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Case

A Data-Driven Approach to Improving Hospital Observation Unit Operations

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Dr. Erin Kelly was in charge of a 23-bed observation unit (OU) at Montanaro, a 260-bed hospital in a medium-sized U.S. city. Looking over the monthly management report, Dr. Kelly was concerned about the average length of stay for patients in her OU and about the large number of patients who "flipped" from observation status to inpatient status. The OU had been in operation for a little more than a year, and Dr. Kelly felt it was time to evaluate current protocols and rethink patient placement rules for her unit.

Background on Observation Units

A significant proportion of patients present to emergency departments (EDs) at hospitals with complex but not life-threatening symptoms. Healthcare providers need to be able to keep such patients under observation for a period of time to see whether inpatient hospitalization is required or if a patient can be safely discharged.

Theoretically, the observation level of care requires fewer hospital resources than does inpatient care. Both public and private medical insurance providers compensate hospitals at a lower rate for observation care than they do for inpatient care.

Many hospitals in the United States keep observation patients in the ED or in beds in various inpatient units (hospital wards). Montanaro management believed that a dedicated unit specializing in observation-level care could effectively increase hospital capacity and relieve ED overcrowding while providing the right care using fewer resources. Montanaro's OU was built to cohort lower-acuity observation patients who are generally expected to need less than 48 hours of observation-level care. Rooms in the observation units did not have to meet the same architectural standards as inpatient rooms: Montanaro OU rooms did not have outside windows and were smaller than inpatient rooms. On the other hand, the unit was recently built, and the rooms were newer and all single occupancy—unlike the inpatient rooms that were in the older wing of the hospital and were mostly double occupancy.

Impetus for the OU Exclusion List Improvement Project

About a third of the patients admitted to Montanaro OU were postsurgery patients, and they were discharged, on average, 24 hours after being admitted to the unit. Two-thirds of the patients were medicine service patients, and their average length of stay in the OU was over 60 hours. In a week, on average, 44 medicine service patients were placed in the OU to undergo observation. For 20 out of 44 (45%), the appropriate level of care was at some point changed to inpatient.

At the same time, 115 observation-level patients, on average, per week were placed in inpatient beds, either because of a lack of OU bed capacity or because the patients' preliminary diagnoses were on an OU "exclusion list" that specified which observation-level patients should not be placed in the OU.

In a hospital where inpatient wards run at close to 100% utilization, using inpatient beds to care for observation-level patients is an inefficient use of resources. Transferring patients between inpatient wards and the OU also wastes hospital resources, increasing the patients' overall length of hospital stay, as well as chances of medical errors as a result of handoffs. Dr. Kelly believed that a predictive model could help to define the OU exclusion list better, leaving more bed capacity for OU-appropriate patients.

The original exclusion list (Figure 1) covered six preliminary diagnosis-related groups (DRGs). Dr. Kelly expected that a more accurate exclusion list would decrease the average length of patient stay in the OU, increasing the unit's throughput and thus Montanaro's capacity during the upcoming flu season. She believed that job satisfaction and retention for OU nurses would improve, as there would be more lower-acuity observation patients triaged to the OU. Another long-term benefit as a result of improved patient flow through the OU would be a less crowded ED. That, in turn, could reduce the number of patients who present to the ED but then leave without being seen by a provider (referred to as LWBS). There were close to 1,900 LWBS cases in the previous year. On average, Montanaro received $700 for an emergency room visit. Reducing the number of LWBS cases could add a substantial amount to the hospital's bottom line.

Estimating the Project's Impact
Dr. Kelly analyzed her unit's current performance in order to estimate the project's potential benefit. On average, 22 postsurgery patients underwent observation in the OU per week. Their stay averaged 24 hours. The medicine service patients who maintained their observation classification stayed, on average, 40 hours in the OU. That was approximately 55% of medicine-service patients. The other 45%, whose status was

eventually changed to inpatient, stayed longer. About 25% of these patients ended up in a hospital ward, after spending, on average, an additional 38 hours in the OU. The rest spent, on average, yet another 11 hours in the OU and then were discharged from the hospital. Figure 2 shows the patient flows.

Dr. Kelly estimated that, keeping everything else the same, if she could decrease the percentage of flipped patients from 45% to 20%, she could treat 55 medicine service patients per week in the OU instead of 44. That would mean about 570 extra patients per year. Even if the percentage of flipped patients was reduced to one-third, the change would still be worthwhile: the OU would treat, on average, 5 more patients every week, which would amount to 260 additional patients per year.

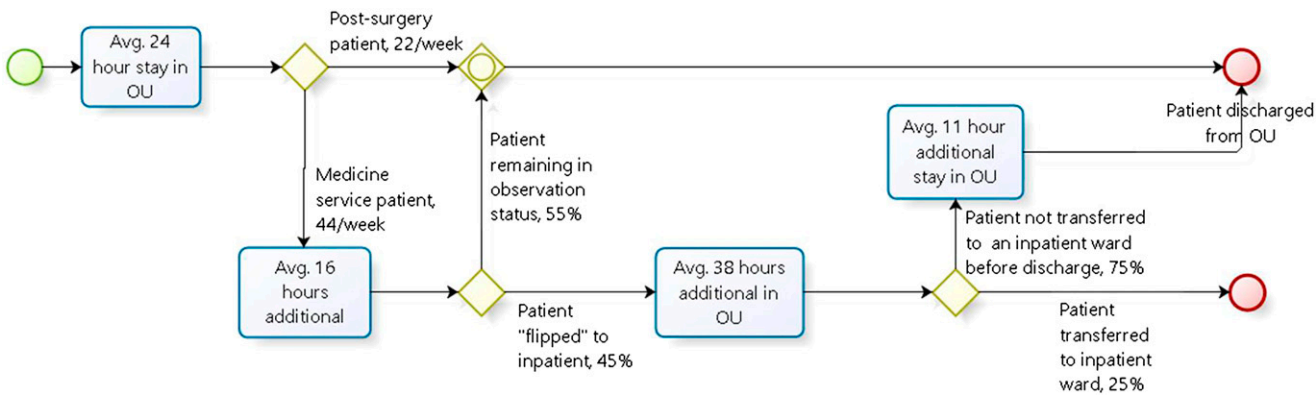### Updating the OU Exclusion List Based on Historical Data
Dr. Kelly started the OU exclusion list project in August with the goal of implementing the changes during the first week of January, in time for the coming peak of respiratory flu season. She described the project as getting "the right patient to the right bed" and secured the commitment of the chief of medicine (see the organizational chart in Appendix A, Figure A.1) to be the project's sponsor. Dr. Kelly's academic advisor in the master's of medical management program was interested in data-driven decision making in healthcare operations and promised to help Dr. Kelly with some of the technical analysis.

Figure 3 diagrams the process of placing an ED patient for observation in the OU and then monitoring the patient to decide whether the transfer to inpatient level of care is warranted. The process involves ED physicians, physicians responsible for OU admissions (depending on the time of the day, that could be a hospitalist, a nocturnist, or the medical director of the OU), OU nursing staff, utilization management nurses and staff (who review the decisions against the terms of the hospital's contracts with the patient's insurance provider), and medical service admissions staff. Dr. Kelly worked with these colleagues as well as with pharmacists and social workers to create a list of patient characteristics believed to be most useful for

Figure 1. Montanaro Original OU Exclusion Diagnoses List

1. *Alcohol intoxication*
2. *Alcohol withdrawal*
3. *Mental health disorder with behavioral disturbance or suicidality*
4. *Obstetrics patients*
5. *Sickle cell anemia crisis*
6. *Cerebrovascular accident (stroke)*

Figure 2. OU Patient Flow Prior to Exclusion List Expansion

Avg. 24 hour stay in OU
Post-surgery patient, 22/week
Medicine service patient, 44/week
Avg. 16 hours additional
Patient remaining in observation status, 55%
Patient "flipped" to inpatient, 45%
Avg. 38 hours additional in OU
Avg. 11 hour additional stay in OU
Patient not transferred to an inpatient ward before discharge, 75%
Patient transferred to inpatient ward, 25%
Patient discharged from OU

predicting whether an observation-level patient would become inpatient (Figure 4). She then turned to Montanaro's Information Systems Department (ISD) to obtain historical data on observation-level patients.

Obtaining clinical data turned out to be a big challenge. The requested data had to be extracted from Montanaro's electronic health records (EHR) database. Multiple proposal applications had to be filed with and approved by the ISD advisory council to get ISD resources allocated to the project. The ISD advisory council met once every two weeks, but the data for the OU exclusion list project never seemed to move up the priority list. The OU program administrator went above and beyond her official responsibilities to help

Dr. Kelly navigate the ISD bureaucracy: completing forms, obtaining signatures, and persistently following up. However, neither this diligence nor the support of the hospital's chief operating officer (COO) succeeded in pushing the request through the ISD resource allocation system. With Thanksgiving approaching, Dr. Kelly appealed to the chief medical officer (CMO) of the entire healthcare system for help. Only then were the needed resources allocated. Dr. Kelly then worked with Montanaro's Health Insurance Portability and Accountability Act (HIPAA) privacy office to obtain clearance to share the limited data set with her advisor.

Dr. Kelly had been wary of asking for too much data for fear of having her request denied outright. So the

Figure 3. Montanaro ED-to-OU-to-Inpatient Admitting Process

ED
ED patient should be placed under observation/admitted as inpatient
ED MD consults with designated MD
Patent not suitable for OU

OU
Observation in the OU
Discharge from OU

Utilization Management
Review for observation/in patient status

Medical Admissions
Reassign to an inpatient unit
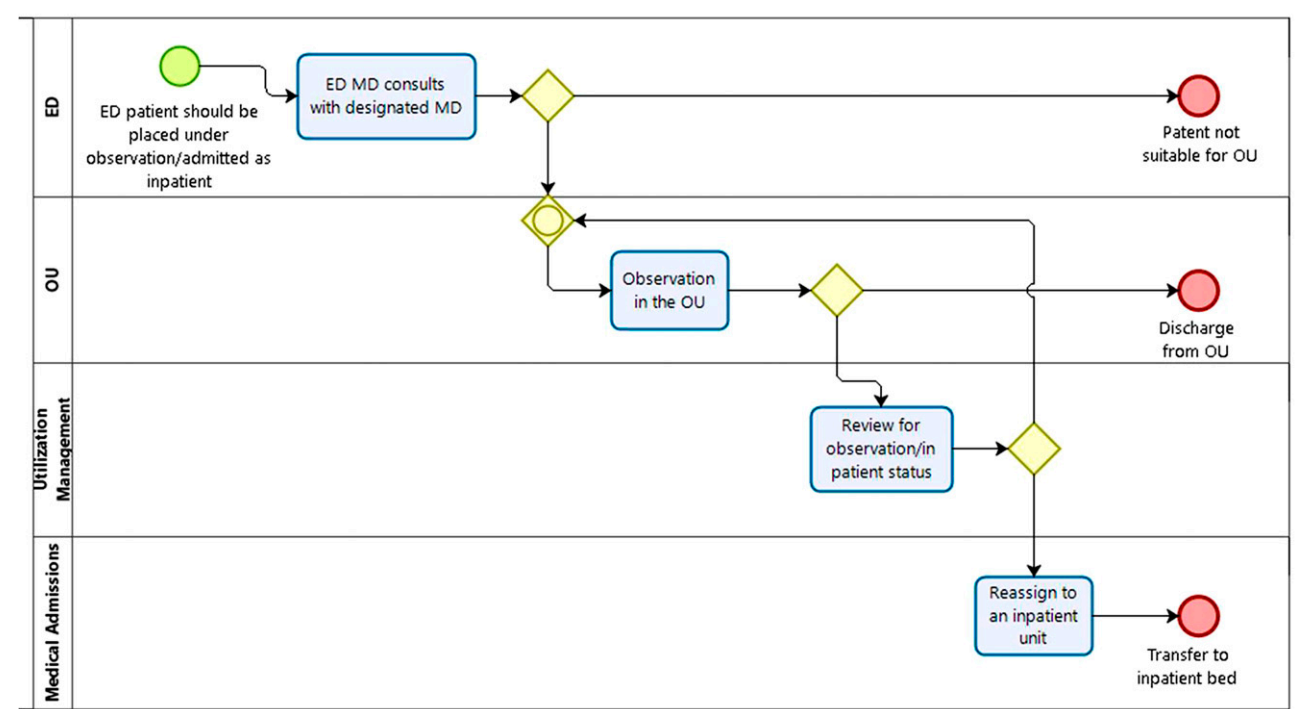Transfer to inpatient bed

Figure 4. Variables Potentially Useful as Predictors of Whether a Patient Will Flip

1. *Age*
2. *Gender*
3. *Residence Type: Independent, Assisted Living, Nursing Home, Homeless, or Other*
4. *Health Insurance: Public, Private, Other*
5. *Preliminary diagnosis-related group (DRG) code*
6. *List of ED administered medications with doses and routes of administration (oral, intravenous, etc.)*
7. *Laboratory Values when available: HCT, BUN, WBC, Number of Band Cells, Creatinine Kinase, Creatinine, GFR, Total Bilirubin, Magnesium, Calcium, Lactate*
8. *Vital Signs Values when available: Heart Rate, Blood Pressure, Respiratory Rate, Pulse Oximetry Saturation, Temperature*

data set covered a period of one year and was limited to the patients treated in the OU, even though the majority of Montanaro's observation stays were in inpatient beds. Exploring the data set, Dr. Kelly discovered that many records had missing values. For example, social workers recorded the residence type only for some patients. There were multiple instances of vital sign readings for some patients and only a single reading for other patients, so decisions needed to be made about whether the predictive model should be using the latest, the average, or some other value in cases of multiple readings. Different subsets of laboratory tests were administered to different patients. For the total of 2,300 patients in the data set, there were hundreds of preliminary DRG codes and dozens of various medications/doses/routes and frequencies with which the medications were administered.

Dr. Kelly remained undeterred and worked with her academic advisor to create a predictive model to identify which patients were more likely to flip from observation to inpatient status. At the same time, Dr. Kelly—with support from the chief of medicine—assembled an interdisciplinary team tasked with deciding how to expand the OU exclusion list based on the findings from the predictive model. In addition to Dr. Kelly, the team included an ED physician, a hospitalist physician, two OU nurses, and the OU program administrator. The team reached a consensus to expand the original exclusion list with the nine additional preliminary diagnoses shown in Figure 5.

With three weeks remaining to the new exclusion list's launch, it was time for a "road show." Dr. Kelly scheduled meetings to get buy-in for the change from all those individuals affecting the process and affected by it. The scheduling of the meetings was a logistical challenge in itself, as doctors and nurses work a variety of shifts. Dr. Kelly was able to get her presentation on the agenda for the monthly ED meeting, allowing her to give just one presentation to ED nurses and providers. In her own OU unit, she had to schedule two

Figure 5. OU Exclusion Diagnoses Added by the Interdisciplinary Team

1. *CHF*
2. *Acute Encephalopathy*
3. *Community Acquired Pneumonia if WBC >13,000, and Chest X-ray Abnormality*
4. *GI bleed with HCT <34*
5. *UTI in males*
6. *Intractable /Cyclic Vomiting*
7. *Pancreatitis*
8. *Rhabdomyolysis*
9. *Ileus/Partial Small Obstruction*

meetings during nurse shift changes to let all the OU nurses hear about the change. At every meeting, she explained the rationale for the project and how it would affect the specific group. The methodology behind the predictive model and the results of her data analysis were not equally interesting to her different audiences, so at every meeting she adjusted the level of detail of her presentation. Most presentations took place in conference rooms equipped with projectors, but some were 1:1 or were held in clinical work rooms; there, Dr. Kelly relied on paper handouts. Dr. Kelly also listened for feedback on who else should be made aware of the upcoming change and what kind of reminders and documentation would be helpful. This process is summarized in Table B.1 in Appendix B.

Next Steps

As Dr. Kelly reflected on the challenging six-month project she just completed, she was pleased that the changes were successfully enacted before the onset of the flu season. She now planned to gather data about how the new arrangements were working in practice (the "study" phase of Deming's Plan-Do-Study-Act cycle). She wanted to make sure that the expected benefits were actually realized and to identify whether any adjustments would be required. As the organizational and human side of the change process had been more challenging than she had anticipated, she decided to monitor data trends for several months before making major refinements to ensure the trends were real and to avoid an outbreak of "initiative fatigue."

Appendix A

Figure A.1. Montanaro Organization Chart
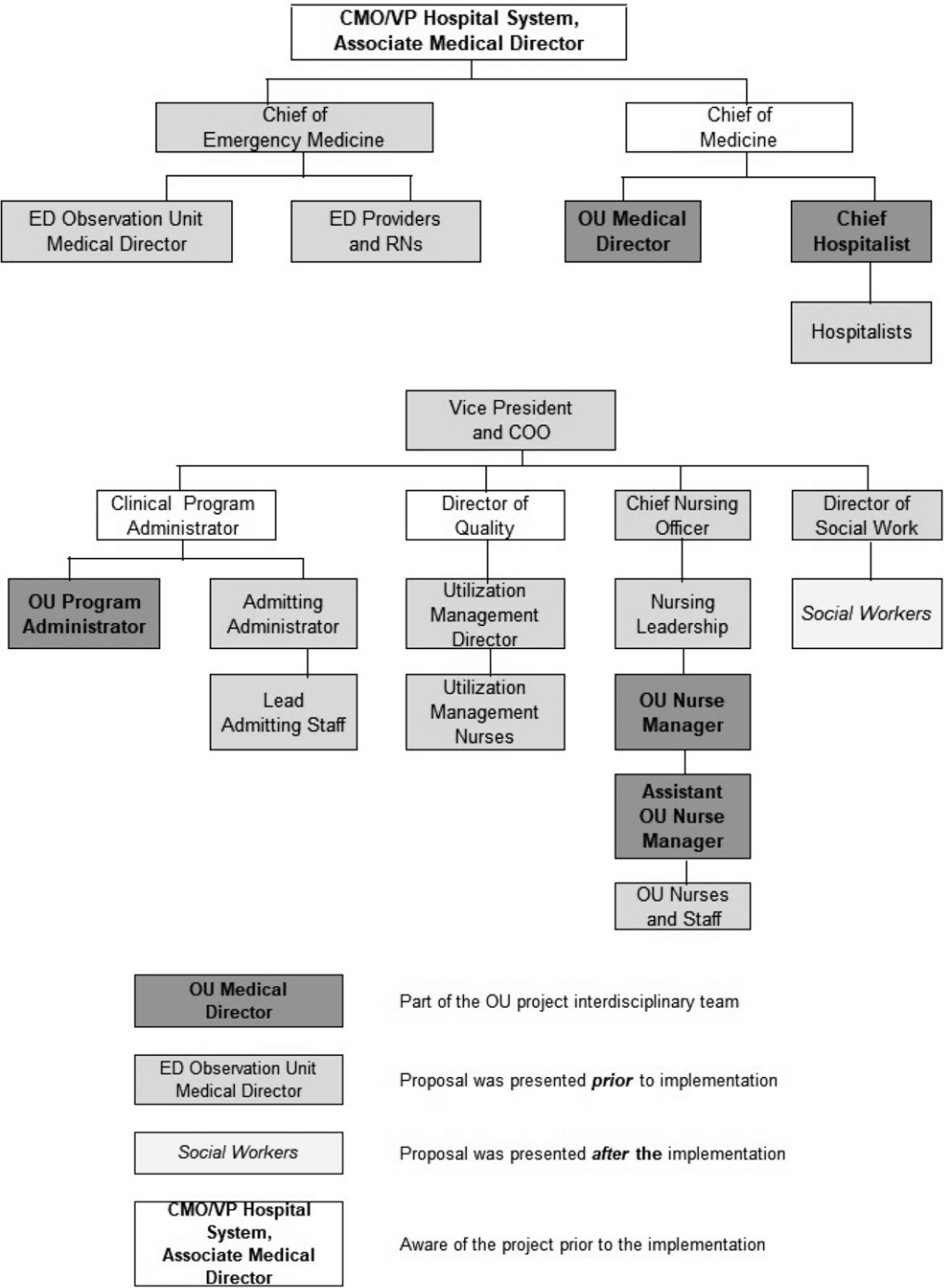
Note. RN, registered nurse; VP, vice president.

Appendix B

Table B.1. Meetings schedule

Meeting with/when	Duration	Recommendations/requests
Three weeks prior to launch		
Director, ED OU	15 min	
Hospitalists	45 min	Meet separately with nocturnists
Two weeks prior to launch		
Nursing leadership: Chief nursing officer, nurse managers of inpatient units, others	15–20 min	Give a presentation to admitting staff
Administration: COO, associate chief of medicine department, lead for utilization management, head of social work, OU social worker	45 min	Give a presentation to all the social work departments of the hospital
Utilization management RNs	25 min	
ED providers and RNs	15 min, during monthly ED meeting	Send out an email reminder via ED chief and post the list printout in the ED once the new list goes live
Nocturnists	45 min	
OU staff	Two meetings, 10–15 min each	Work with RN leadership to create and disseminate an admitting/flow process map
Admitting staff	20 min	Add the updated exclusion list to the admitting policy document
One week postlaunch		
Social work department	25 min	

Note. RN, registered nurse.