ORIGINAL ARTICLE

A new look at observation units: evidence-based approach

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ABSTRACT

Background: Observation patient classification and billing are an important focus area for recovery audit contractors (RACs) and creation of a centralized observation unit (COU) could be a good strategy for Academic Medical Centers (AMCs) to improve care and fiscal management of a growing observation/patient volume.
Objective: To define and investigate the feasibility of a dual purpose COU at an AMC.
Methods: Retrospective data analysis and domain expertise were utilized to define potential observation patients. A pre/post study design was used to test the effects of three strategies. These strategies included: 1) all observation patients; 2) all observation patients except Emergency Department (ED) sourced patients; and 3) only post-procedural and post-surgical observation patients measured on unit efficiency metrics (*i.e.*, bed placement wait time and occupancy rate), through simulation modeling. In addition, domain experts determined operational feasibility of each strategy based on multiple criteria.
Results: Results of the simulation model demonstrated two feasible strategies that included COUs focusing on non-ED sourced observation patients on inpatient units (wait time $\leq$ 1 minute; occupancy rate = 8.26 $\pm$ 3.8 beds) and post-surgical and post-procedural observation patients only (wait time $\leq$ 1 minute; occupancy rate = 5.15 $\pm$ 3.04 beds).
Conclusions: A multi-purpose COU with clear definitions and patient care protocols for observation patients allows efficient medical care to be delivered, facilitates correct documentation and billing to third-party payers, and frees capacity on inpatient care units. Additional hospital revenue and reimbursement with modest investment given clinical feasibility bolster financial viability of a COU.

Key Words: Observation unit, Observation patient, Simulation modeling

1. INTRODUCTION

United States healthcare costs are high and continue to increase, with approximately $2.9 trillion (*i.e.*, 17.4% of gross domestic product) spent in 2013.[1] Academic medical centers (AMCs) typically have high operational cost due to their mission and goals such as research, clinical education, and specialized medical care.[2] Consequently, the federal government, managed care payers, and consumers are placing a stronger emphasis on limiting health care costs, while still insisting on safe, efficient, and effective care to patients.

The Centers for Medicare and Medicaid Services (CMS) have established contracts with recovery audit contractors (RACs) to limit spending on unnecessary medical care to help preserve the Medicare trust fund for a growing population.[3] In ensuring that Medicare payments to hospitals are appropriate, RACs assess hospitals for correct criteria, coding, and classification of patient types.[3] With a shift towards outpatient care when appropriate, it is vital that clear

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outpatient criteria, coding, and care protocols are established for hospitals to comply with federal government and other reimbursement funding criterion.[4] CMS defines observation/outpatient care as usually lasting less than 24 hours, and that, in only rare and exceptional cases, should last more than 48 hours.[5] To avoid inconsistencies, CMS has released new rules for 2014 that modify the observation status definition to include only physician ordered medically necessary services with no more than two mid-nights hospital stays.[6] Since managed care payers are rigid on standards of payment for their subscribers, it is important for AMCs to find ways to effectively utilize and allocate resources for their growing outpatient populations. One possible strategy is the establishment of centralized observation units (COUs).

Various domestic and international hospitals have evaluated the implementation of observation units within their institutions.[7,8] The number of observation patient types is likely to increase, due to expected population growth and increased hospital utilization.[9] Emergency Department (ED)-based observation units were most common[10] and 36% of EDs in the US had a dedicated observation unit as of 2007.[11] Proponents of a dedicated observation unit indicated that a centralized location provides timely care to observation patients.[7]

Although the types of patients admitted to an observation unit differs across hospitals, the general function of an observation unit is to monitor patients for both minor and emergent health conditions within a short length of stay.[12] Inconsistency in defining observation units creates a need to standardize the definition. The effectiveness of observation units has been commonly evaluated by assessing the number of patients transferred from observation to inpatient unit care.[1,13] In addition, implementation of ED-based observation units has indicated a high level of patient satisfaction.[8] Many institutions have found benefits including the ability to observe patients with unknown diagnoses and prevent readmissions.[14] Survey results also indicated the possible elimination of unnecessary primary admissions. In addition, a Meta study comparing the short stay and inpatient units indicated that the short stay units had 3 days lower length of stay.[15] A Monte Carlo simulation model showed that there would be substantial national cost savings if selected syncope patients were managed in the observation unit instead of alternative or inpatient units.[16] Even though a number of studies indicated increased efficiency and effectiveness with implementation of an observation unit, there has been conflicting evidence regarding financial implications.[8,14,17]

In addition to analyzing various implementation strategies through statistical testing, a simulation modeling technique has been used to evaluate the impact of an observation unit on patient throughput within the Pediatric ED. Results of simulation modeling on observation units indicated a decrease in time for clinicians to see patients as well as a decrease in length of stay.[18] Simulation modeling has been shown to be an effective tool used in the healthcare setting in reducing wait times, optimizing patient flow, and decreasing bottlenecks.[19,20]

While many studies indicate observation units have positive implications for hospitals, further research is needed to test the effectiveness of a COU at an AMC, through simulation modeling. It is important to assess the optimal patient-type mix in an observation unit. There is a need to create uniform observation patient criteria and definition. Therefore, the objective of this study was to develop a clear definition of observation patients and investigate the feasibility of a COU at an AMC. The strategy had two main parts. First, the study considered the best patient-type mix to be housed in an AMC observation unit, by studying the admission source and characteristics of these patients. Second, based on the limited capacity allocated for the observation patient-type at the study AMC, the feasibility of housing observation patients was tested across different patient-type mixes, given the refined definition of observation patients.

2. METHODS

2.1 Setting

This study was conducted at a large 672 bed AMC with approximately 32,000 inpatient admissions, 50,000 emergency visits, and 250,000 total hospital outpatient visits. The AMC was investigating the prospect of designating a twenty-four bed dual purpose unit to house observation patients and extended recovery patients as well as being used for routine surgical and interventional procedure patients' pre-procedural preparation.

2.2 Sample and observation patient definition

The initial sample consisted of all inpatients, outpatients, and ED patients entering the AMC between July 1, 2008 and June 30, 2009. Based on the service line definitions, any patients who had an observation charge (in a medical/surgical unit or ED) or any outpatient managed in a medical/surgical inpatient bed were defined as "Observation Patients" and were included in the study (n = 5,613 patient visits). Based on admitting source (*i.e.*, ED, operating room [OR], and physician office) the following five distinct observation patient categories were crafted to standardize observation patient definitions:

- OBS 1. Patients transferred from the ED to medical/surgical inpatient units for further observation

- OBS 2. Patients who entered and remained in the ED for further observation
- OBS 3. Patients who were admitted directly to medical/surgical inpatient units for further observation with a physician's directive (no ED visit)
- OBS 4. Patients who were transferred from other hospital areas (*e.g.*, ambulatory surgery, labor and delivery triage) to medical/surgical inpatient units for further observation
- OBS 5. Post-surgical and post-procedural outpatients who need Extended Recovery service prior to discharge

These criteria were used to test if the COU would suffice as a replacement for any of the medical/surgical inpatient beds or ED observation beds currently used to house these observation patients. Further, as the COU was anticipated to also serve routinely scheduled interventional procedure patients both pre- and post-procedurally (*i.e.*, early morning through early evening, Mondays through Fridays) it was determined to reserve 50% (*i.e.*, 12) of the beds in the simulation model for these patients during these times based on historical utilization and domain experts'/stakeholder advice.

2.3 Study design and hypothesis

A pre/post simulation based study design was utilized with the independent variable as pre- and post-testing of three different virtual COU (VU) strategies and dependent variables as unit efficiency metrics (*i.e.*, bed placement wait time and VU occupancy rate). Multiple strategies based on above defined mix of observation patients were tested, but for this article we present the three most relevant strategies: 1) All Patient Types (*i.e.*, OBS 1 to OBS 5) (*i.e.*, pre/base strategy); 2) All Patient Types Less ED-Sourced Patients (*i.e.*, OBS 3 to OBS 5) (*i.e.*, post/alternative strategy); and 3) Patients coming from only Post-Procedural and Post-Surgical interventions (*i.e.*, OBS 5) (*i.e.*, post/alternative strategy). The null hypothesis was that there is no difference in unit efficiency metrics (*i.e.*, bed placement wait time and occupancy rate) among the three different VU strategies. Approval from the Institutional Review Board was requested and granted for the research study.

2.4 Simulation modeling and analysis plan

As testing the strategies in a real world setting was impractical, simulation models were built to evaluate the three VU strategies and obtain unit efficiency metrics. The simulation models replicated a virtual AMC environment with scientific rigor, taking into account the VU along with other units (*e.g.*, ED, OR, orthopedics, surgical, medical, medical and surgical intensive care, surgical intensive care, bone marrow transplant, neuroscience, oncology, cardiac surveillance, short stay surgical, and neuroscience intensive care units) where patients may travel throughout their stay at the AMC. Discrete distributions by unit, arrival patterns (based on day of the week and time of day) by five admission sources (*i.e.*, ED, OR, direct VU, Non OR Procedure, and other), and sequences of patient visits (*e.g.*, ED → VU, OR preparation area [Prep] → OR had a significantly → Intensive Care Unit [ICU] → VU) for the 5,613 patients were included in the model (see Figure 1). Adjustment factors were added to the inter-arrival patterns to account for any discrepancies observed between the modeling results and the actual July 2008 through June 2009 (FY2009) patient data prior to modeling the VU strategies. In addition, patients coming from similar admission sources were considered to be homogeneous, and therefore were grouped together and treated similarly when calculating various input variables for the simulation model. The observation patients entered the simulation model through the arrival logic and various patient-related attributes were assigned to the patients (*e.g.*, hospital transfer sequences and day of the week). Thereafter patients were navigated to various unit(s) prior to entering the VU depending upon a randomly assigned historically observed sequence (based on discrete distribution). Upon completion of the VU stay, patients were discharged and exited the simulation model. After testing and validating the models, an outpatient growth rate of 14.2% was incorporated into the model (based on the AMC's Strategic Planning Department's 2013 projections). The model was revalidated prior to testing different strategies to ensure the projected growth was realized in the new models.

The models (*i.e.*, strategies) were executed for ten cycles of a one year period (excluding the 90 day warm-up periods) to generate the dependent variables: bed placement wait time and occupancy rate for the VU. The bed placement wait time was defined as the number of minutes it took to place the patient in an observation unit bed. Bed placement wait time was calculated by taking the difference in the timestamps for bed request and when the patient actually occupied the bed. The occupancy rate was determined by averaging the hourly census data for the virtual observation unit. The simulation model recorded the total number of patients occupying beds in the observation unit on hourly bases. The bed placement wait time indicates the availability of beds on request (*i.e.*, supply of beds is matching demand) while the occupancy rate provides the number of observation beds utilized so as to not exceed allocate beds throughout the 24 hour period. These outputs were then statistically analyzed (*e.g.*, Analysis of Variance, ANOVA and post hoc Bonferroni test) using Statistical Package for the Social Sciences v12 (SPSS) ®.

The criteria for selecting the best strategies consisted of: 1) minimal to no bed placement wait time; 2) high occupancy rate for observation patients; 3) appropriate number of beds available for managing the routinely scheduled procedural patients; 4) clinical feasibility; 5) meeting staffing requirements; and 6) additional cost for implementation.

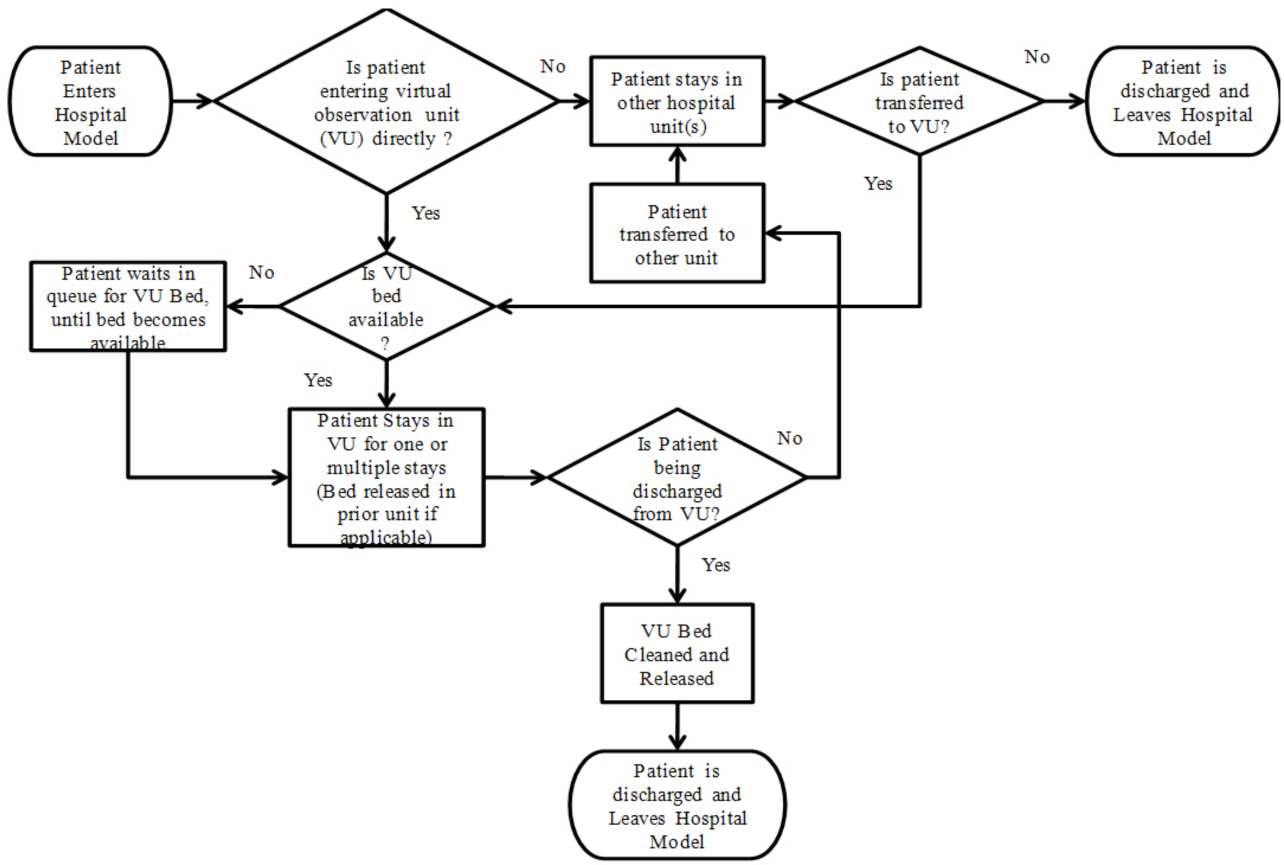

Figure 1. Simulation model- observation patient flow

3. RESULTS

More than half (*i.e.*, 2,840/5,613 = 50.6%) of patients included in the study were classified as having observation charges and 56.62% of these patients had ED as the admission source (see Table 1). Of all observation patients, those sent directly to the medical/surgical units, those who were post surgical/post procedural, and those passing through the ED consisted of 10.64%, 38.43% (*i.e.*, 27.31% + 11.12%), and 44.41%, respectively (see Table 1). In addition, the average time spent by all observation patients (OBS 1 through 5), all observation patients except the ED based observation patients (OBS 3 to 5), and only procedural based observation patients (OBS 5) on any type of inpatient/ED type observation bed per sequence were 22.1 $\pm$ 20.24, 19.27 $\pm$ 18.67, and 17.75 $\pm$ 14.39 hours, respectively (see Table 2).

Based on simulation modeling outputs, unit efficiency measures were compared using ANOVA between the three VU strategies (see Table 3). Results showed that strategy one (OBS 1 to OBS 5; wait time = 47.507 $\pm$ 140.021 minutes; occupancy rate = 16.95 $\pm$ 4.66 beds) had a significantly (p-value < .05) higher average wait time and occupancy rate than strategies two (OBS 3 to OBS 5; wait time $\leq$ 1 minute; occupancy rate = 8.26 $\pm$ 3.8 beds) and three (OBS 5; wait time $\leq$ 1 minute; occupancy rate = 5.15 $\pm$ 3.04 beds). Based on the variable target utilization through the 24-hour day (*i.e.*, 24 bed available capacity at night and 12 bed available capacity by day), strategies two and three underutilize available beds by 3.74 (*i.e.*, approximately 4 beds) and 6.85 (*i.e.*, approximately 7 beds) beds respectively, while strategy one exceeds the day time target utilization by about 5 beds (see Figure 2). In addition, the average length of stays of the patients on the VU was less than 24 hours.

Table 1. Total observation patients included in study

	Categories	Patients with Observation Charge (N = 2,840)	Outpatients in a Bed (N = 2,773)	Total (N = 5,613)
Patient Arrivals	Emergency Department	1,608 (56.62%)	885 (31.91%)	2,493 (44.41%)
	Post-Surgical	761 (26.8%)	772 (27.84%)	1,533 (27.31%)
	Post-Procedural	156 (5.49%)	468 (16.88%)	624 (11.12%)
	Direct Admit to Medical/ Surgical Inpatient Units	231 (8.13%)	366 (13.2%)	597 (10.64%)
	Other Areas	84 (2.96%)	282 (10.17%)	366 (6.52%)
Medical/Surgical Inpatient Units	ED based Observation Unit	542 (19.08%)	-	542 (9.66%)
	Orthopedics Unit	252 (8.87%)	361 (13.02%)	613 (10.92%)
	Surgical Units	463 (16.3%)	872 (31.45%)	1,335 (23.78%)
	Surgical Intensive care Unit	0 (0.0%)	6 (0.22%)	6 (0.11%)
	Medical Units	953 (33.56%)	925 (33.36%)	1,878 (33.46%)
	Bone Marrow Transplant Unit	8 (0.28%)	5 (0.18%)	13 (0.23%)
	Neuroscience Unit	140 (4.93%)	75 (2.7%)	215 (3.83%)
	Oncology Unit	20 (0.7%)	25 (0.9%)	45 (0.8%)
	Cardiac Surveillance Unit	11 (0.39%)	21 (0.76%)	32 (0.57%)
	Medical Intensive Care Unit	198 (6.97%)	326 (11.76%)	524 (9.34%)
	Short Stay Surgical Unit	253 (8.91%)	145 (5.23%)	398 (7.09%)
	Neuroscience Intensive Care Unit	0 (0.0%)	12 (0.43%)	12 (0.21%)

Table 2. Length of stay on observation units

Patient Arrivals	Length of Stay on Observation Units (Average ± Standard deviation)			
	Individual Source	All Patients (OBS 1-5)	All Patients Less ED-Sourced Patients (OBS 3-5)	Only procedural based observation patients (OBS 5)
Emergency Department	18.97 ± 15.00	X		
Post-Surgical	11.59 ± 10.91	X	X	X
Post-Procedural	14.73 ± 12.25	X	X	X
Direct Admit to Medical/ Surgical Inpatient Units	29.02 ± 28.91	X	X	
Other Areas	18.97 ± 15.00	X	X	
Total	22.1 ± 20.24	22.1 ± 20.24	19.27 ± 18.67	17.75 ± 14.39

Note. X: Individual patient arrival source included

Table 3. Unit efficiency results from simulation models

Strategy	Wait Times (Minutes) Average ± Standard deviation	Occupancy (Number of beds) Average ± Standard deviation
1. All Patient Types	47.507 ± 140.021	16.95 ± 4.66
2. All Patient Types Less ED-Sourced Patients	0.004 ± 0.467*	8.26 ± 3.8*
3. Patients coming from only Post-Procedural and Post-Surgical units	0.001 ± 0.226*	5.15 ± 3.04*

* Analysis of Variance (ANOVA) was used to identify which strategy had a p-value less than .05

4. DISCUSSION

This study provided a clear definition for the observation patient based on admit source and clinical need at disposition from a prior unit. Bed management protocols developed based on this can lead to appropriate patient care operations as well as improved throughput. This will not only allow delivery of timely and efficient care to the observation patient, but also standardized practice across the AMC. In addition, clearly identifying observation patients and appropriate documentation would lead to improved compliance with RAC audits and protect reimbursement revenue streams. Improved management and documentation of patient types within these observation patient definitions may lead to improved reimbursement experience from other third-party payers.

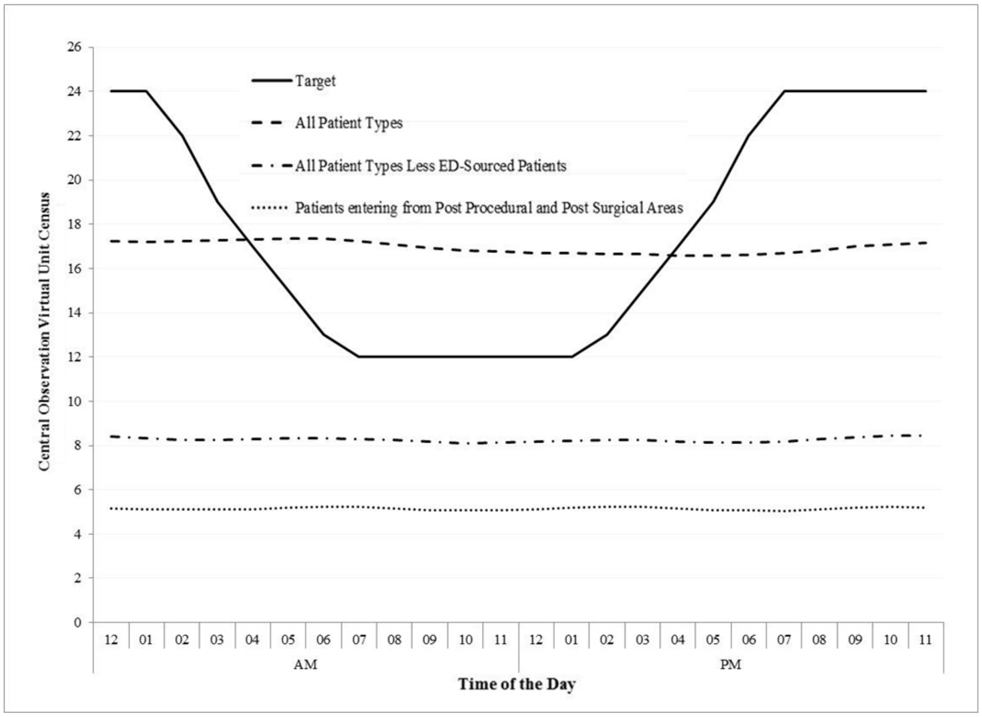

Figure 2. Average bed utilization by hour of day and strategy type
Target accounts for affording 12 procedure preparation bays

Table 4. Comparison of observation unit strategies

Factors	Criteria	Strategy 1: All Patient Types	Strategy 2: All Patient Types Less ED-Sourced Patients	Strategy 3: Patients coming from only Post-Procedural and Post-Surgical units
Waiting Times	< 15 minutes	--	++	++
Occupancy	≤ 12 beds	-- --	++	++
Clinical Feasibility	Expertise to manage patient population	-- --	--	+
Staffing Resources	Staffing grids	-- --	+	+
Cost	Additional FTE & Re-configuring cost	--	++	++

Note. Notations: -- -- Very Difficult to Implement; -- Difficult to Implement; + Feasible to Implement; ++ Very Feasible to Implement; Designation of feasibility of implementation is based on domain expert opinions

The gains achieved through the clear definition of observation patient and bed management protocols will be further enhanced with a dual use COU. Based on the simulation results, strategies two (OBS 3 to OBS 5) and three (OBS 5) demonstrated lowest wait time to assign bed and also their expected occupancy did not exceed set threshold so as to accommodate the dual use population of routinely scheduled interventional procedure patients. With the implementation of strategy two (OBS 3 to OBS 5), the expected number of COU beds utilized is between 4 to 12 (8.26 $\pm$ 3.8) while for strategy three (OBS 5) it is between 2 to 8 (5.15 $\pm$ 3.04). Thus, both the strategies have high feasibility in terms of meeting minimal wait time (*i.e.*, typically 15 to 30 minutes) and not exceeding set threshold of 12 beds (see Table 4). As the patient populations for strategy three (OBS 5) are homogenous (*i.e.*, surgical or procedural), it would be an extension of the current post recovery time for the patients in the COU-staffed by post recovery clinicians- instead of the inpatient unit. Thus strategy three (OBS 5) will have enhance clinical and staffing feasibility for implementation. Strategies one (OBS 1 to OBS 5) and two (OBS 3 to OBS 5) will have heterogeneous medical and surgical populations, which would reduce their clinical and staffing feasibility for implementation. In terms of staffing grids for nurses (*i.e.*, 1 nurse to 4 patients) and attending (*i.e.*, 1 attending to 8 patients) as well as built-in redundancies for patient safety, it would be desirable to have at least 2 nurses and one attending staffing the COU. Thus, strategy two (OBS 3 to OBS 5) would be optimal for resource staffing but requires trained staff to provide clinical care for both surgical and medical observation patients. As the dual-use COU was already included in the hospital renovation plans for routinely scheduled interventional procedure patients there would be minimal incremental capital and re-configuration ($ per additional bed) cost to convert the unit/beds to cater to other observation patients. As the interventional procedure patients are typically for shorter duration of time on the unit, the unit rooms are without doors and typically a restroom is shared between two rooms. Thus, the main re-configuration cost would include adding room doors and additional restrooms on the unit. The clinical full-time equivalent (FTE) required for staffing the unit would vary based on the expected occupancy. In addition, to determine the return on investment, additional financial analysis is required. For strategy one (OBS 1 to OBS 5) most of the criteria indicate higher difficulty in implementation (*i.e.*, less feasible option).

As the unit efficiency measures (such as bed placement wait time and occupancy rate/utilization) along with the feasibility of implementation criteria had a significant impact on the types of observation patients that could be housed in the AMC COU, optimization of unit operations is essential for successful implementation. Observation unit size tailored carefully to patient demand and patterns of service would enhance efficiency and allow consideration of novel multi-purpose, mixed patient population utilization strategies. As the twenty-four bed unit at the AMC under study is under-utilized over a 24 hour period for strategies two (OBS 3 to OBS 5) and three (OBS 5), managers need flex staffing to fit demand patterns, and/or consider allowing a percentage of ED-sourced observation patients (*i.e.*, approximately 3 to 4 patients per day) to be housed in the unit to improve utilization. However, careful analysis of the appropriate level of nursing care for this mixed surgical and medical patient population would be important. To maintain adequate capacity for the scheduled, routine pre- and post-procedural population during the week, frequent capacity management reviews per day should be held by bed managers and clinical personnel from various admitting sources. In addition, an appropriate clinical/management team either led by attending hospitalist or charge nurse to govern the unit is important. Finally, physician preferences and practice patterns, which can impact patient placement, bed placement wait time, and occupancy rates across units, need to be factored in to the clinical feasibility.

With implementation of strategies two (OBS 3 to OBS 5) and three (OBS 5) and a dedicated dual-use COU, additional capacity on the medical/surgical units will be created as these patients will not be occupying an inpatient bed. With the implementation of strategy two (OBS 3 to OBS 5), there will be 3,120 patients (see Table 1) in a year who will receive care in the COU for approximately one (*i.e.*, 19.27 $\pm$ 18.67 hours) day. Thus the available capacity on the medical/surgical units would increase by 2,505 (3,120 $\times$ [19.27/24] = 2,505) bed days per year. Assuming average inpatient bed charges of $1,800 per day and the additional capacity is utilized with new patient volume, strategy two (OBS 3 to OBS 5) has a potential to generate additional charges of around $4.5 million per year (*i.e.*, 2,505 bed days $1,800 charges per day = $4,509,000) without taking into account any downstream charges. Even if the additional capacity is not fully utilized by new volume, medical/surgical units and ED will experience smoother operations and improved wait times to admit patients, opportunity for expansion of service lines, and ultimately additional revenue. Furthermore some of additional benefits of a COU are: 1) it allows patients to be closely monitored and tested when a clear diagnosis is unknown, supporting safe and effective care; 2) standardization of observation unit patient care protocols and processes can be expected with centralization; and 3) better adherence to admission to the unit, course of treatment, and discharge protocols can lead to more timely and efficient care for patients, and help ensure that the AMC is following guidelines for all government and other third-party payers. As per Baugh and Schuur (2013), dedicated observation units provide high-value observational care while simultaneously minimize cost shifting to patients.[6]

At the time of this applied research study, the COU was not built thus testing the strategies on the unit were not feasible. Therefore, we utilized simulation modeling approach to investigate the feasibility of such dual use COU. As the data for the simulation model was based on actual observation patients seen in the AMC and the simulation modeling logic replicates the planned workflows for these observation patients (which were validated by clinical and operational domain experts), the output generated were reliable and valid. Considering that there wouldn't be any resistance from clinical and administrative staff to implement the recommended strategies, we expect the actual implementation results would be similar to simulation output. The recommendations of the study were presented to the AMC leadership. As the leadership expected that planned bed capacity in the renovated AMC will accommodate the projected observation patient demand as well as feasibility challenges associated with the proposed strategies, the dual purpose COU was not implemented during the study timeframe. Recently, with the increased patient volume, the leadership is re-investigating the possibility of investing in a dedicated COU. The simulation modeling results along with updated demand patterns formed the basis for the ongoing evaluation of both dual purposed COU on the 24 bed extended post recovery unit as well as a standalone COU on a separate unit.

In conclusion, implementation of a COU in this environment under current operating conditions was feasible on clinical factors, waiting times, occupancy, and support of the routinely scheduled procedural patients, if strategy two (all patient types less ED-Sourced patients) or strategy three (patients entering from only post-procedural and post-surgical care) were to be implemented (see Table 4). In addition, the tested strategies have the potential to provide additional medical/surgical inpatient and ED capacity, while providing improved and appropriate clinical care and documentation standards, leading to enhanced fiscal management and protecting reimbursement. To translate the simulation results and operational feasibility outcome into actionable steps for implementation at the AMC includes stakeholder-buy-in in the concept of dual use COU, availability of dedicated unit and supporting staff, and operational protocols for smooth functioning of the dual use COU. The above approach can be generalized to other medical centers and corresponding opportunity revenue can be calculated based on the current de-centralized observation patient mix, size of the dual use COU, and volumes of scheduled interventional procedure patients who would be occupying the COU.

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