Admission bottlenecks, especially during peak hours.

Contributions to the Hospital:

- Provided a detailed mapping of each discharge step, helping the hospital pinpoint exact bottlenecks.
- Established average time benchmarks for each department.
- Offered actionable insights to enhance planning, workflow, and coordination.
- Recommended improvements such as:
  - A digital discharge tracking application.

- Appointment of a discharge coordinator or case manager.
- Use of electronic clearance checklists.
- Preparing discharge summaries and medications a day in advance for planned cases.

Recommendations:

- Improve nursing readiness by preparing summaries earlier.
- Maintain sufficient pharmacy stock and set up fast-track counters for returns.
- Strengthen communication and staff training in lab and radiology departments.
- Enhance coordination between insurance and billing with standardized communication.
- Implement technological solutions for real-time tracking of discharge status.

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