Decreasing Environmental Services Response Times

*Murray J. Côté, Ph.D., Associate Professor, Department of Health Policy & Management, Texas A&M Health Science Center; Zach Robison, M.B.A., Administrative Fellow, University of Colorado Hospital; John Pham, Director, Environmental Services & Patient Transportation, University of Colorado Hospital; Rob Leeret, RN, Director of Emergency Department/Trauma & Capacity, University of Colorado Hospital*

*Executive Summary*

Improving patient flow in a hospital’s inpatient setting requires a collaborative effort involving numerous multidisciplinary resources. Physicians, access center representatives, hospital nurse managers, inpatient nursing staff, ancillary support staff, patient transporters, and environmental service technicians/housekeeping staff must all work together with the patient to provide handoffs of care in a healing environment. Managing bed capacity to create a more efficient utilization of resources can increase patient flow, quicken time to actual care delivery, and improve overall throughput. Reducing the waiting times for patient bed placement is crucial to both patient care and patient satisfaction, and decreasing non-value added times, such as environmental services response times to clean dirty inpatient beds, can have a significant impact on inpatient operations and the patient experience. University of Colorado Hospital created an innovative EVS staffing model by looking at peak inpatient dismissal volumes by each hour of the day and day of the week and capturing the hourly productivity of environmental services staff dedicated to those dismissals. Some staff was converted from full-time status to part-time status to match peak dismissal volumes, which led to a reduction in response times for both ‘Stat’ and ‘Clean Next’ bed requests. The project was kept budget neutral through the development of a more effective schedule and appropriate resource allocation.

*Introduction*

Crothall Services Group provides environmental services (EVS), laundry, linen and patient transport at University of Colorado Hospital (UCH). UCH has been operating at or near capacity since its opening at the Anschutz Medical Campus in 2007. EVS technicians help to create the UCH ‘Picture Perfect Room’: a clean and welcoming environment in patient rooms, patient and family waiting areas, bathrooms, and both clinical and office spaces throughout the hospital.

Bed assignments increase with increasing inpatient admissions. Available beds will depend on the number of ‘dirty’ beds left from discharged patients that can be cleaned and prepared for the next incoming patient. With the steady influx of admissions and discharges, EVS technicians are often overwhelmed by the requests made to respond to these bed dismissals. Decreasing the time it takes to respond to these requests to clean patient rooms poses
two major challenges: 1) adding extra EVS technicians to process these bed requests faster can be cost prohibitive for healthcare organizations, and 2) increasing the workflow speed to meet the demand of bed requests can impact the ‘Picture Perfect Room’ quality of the patient environment. In order to implement effectively, an organization must strive to decrease EVS response times in a manner that is both budget neutral and does not sacrifice quality. It is also the intention that with a focus on improved flow by decreasing in bed cleaning response time, patient throughput and capacity owners can ensure that patients are placed into the right bed and onto right unit, rather than the next available bed in an offsite care area.

**Methods**

EVS technicians at UCH use a pager, telephone, and a central bed tracking software system to respond to bed requests categorized as ‘Dirty’ (no patient assigned), ‘Clean Next, (patient is assigned)’ or ‘Stat’ (urgent – patient is assigned). Peak dismissal volume was reviewed and assessed using historical TeleTracking data from the central bed tracking software.

As patient discharges typically increase in the afternoon, a large backlog of bed requests begin to reach their peak between the hours of noon and 6 pm. Response times significantly increase as EVS technicians travel to and process the lengthening queue of incoming bed requests.

In order to decrease response times in environmental services, thereby enhancing throughput and patient flow at University of Colorado Hospital, a staffing model was developed and implemented based on components of queuing theory and operations management in health services delivery. The model sought to balance the appropriate staffing levels to meet a predicted hourly arrival rate of clean bed requests on the inpatient units.

Figure 1 shows the average bed requests (in which dismissals initiate a room turnover) per hour at UCH for the consecutive time period from 1/31/10-7/31/10, for a total number of 4,368 patient dismissals. Peak dismissals are felt steadily rising from 11 am through 6 pm. Figure 2 thus shows the increase in cleaning response time due to the lengthening of the queue of bed requests, doubling between 10 am and 4 pm.
Average Hourly Bed Requests – 1/31/10-7/31/10, n = 4,368

Employee schedules resulted in a 16% and 26% faster response time respectively, without compromising quality, safety, or costing the organization additional resources.

Secondary gains indicated an increase in Press Ganey patient satisfaction scores, employee flexibility, and contribution to decreases in the median discharge time and the ‘clean to occupy’ patient bed placement time.

Implications for Other Healthcare Operations
Figure 3

Average Hourly Bed Requests Per Hour per Day - 1/31/10-7/31/10, n = 4,368

Figure 3 describes a generally even distribution of dismissal peak times with little variation from weekdays to weekends. COO, nursing, and clinician perception is supported that middle of the week through Saturday often ‘feel’ the busiest.

*Establishing a Utilization Rate*

Several variables can be determined from the aforementioned data to establish a Utilization Rate $r$ of processing bed requests (cleaning rooms), which is defined by:

$$r = \frac{\text{arrival rate of bed requests (} \lambda \text{ in hour (} t \text{))}}{(\text{housekeeping staff (} s \text{) x service rate (} m \text{))}}$$

where

- $\lambda(t)$ = average arrival rate of bed requests in hour $t$
- $s$ = number of housekeeping staff dedicated to dismissals only
- $m$ = hourly service rate associated with the time needed to respond to and clean a bed
- $r$ = utilization rate $= \lambda(t)/(s \times m)$

The Utilization Rate $r$ calculates a percentage of productivity in which bed requests are continuously processed upon their rate of hourly arrival.
**Establishing a ‘Quick and Dirty’ Service Rate**

The Service Rate $m$ is a consistent time period used to standardize the work flow of ‘processing’ dirty beds. This amount of time consists of the time needed both to respond to and clean a bed.

Given that cleaning a bed and preparing a room for an incoming patient takes EVS technicians on average 30 minutes, this time standard is a consistent ‘fixed’ component of the service rate. The variable timeframe of the service rate exists in the response to the bed request, which may be shorter, or longer depending on issues such as bed request prioritization, distance needed to travel, and prior bed requests in the queue needing processing.

These variations in response are categorized into three priorities ranging from low to high:

- **Dirty - no patient assigned**
- **Clean Next - patient is assigned**
- **Stat - patient is assigned**

This categorization creates three separate service rates that both meet organizational EVS productivity metrics and provides the anticipated ‘service guarantee’ of bed preparation and availability in a quantifiable timeframe. Figure 4 shows the calculation of Service Rate $m$ as it relates to bed request priorities:

**Figure 4**

**Hourly Service Rate $m$**

<table>
<thead>
<tr>
<th>Bed Request Priority</th>
<th>Dirty</th>
<th>Clean Next</th>
<th>Stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1/m = 70$ min.</td>
<td>$1/m = 60$ min.</td>
<td>$1/m = 50$ min.</td>
<td></td>
</tr>
<tr>
<td>$m = 0.86$</td>
<td>$m = 1.00$</td>
<td>$M = 1.20$</td>
<td></td>
</tr>
</tbody>
</table>

Hourly Service Rate $m$ allows for a 30 minute bed clean time + a 40, 30, and 20 minute response time for Dirty ($30+40=70$), Clean Next ($30+30=60$), and Stat ($30+20=50$) requests, respectively per EVS goals.

The Utilization Rate $r$ was applied to the current environmental services staffing schedule at UCH. Service Rate $m$ was set as $m = 1.00$ for the ‘Clean Next’ bed request
priority. Results are shown in Figure 5. The Utilization Rate, or 'percent busy-ness', creates a visually intuitive measure of productivity for the environmental services workload demand.

From the hours of 11 am to 2 pm, staff members are processing a large arrival rate of bed requests over 90% of the time. This can lead to several issues that may hinder this high level of productivity if it continues for an extended amount of time: 1) repetitive motion injury, 2) ‘burn-out’, 3) increase backlog of bed requests, and 4) compromise of quality due to staffers’ struggle to keep up with the demand. The result is a quickly overwhelmed system that must operate at over 100% to keep up with the demand of bed requests.

**Figure 5**

**Previous EVS Schedule**

<table>
<thead>
<tr>
<th>Hour</th>
<th>Total bed requests</th>
<th>Average bed requests per hour, λ(t)</th>
<th>Shift 1</th>
<th>Shift 2</th>
<th>Shift 3</th>
<th>Total staff (FTE)</th>
<th>Utilization Rate, r</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 am</td>
<td>1,177</td>
<td>3.23</td>
<td>3.5</td>
<td>3.5</td>
<td>3.5</td>
<td>92%</td>
<td></td>
</tr>
<tr>
<td>Noon</td>
<td>1,448</td>
<td>3.98</td>
<td>3.5</td>
<td>3.5</td>
<td>3.5</td>
<td>114%</td>
<td></td>
</tr>
<tr>
<td>1 pm</td>
<td>2,203</td>
<td>6.05</td>
<td>3.5</td>
<td>3</td>
<td>6.5</td>
<td>93%</td>
<td></td>
</tr>
<tr>
<td>2 pm</td>
<td>2,760</td>
<td>7.58</td>
<td>3.5</td>
<td>3</td>
<td>6.5</td>
<td>117%</td>
<td></td>
</tr>
<tr>
<td>3 pm</td>
<td>1,595</td>
<td>4.38</td>
<td>5</td>
<td>3</td>
<td>8</td>
<td>55%</td>
<td></td>
</tr>
<tr>
<td>4 pm</td>
<td>2,492</td>
<td>6.85</td>
<td>5</td>
<td>3</td>
<td>8</td>
<td>86%</td>
<td></td>
</tr>
<tr>
<td>5 pm</td>
<td>2,274</td>
<td>6.25</td>
<td>5</td>
<td>3</td>
<td>8</td>
<td>78%</td>
<td></td>
</tr>
<tr>
<td>6 pm</td>
<td>1,888</td>
<td>5.19</td>
<td>5</td>
<td>3</td>
<td>8</td>
<td>65%</td>
<td></td>
</tr>
<tr>
<td>7 pm</td>
<td>1,554</td>
<td>4.27</td>
<td>5</td>
<td>3</td>
<td>8</td>
<td>53%</td>
<td></td>
</tr>
</tbody>
</table>
Thus, a baseline Utilization Rate $r$ of 80% was set as a targeted goal to provide a constant, yet manageable workflow. This was done by accordingly adjusting the amount of staffers $s$ dedicated to dismissals to meet the hourly arrival rate of bed requests $\lambda(t)$.

$$r = \frac{\text{arrival rate of bed requests ($\lambda$) in hour ($t$)}}{(\text{housekeeping staff (s)} \times \text{service rate (m)})}$$

Results shown in Figure 6 show a leveling of the workload and thus a decrease in the Utilization Rate to a more manageable workflow. EVS Technician FTE remained the same throughout to demonstrate a budget-neutral adjustment. The conversion of 2 full-time FTEs to 4 Part-time shift workers provided extra hands at peak times to process bed requests in the queues more effectively, in effect decreasing the percent productivity toward the 80% goal target. The staffing model was designed to effectively even the workload, and mitigate long work queues by distributing the proper amount of staffers at peak times. This measured decrease in labor ‘intensity’ creates a more balanced approach to the variation of work throughout the hours of the day. Essentially, smoothing out the Utilization Rate attempts to achieve a continuous stream of consistent productivity. Figure 7 shows a summary of the prior and new staffing schedules.
## Figure 6

### New EVS Schedule

<table>
<thead>
<tr>
<th>Hour</th>
<th>Total bed requests</th>
<th>Average bed requests per hour, $\lambda(t)$</th>
<th>Shift 1</th>
<th>Part-time</th>
<th>Shift 2</th>
<th>Total staff (FTE)</th>
<th>Utilization Rate, $r$</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 am</td>
<td>1,177</td>
<td>3.23</td>
<td></td>
<td>2</td>
<td>5.5</td>
<td>59%</td>
<td></td>
</tr>
<tr>
<td>Noon</td>
<td>1,448</td>
<td>3.98</td>
<td></td>
<td>2</td>
<td>5.5</td>
<td>72%</td>
<td></td>
</tr>
<tr>
<td>1 pm</td>
<td>2,203</td>
<td>6.05</td>
<td></td>
<td>5</td>
<td>8.5</td>
<td>71%</td>
<td></td>
</tr>
<tr>
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<td>7.58</td>
<td></td>
<td>2</td>
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<td>72%</td>
<td></td>
</tr>
<tr>
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<td></td>
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<td>9</td>
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<td></td>
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<td></td>
<td>2</td>
<td>7</td>
<td>76%</td>
<td></td>
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<td></td>
<td>2</td>
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<td></td>
<td>7</td>
<td>7</td>
<td>74%</td>
<td></td>
</tr>
<tr>
<td>7 pm</td>
<td>1,554</td>
<td>4.27</td>
<td></td>
<td>7</td>
<td>7</td>
<td>61%</td>
<td></td>
</tr>
</tbody>
</table>
Figure 7

EVS Schedule Summary*

*Graph denotes both dedicated discharge housekeepers and additional environmental services staff.

Previous EVS staffing:

- 8 FTEs
  - 8 Full Time dedicated discharge housekeepers
    - 3 FT housekeepers: 1:00pm – 9:30pm
    - 5 FT housekeepers: 3:00pm – 11:30pm

New EVS staffing (Implemented January 2011):

- 8 FTEs
  - 6 Full Time dedicated discharge housekeepers
  - 4 Part Time dedicated discharge housekeepers
    - 3 FT housekeepers: 11:00am – 7:30pm
    - 2 FT housekeepers: 1:00pm – 9:30pm
    - 1 FT housekeeper: 3:00pm – 11:30pm
    - 4 PT housekeepers: 1:00pm – 5:00pm
**Outcomes**

Data was tracked from January 2011 to present for monthly average response times for Stat, Clean Next, and Dirty Bed, with summary shown in Figure 8.

**Figure 8**

**EVS Bed Requests Average Response Times**

<table>
<thead>
<tr>
<th>Bed Request Priority</th>
<th>1/10 – 12/10 Average Response Times</th>
<th>1/11 – Present Average Response Times</th>
<th>Percent Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stat</td>
<td>19 minutes</td>
<td>13 minutes</td>
<td>31%</td>
</tr>
<tr>
<td>Clean Next</td>
<td>31 minutes</td>
<td>25 minutes</td>
<td>19%</td>
</tr>
<tr>
<td>Dirty</td>
<td>35 minutes</td>
<td>35 minutes</td>
<td>0%</td>
</tr>
</tbody>
</table>

UCH incurred no associated costs for this new implementation and no new FTEs were added. These changes helped to create the lean concept of “pull” of patients to beds, a process improvement methodology, which reduces patient admit wait times for beds to be clean.

Additionally, inpatient capacity managers saw a positive impact on the UCH organizational metric *Clean to Occupy Time within 60 minutes* (2009: 22%; 2010: 47%; 2010:53%) by EVS’ ability to provide more clean beds through a decreased response time, shown in Figure 9.
Secondary gains indicated maintaining an upward trend in Press Ganey patient satisfaction scores as shown in Figure 10.
There is also potential for this staffing model to support an earlier median discharge time throughout the inpatient units (i.e., earlier into a bed may shift LOS to an earlier discharge), though this metric is compounded by other factors (LOS, patient volume, pending discharge orders, etc.) and has continued to remained flat.

Testimonial from the Field

The Hospital Manager sent an email just six days after implementing the aforementioned changes. She and her staff recognized on that day 18 more rooms were cleaned in 11 minutes less time in comparison to another day when volume was extremely high:

Sent: Thursday, January 06, 2011 6:51 PM
To: UCH-House Managers Report
Subject: Thursday evening census

Good Evening,

We appreciate everyone’s efforts today. See report for special mention. Thanks to EVS. This week they implemented a new staffing pattern. Comparing today to 12/9, when our volume was also high, today - they cleaned 18 more rooms in 11 minutes less time. The difference was felt throughout the house. Appreciate the efforts by both shifts and all involved!

Have a good evening,

Paige
Hospital Manager

Managerial Challenges

The conversion of full-time staff to part-time staff and insuring that management was available during each of the three different start times (11 am, 1 pm, and 3 pm) required critical coordination for success. Employees were asked for their preferred start times and were able to openly discuss any concerns with their appropriate manager. Management was very diligent in putting the right people in the right places the first time, though turnover and recruiting challenges did occur. Normal employee turnover was used to re-fill positions in the new shifts.

With economic downturn being felt in all industries, it is often difficult to get part-time employees to stay part-time. In an innovative move, the Director of Environmental Services & Patient Transportation partnered with a nearby McDonalds so some staff could work the UCH part time shift in the afternoon as well as an additional four hours
in McDonalds food service. Staffing resource allocation continues to remains a challenge at times when peak dismissal activity continues into the evening, costing overtime.

**Conclusion**

Building the most effective environmental staffing model that aligns with patient throughput and capacity management has helped to improve patient flow under limited resources. Effective staffing management through workload leveling has successfully and sustainably decreased environmental services response times. Data will continue to be collected and staff scheduling will continue to be optimized to meet the demands of peak bed requests.

A pilot program using similar arriving workload methodologies has recently rolled out on four inpatient units that accommodate nursing staffing hours in relation to peak rates of admits, transfers, unit census, and discharges. Additionally, this methodology is currently being explored in other areas of University of Colorado Hospital including food call center and delivery, valet parking, and facilities management.

Most importantly, these changes did not come without the collectively hard work and stress management of leadership and staff of EVS at University of Colorado Hospital. Strong leadership and engaged employees are both crucial to the continuation of maintained reduction in response times for environmental services in order to provide faster admissions and bed placements for patients.

To improve throughput and response times, healthcare managers can use analytical tools such as the aforementioned Utilization Rate and the Service Rate in operations management of healthcare processes. The appropriate data can be used to support or negate ‘emotional data reporting’ where managers may make decisions based on hunches and be led down an arbitrary rabbit hole. Managers provided with the historical and quantifiable evidence when needing to make important changes can avert poor decisions and sometimes disastrous consequences. Armed with such tools, real staffing and throughput optimization can be developed to not only effectively improve operational processes, **but** synchronously lend to improving the overall quality of patient care.

**Bibliography**