Bed Control Process Standardization using DMAIC Framework

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Abstract

A County hospital is facing issues in the Emergency Department (ED) and Bed Control Department (BCD). The issues arise from assigning patients from the ED to a bed in an inpatient unit and moving the patient to that unit. Many factors come into play in determining which patient will be assigned what bed, which in turn causes higher patient waiting times. Factors such as shift change, patient hand-off, physician change, and patient prioritization are just a few to name. due to time, administrative, and budget constraints, this study is limited to the BCD processes.

Through this study, we aim to standardize the process of bed control by clearly detailing each step of the current and future state processes and each action to be taken at the current state to attain a future improved state. We are using DMAIC, a six sigma framework to reduce the patient waiting times. This framework allows us to define the problem, measure existing data, analyze defects at each of the process sequence and its variability, and improve by generating standardized solutions and control the improved future state [1]. A standard operating procedure will be developed for the BCD, which will help them reduce patient waiting times and reduce the time delay involved in bed requests, bed assignment, inpatient unit transfers, and transfers from other hospitals. BCD will be able to utilize their resources (e.g. beds) in a better manner using the system software and this will in turn improve the lead time between steps followed to admit a patient, thereby improving patient satisfaction and delivering high quality care.

Introduction

A County hospital is facing issues in the ED and BCD. Issues range from assigning patients from the ED to a bed in an inpatient unit, moving the patient to that unit, transferring patients between units, etc.. Many factors come into play in determining which patient will be assigned what bed, which in turn causes higher patient waiting times. Factors such as shift change, patient hand-off, physician change, patient prioritization, and unit transfers are just a few to name [2].

With the amount of new patients ED receives daily, there is an increase of overall time the patients spend in the system. By system, we mean that only the number of patients who are admitted and assigned beds are taken into account for the purpose of this study. The BCD manager wants to significantly compress the total time between – when beds are requested and when beds are actually assigned to patients as well as reducing the wait times for patients to bed moved to their assigned beds.

The purpose of this study is to standardize the process of bed control, to improve the utilization of resources, minimize lead time between ED patient receiving to inpatient admission, thereby improving patient satisfaction and keeping costs low. By using the six sigma framework and reducing number of errors in the process, positive outcomes are ensured in the bed control department. The units assessed for this study are 3-Surgical, 4-Medical, 4-Surgical, TCU Telemetry, ED Express Care, Primary Care, Inpatient Transfers, and Outpatient-Inpatient Transfers.

DMAIC Framework

DMAIC stands for design, measure, analyze, improve, and control. These steps are used to assess a current state and improve them to achieve the slated deliverables.

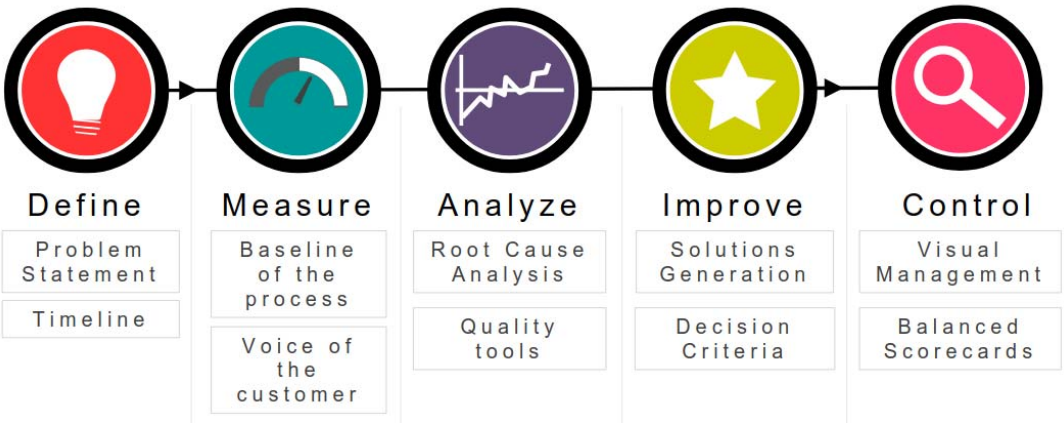

Figure 1 – DMAIC Framework.

Design

In this phase, a project charter was formulated to better understand needs of the study and get a sign-off from the stakeholders. The problem statement shall level set expectations. A tentative timeline was also included for the stated deliverables.

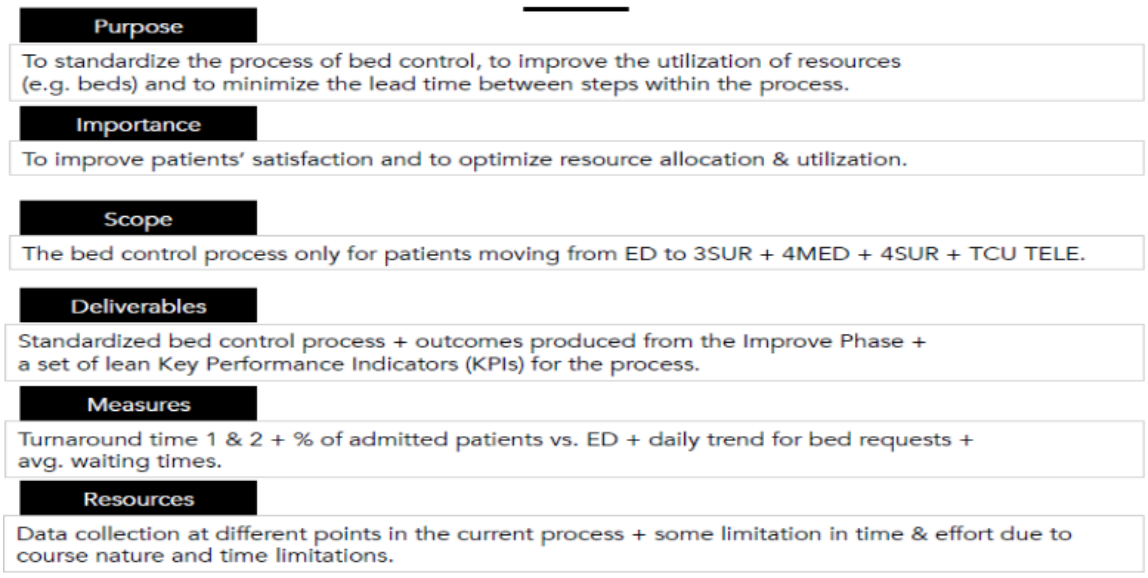

Figure 2 – Design Phase with an outline of the Project Charter.

	Task Name
1	Meeting with Project Sponsor
2	Defined needs from the department
3	Viewed actual process
4	Sent data requests to be retreived from the EHR
5	Gathered initial data
6	Asked questions about the process
7	Began analysis of data
8	Clarify questions and points for further analysis
9	Presentation on "Define" phase of DMAIC, present initial work and use as a check-in of progress to date
	Task Name
10	Begin "Measure" and "Analyze" phases of DMAIC
11	Review data for Sept. and Oct. from Bed Control
12	Review ED Boarding data for Sept.
13	Analyze Time 1 and Time 2
14	Analyze Total Turnaround Time
15	Analyze number of admitted patients, transfers, etc.
16	Review daily trends for bed requests
17	Presentation on "Measure" and "Analyze" phases

	Task Name
18	Begin "Improve" and "Control" phases
19	Suggest improvements and study possible outcomes
20	Formulate implementation plan
21	Document and detail improvement phase
22	Detail control phase
23	Presentation of whole project (highlighting "Improve" and "Control" phases) ??
24	Presentation of whole project (highlighting "Improve" and "Control" phases) ??

Figure 3 – Tentative Project Deliverables and Timeframe.

Measure

During this phase, data was collected by various methods of verification and observation. A baseline was established using the data collected regarding patient waiting times, inputs from

BCD manager, admitting supervisor, and coordinator. The below flowcharts were developed to describe the current BCD process.

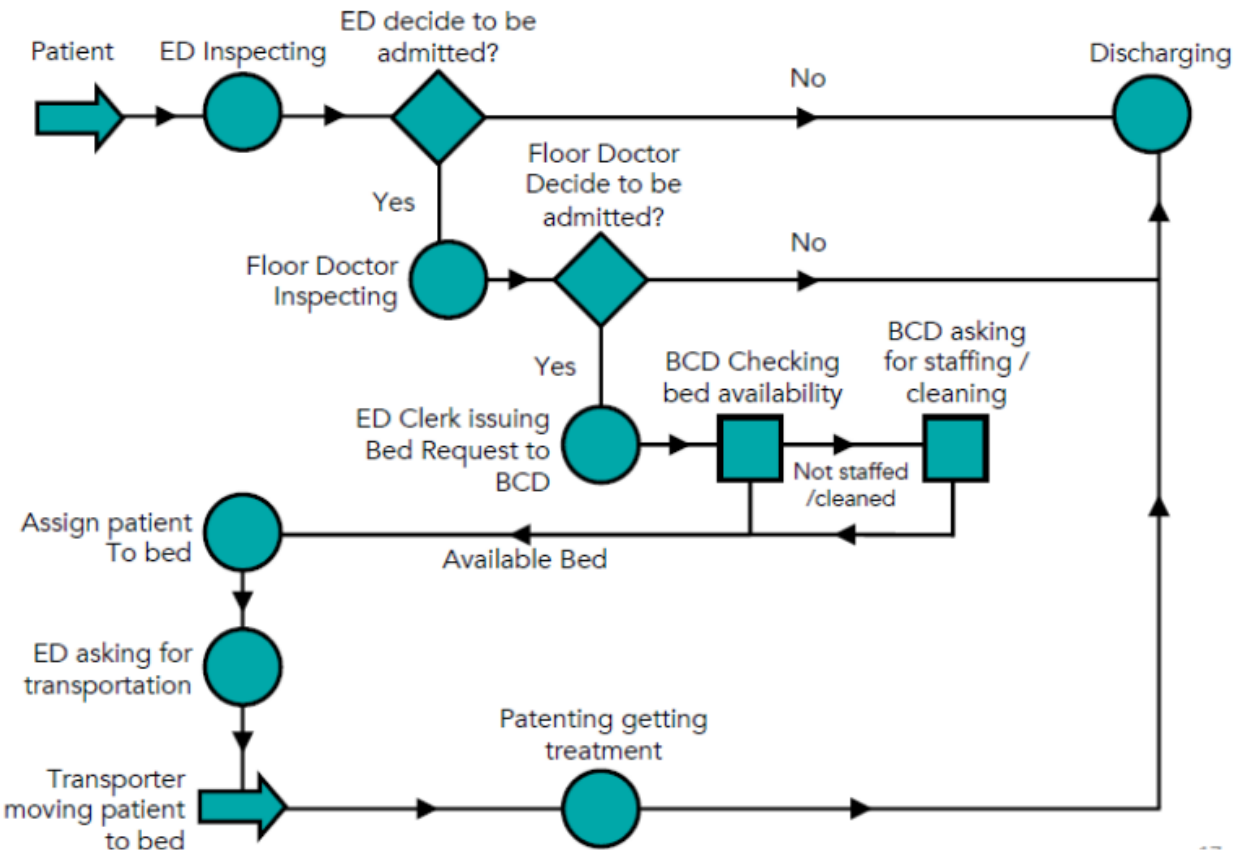

Figure 4 – Initial flowchart developed after data collection.

3 Surgical Data

September Bed Requests

Row Labels	Sum of # Requests?
Sunday	31
Monday	45
Tuesday	22
Wednesday	30
Thursday	38
Friday	32
Saturday	25
Grand Total	**223**

October Bed Requests

Row Labels	Sum of # Requests?
Sunday	22
Monday	34
Tuesday	43
Wednesday	24
Thursday	38
Friday	31
Saturday	33
Grand Total	**225**

Figure 5 – Data from 3-Surgical.

Looking at the data from 3-Surgical, one can observe that there tends to be a high volume of bed requests after Sunday, which then slightly decreases towards the mid-week. It again increases on Thursday followed by another decrease going in to the weekend.

With the exception of 4-Surgical, which is an overflow unit, all units display a similar trend. The study done at other units confirmed this observation and trends.

Analyze

In this phase, the data collected was studied for pain points in the current process. The following were developed during this phase.

- Current admit process from ED
- Current bed control process
- Bed request to bed assignment
- Bed assignment to patient move
- Fishbone diagram
- Service blueprint
- Best practices

Further flowcharts are developed to describe the problem areas to the BCD.

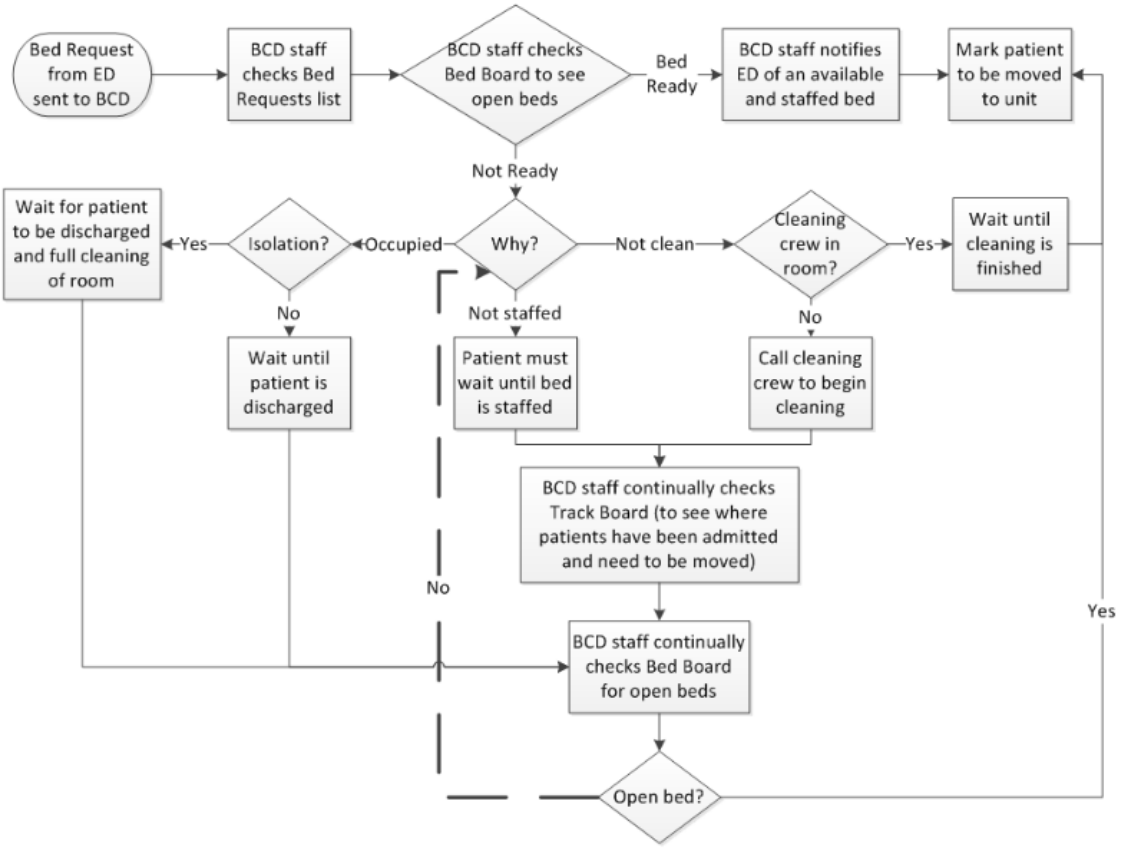

Figure 6 – Flowchart for bed request and assignment.

In the analyze phase, a root cause analysis was developed to create a flow between the problems and why it occurs. This was done using the cause and effect methodology.

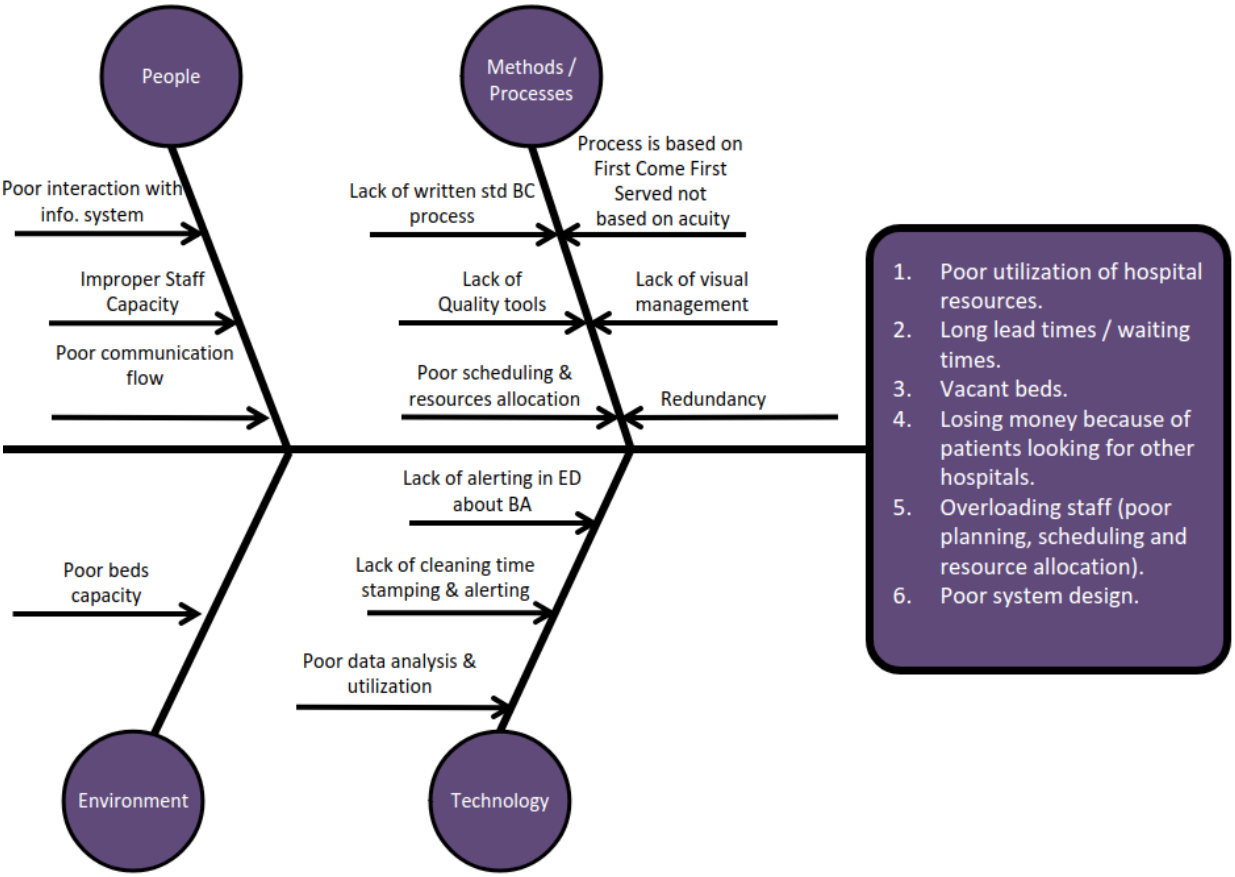

Figure 7 – Cause and effects of current bed control process.

The scope of the causes was limited to:

1. Lack of written bed control processes,
2. Redundancy of tasks,
3. Lack of visual management for staff,
4. Poor communication between staff,
5. Lack of alerting in the bed control and patient admitting process software.

Improve

In this phase, best practices were researched and suggested to the BCD. The work of generating a solution that can really help in improving the current states and problems were developed in this phase using forecasting, simulation, and other solution methodologies.

In order to be proactive, a forecasting model was created to predict the number of bed requests needed per week as the demands for beds.

way	mean	Standard Deviation
1	223.375	17.02
2	225.125	17.52

For this purpose, we have assessed September and October bed requests' data to predict a moving average of November and December data.

duration	week no.	actual		forecast	forecast error
1 to 7	week 1	218			
8 to 14	week 2	192			
15 to 21	week 3	216			
22 to 28	week 4	247		208.6666667	38.33333333
29 to 5 no 31	week 5	215		218.3333333	-3.333333333
6 to 12	week 6	231		226	5
13 to 19	week 7	247		231	16
20 to 26	week8	221		231	-10
next week				233	
1 to 7	week 1	218			
8 to 14	week 2	192			
15 to 21	week 3	216			
21 to 28	week 4	247		208.6666667	38.33333333
1 to 7	week 5	217		218.3333333	-1.333333333
8 to 14	week 6	229		226.6666667	2.333333333
15 to 21	week 7	250		231	19
21 to 28	week 8	232		232	0
next week				237	

Figure 8 – Moving average model of prediction.

An exponential smoothing model was also developed:

duration	week no.	actual		forecast	forecast error
1 to 7	week 1	218		201	17
8 to 14	week 2	192		209.5	-17.5
15 to 21	week 3	216		200.75	15.25
22 to 28	week 4	247		208.375	38.625
29 to 5 no 31	week 5	215		227.6875	-12.6875
6 to 12	week 6	231		221.34375	9.65625
13 to 19	week 7	247		226.171875	20.828125
20 to 26	week8	221		236.5859375	-15.5859375
next week				228.7929688	
1 to 7	week 1	218		201	17
8 to 14	week 2	192		209.5	-17.5
15 to 21	week 3	216		200.75	15.25
21 to 28	week 4	247		208.375	38.625
1 to 7	week 5	217		227.6875	-10.6875
8 to 14	week 6	229		222.34375	6.65625
15 to 21	week 7	250		225.671875	24.328125
21 to 28	week 8	232		237.8359375	-5.8359375
next week				234.9179688	

Figure 9 – Exponential smoothing model of prediction.

The measure of error is calculated for both models and a model with less error is picked.

Moving Average

way	Mean Absolute Deviation (MAD)
1	14.533
2	12.199

Exponential Something

way	Mean Absolute Deviation (MAD)
1	18.391
2	16.735

Figure 10 – Comparison of errors between the two forecasting models.

The suggested best practices are as follows:

1. Create a week long fast track program. This program will allow the express care to open 4 hours earlier than usual. The program will assign 1 physician, 2 nurses, and 1 secretary. This will help to check uninsured patients, patients who do not require ED or inpatient treatments. This will also ensure a fast flow of frequent users of the ED [3].
2. Increase access to primary physicians at urgent care and express care centers. This will ensure fewer patients to the ED, reducing costs and waiting times.
3. Include a discharge resource room. This will improve turnaround of vacated beds to speed admissions from the ED.
4. Include zone nursing in ED to ease workflow of nurses. This will in turn improve patient flow in the ED.
5. Use of formal improvement methods like rapid cycle change on a daily basis to track changes. Improvement methods need to be simple, defined, aimed at achieving improved patient flow and bed assignment.
6. Use of input/ throughput/ output model for patient flow. This addresses problem of patient flow all around the hospital.
7. One method of rapid cycle change needs to be implemented. This will ensure low cost, small number of changes, and easy monitoring of the small changes.
8. Development of a hospital wide patient flow team. This will include all departments – ancillary, housekeeping, and patient transport. This will improve communication between them and increase time of flow between those departments.
9. Education and training of the standard operating procedure for BCD to follow all conditions of bed requests and assignments [4].

Using the data and best practices above, a new improved admit process was developed:

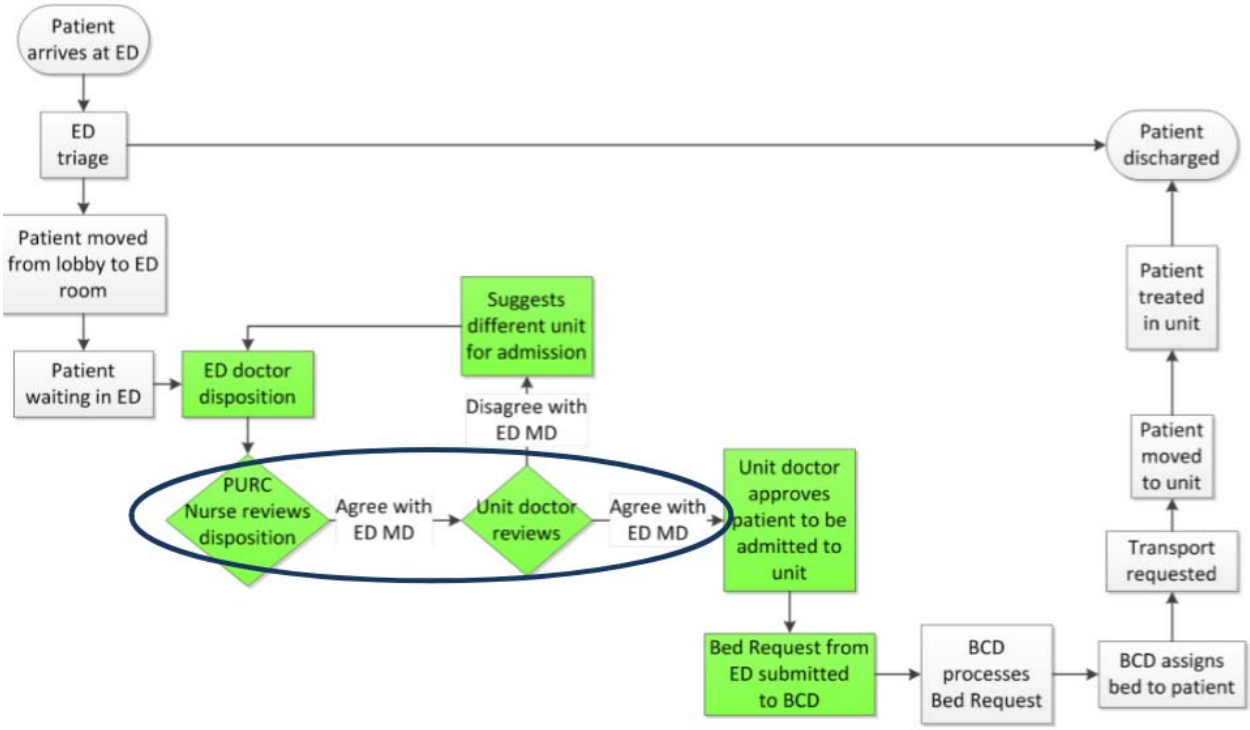

Figure 11 – Improved admit process flow.

Additional flowcharts were created for different situations as follows:

- Occupied bed process flow
- Isolation room process flow
- Marked as discharge process flow
- Marked as cleaning process flow
- No staff available process flow

In addition to the visual cues and alerts, more advanced scheduling, resource allocation, and simulation solutions were recommended.

Control

In this phase, visual management from the patient care department manager, admitting supervisor, and the PURC nurse was used to ensure procedures are followed and adhered to at all times, i.e., during bed request and bed assignment tasks.

The balanced scorecards method was followed in the control phase [5]. This is a strategic management tool that helps in both implementation and performance management. Employee engagement index, utilization scores, average length of stay, average admitting time, average occupation time of hospital bed, average discharge time, projection versus actual bed occupancy were evaluated in this phase [6].

These dashboards were updated every 8 hours. This ensured the readings were consistent and reliable, which leads to better decision making and monitoring.

The control phase included the following steps:

1. Patient flow teams need to be formed at ED and at each inpatient unit this study aims to focus on for standardization bed control processes.
2. The patient flow team consists of:
    a. Nurse managers from these units to give information regarding nurse staffing for expected slow and busy days. Keep BCD updated every 1 hour about bed availability.
    b. Housekeeping team to update on patient room cleaning process. Housekeeping staff must also coordinate with charge nurse to clean rooms as and when patients are discharged.
    c. Patient transport team to coordinate with BCD if there is a time delay in transporting patients from ED to inpatient units.
    d. On busy days, update must be given every 30 minutes instead of 1 hour.
    e. The BCD managers must coordinate with IT to make improvements and develop an alert system to track inflow and outflow based on the data nurses enter on the HealthLink system about patient condition, expected length of stay, discharge summary and date. These alerts can be sent to BCD control person on an hourly basis so that much time is not spent to check bed availability.
    f. Educate and train ED physician in charge and ED nurses about the improved processes and how they can comply to reduce waiting times. Include them in the patient flow team.
    g. Confirm with the ED team about where the patient will be admitted before making the bed request and assignment so as to avoid duplication of efforts.
    h. Existing and new employees will be trained on the standard operating procedure to achieve and maintain reduction in waiting times because of bed assignments and flow from ED to inpatient units.

Conclusion

Systematic results were achieved in the bed control department using the DMAIC methodology.

The following flowcharts were developed for current and improved processes:

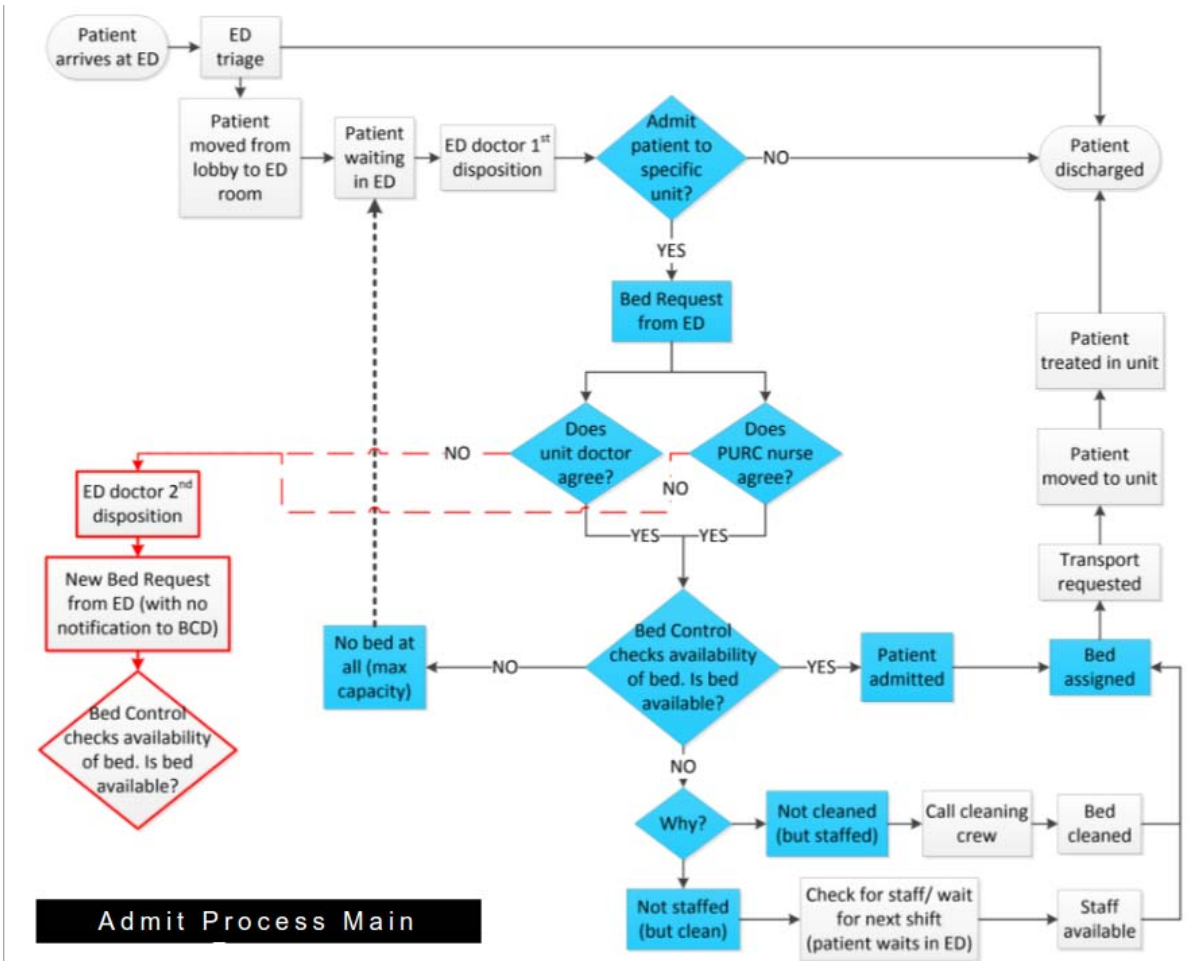

Figure 12 – Admitting process.

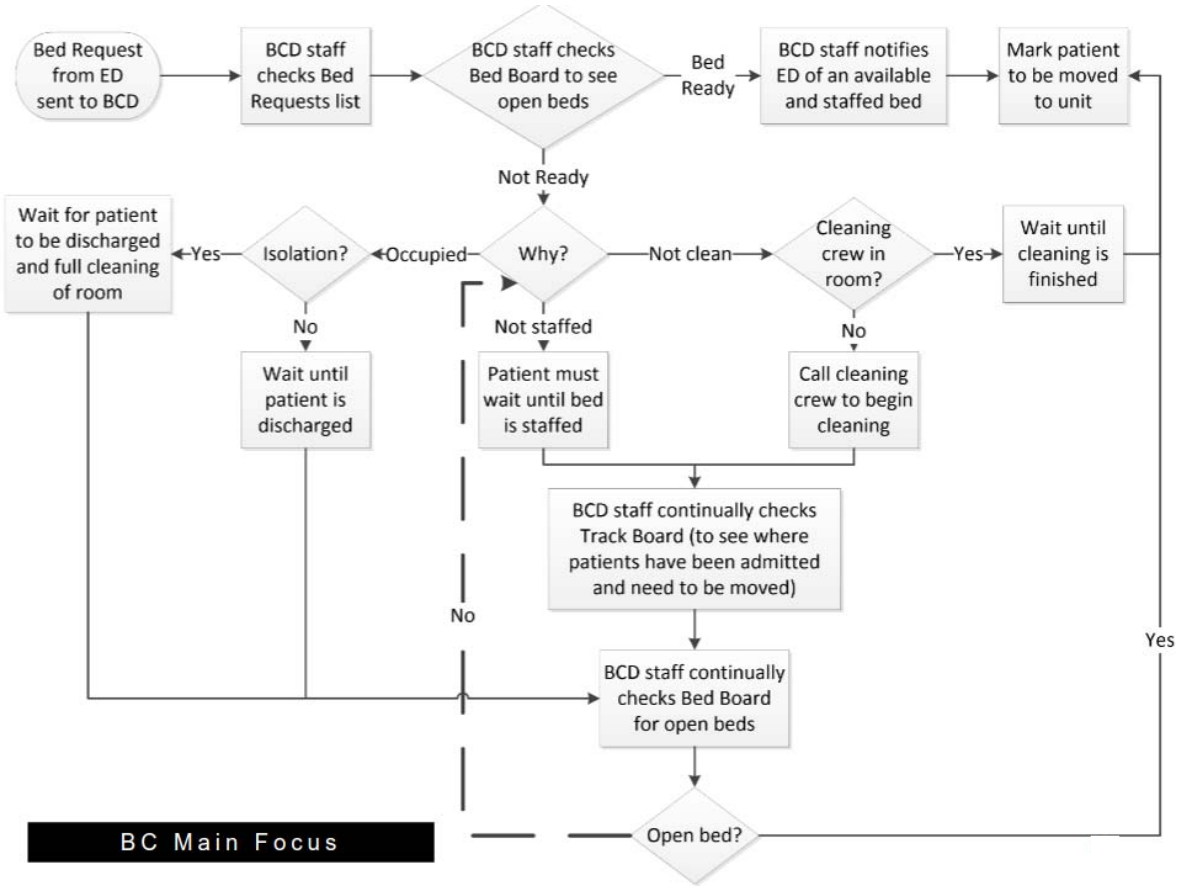

Figure 13 – Main focus of bed control.

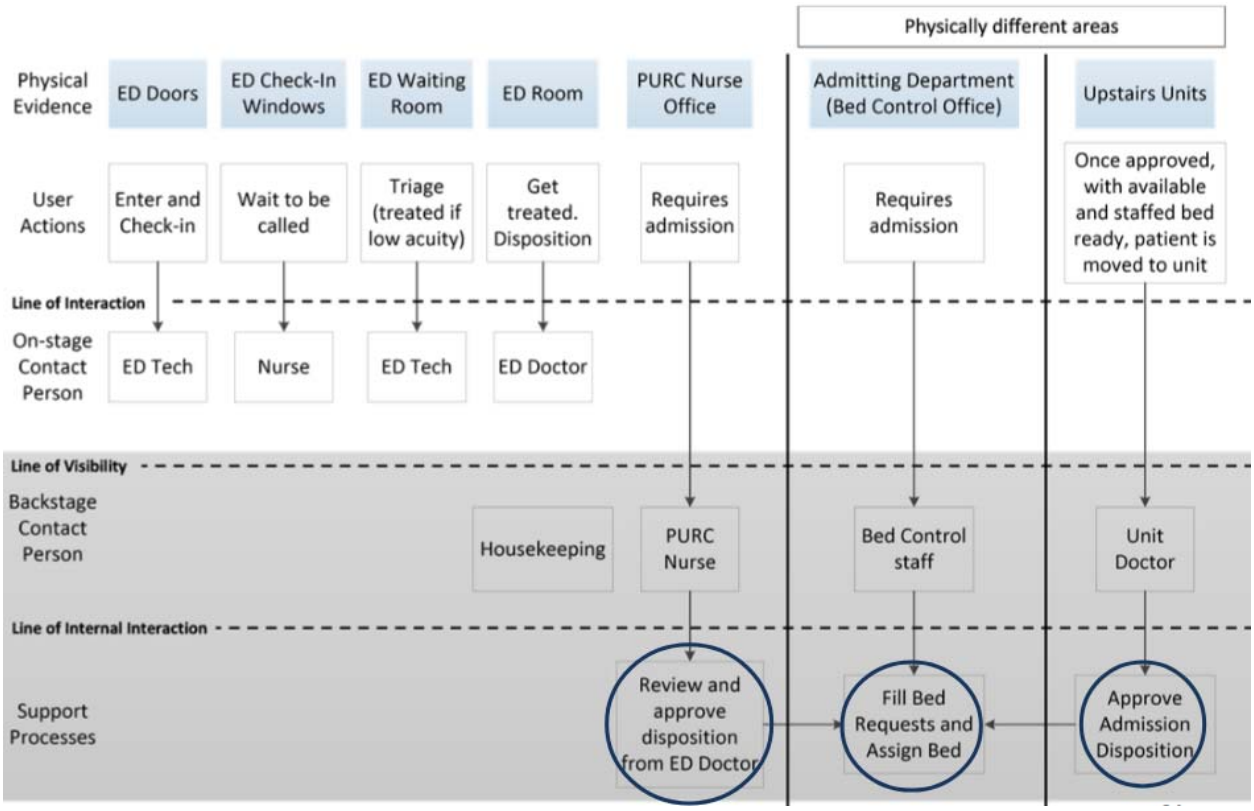

Figure 14 - Service blueprint.

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