This presentation, “Redesigning Operating Room Turnover Using a Lean Approach” was created by Rudy Santacroce, and Roque Perez-Velez of Management Engineering Consulting Services at Shands HealthCare.

Roque Perez-Velez will be the presenter for the 2013 SHS Conference.
Our presentation will begin with a background of Shands HealthCare and its recovery rooms. We’ll then discuss the problem assessment and impact related to relocating the GI/Endo suites from its current location to a new location. Next, we’ll discuss our methodology for assessing the impact, including how we developed a dynamic simulation model. We’ll finish with the results achieved as a result of the project, lessons learned along the way, and a few conclusions. After the presentation, there will be time for questions.
Shands at the University of Florida is located in Gainesville, Florida and is the primary teaching hospital for the University of Florida’s College of Medicine. The hospital has two campuses, the North Campus and the South Campus.

The North Campus is the original hospital which first opened in 1958. It is currently a 630-bed tertiary care facility, which includes 142 ICU beds. 4 GI/Endoscopy suites are located at the North Campus.

The South Campus, which opened on November 1, 2010, has 192 private inpatient beds and specializes in cancer treatment and care. In addition to its specialized cancer care services, the South Campus also houses the emergency department, primary helipad, and 12 operating rooms.

Shands employs more than 500 physicians which represent 110 different specialties. It is a private, not-for-profit hospital and a Level I Trauma Center and organ transplant facility.
Background on space available on each tower / campus.

**GI Suite / South Campus Background**

**4 North Campus GI Suites:**
- 6,200+ procedures / year
- 10 shared prep / recovery shared area
- 3% yearly growth

**South Campus Suites:**
- Ability to expand by design
- 9 Pre-op rooms
- 6 Block rooms
- 16 PACU beds
- 9 Post-Op rooms
Overview of North Campus GI / Endo Suite.
Overview of South Campus Pre-op / Post-op and PACU area.
Problem Assessment

- Suite utilization at or near full capacity (mostly IP)
  - Problem convoluted due to sharing of patient preparation area and post procedural recovery
- Need of specialized care for complex patients
- Patient throughput expected to increase
Previous Efforts

- 2010 – Simulation (current location):
  - Determined factor(s) that impacted patient throughput, length of stay, wait time, and hours of operation
  - Looked into adjusting resources / volume for different scenarios
- 2011 – Studied scheduling delays (current location):
  - Brain drain due to retirement (key personnel)
  - Current state process map of the scheduling process identifying key service problems (high cancelation and no-show rates)
Opportunity

- Reduce case delays, no shows and cancelations
- Improve patient satisfaction (relatives too!)
- Free up prime real estate on North Campus
- Increase case load / week
Management Engineering continued working within the established steps of the Engineering Design Process. After identifying possible criteria and constraints (step #2), the group started to brainstorm possible solutions (step #3). One of these possible solutions consisted of a dynamic simulation. This is when Management Engineering started the Simulation Development Process Cycle and continued with parallel planning.
Problem Formulation

Management Engineering was asked to model the *impact to resource utilization* to the South Tower Pre-Op / PACU area resulting from the *relocation* of the current GI/ENDO procedure suites from 7th floor SUF North Tower to the South Tower Pre-op / PACU area.
Conceptual Model

- Assumptions
  - Growth percentages derived from business plans
  - GI / OR growth:
    - OR - 18% for FY-12, subsequent growth of 10%
    - GI – 3% for FY-13, subsequent growth of 3%
- Constraints
  - Pre-op, block, overflow and PACU rooms are key resources that may impact relocation
  - Proposed GI/Endo impact to South Campus OR resources result from volume from 2 procedure and 2 advanced procedure rooms
Data Collection and Analysis

- Data Analysis
  - GE ORMIS data over specific time range
  - GI Room Cases documentation
    - Scheduled and Delayed
    - Validated processing time (prep, op, procedure & recovery)
    - Validated distributions for arrival patterns and cases
  - Created process flow maps
    - Proposed flow by patient type (OP / IP)
Model Building

- Modeler chooses the method to execute:
  - Monte Carlo
  - Static
  - Dynamic
  - Chooses software
- Time consuming
Verification and Validation

• Met with key personnel to understand, develop, and validate process flow and specific team usage
  – Top down project approach
  – Business Manager
  – South Campus Clinical Manager
  – Associate Vice President for Operations
  – Medicine & Nursing Staff

7. Build a Model or Prototype
Experimental Phase

- Patient Flow:

  - South Campus Outpatient: Pre-op / Block Room → OR → PACU 100% → Overflow 33%

  - South Campus Inpatient: Pre-op / Block Room → OR → PACU → Wards

  - Endo OP & IP: Pre-op → Endo Suites → PACU → Wards / Home

Refine the Design
Experimental Phase

- Scenarios:
  - Current state validation, FY11 OR volume only
  - FY12 Growth Model – 18% Co-growth, 3% ENDO growth
  - FY13 Growth Model – 10% OR growth, 3% ENDO growth
  - FY14 Growth Model – 10% OR growth, 3% ENDO growth
Output Analysis

- Simulation data results by day of week. Data results highlighted as follows:
  - Resource utilization from 70% – 84.99% = ORANGE
  - Resource utilization > 85% = RED
## Output Analysis

<table>
<thead>
<tr>
<th>Room Utilization</th>
<th>2012 Growth Model - 10% OR / 3% ENDO</th>
<th>2013 Growth Model - 10% OR / 3% ENDO</th>
<th>2014 Growth Model - 10% OR / 3% ENDO</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Validation Model FY-2011 OR Volume</strong></td>
<td><strong>Hour of Day</strong></td>
<td>Pre-Op</td>
<td>Black Room</td>
</tr>
<tr>
<td><strong>Room Utilization</strong></td>
<td><strong>Hour of Day</strong></td>
<td>Pre-Op</td>
<td>Black Room</td>
</tr>
<tr>
<td>6</td>
<td>41.4%</td>
<td>34.1%</td>
<td>0.0%</td>
</tr>
<tr>
<td>7</td>
<td>50.8%</td>
<td>40.0%</td>
<td>0.4%</td>
</tr>
<tr>
<td>8</td>
<td>51.5%</td>
<td>41.0%</td>
<td>2.0%</td>
</tr>
<tr>
<td>9</td>
<td>48.8%</td>
<td>38.4%</td>
<td>3.1%</td>
</tr>
<tr>
<td>10</td>
<td>43.6%</td>
<td>32.4%</td>
<td>9.0%</td>
</tr>
<tr>
<td>11</td>
<td>34.6%</td>
<td>28.1%</td>
<td>10.3%</td>
</tr>
<tr>
<td>12</td>
<td>28.6%</td>
<td>23.0%</td>
<td>16.0%</td>
</tr>
<tr>
<td>13</td>
<td>23.6%</td>
<td>17.9%</td>
<td>16.4%</td>
</tr>
<tr>
<td>14</td>
<td>19.3%</td>
<td>15.7%</td>
<td>17.8%</td>
</tr>
<tr>
<td>15</td>
<td>15.1%</td>
<td>13.8%</td>
<td>14.8%</td>
</tr>
<tr>
<td>16</td>
<td>10.2%</td>
<td>8.6%</td>
<td>12.4%</td>
</tr>
<tr>
<td>17</td>
<td>8.7%</td>
<td>7.2%</td>
<td>9.0%</td>
</tr>
</tbody>
</table>
Results Achieved

• Simulation data based on actual FY-11 data:

<table>
<thead>
<tr>
<th>OR Volume</th>
<th>Validation OR Volume FY-2011</th>
<th>2012 Growth Model - 18% OR / 3% ENDO</th>
<th>2013 Growth Model - 10% OR / 3% ENDO</th>
<th>2014 Growth Model - 10% OR / 3% ENDO</th>
</tr>
</thead>
<tbody>
<tr>
<td>OR IP</td>
<td>5,615</td>
<td>6,394</td>
<td>6,922</td>
<td>7,456</td>
</tr>
<tr>
<td>OR OP</td>
<td>1,539</td>
<td>1,802</td>
<td>1,949</td>
<td>2,065</td>
</tr>
<tr>
<td>ENDO IP</td>
<td>-</td>
<td>2,424</td>
<td>2,479</td>
<td>2,567</td>
</tr>
<tr>
<td>ENDO OP</td>
<td>-</td>
<td>4,129</td>
<td>4,221</td>
<td>4,371</td>
</tr>
<tr>
<td>TOTAL</td>
<td>7,154</td>
<td>14,749</td>
<td>15,571</td>
<td>16,459</td>
</tr>
</tbody>
</table>

• Table shows average results of five iterations with a maximum growth % as indicated
• Parameters: One year with no warm-up period
Conclusions

- The *limiting resource* for all scenarios is the *availability* of Pre-Op rooms

- All values highlighted will *significantly* (orange) or *very significantly* (red) impact patient throughput, wait times, and delays; simulation’s standard deviation for Pre-Op utilization was large enough to reach 100% and therefore *causing major delays*
Conclusions

• The *limiting time of day* was between 7a – 9a; delays will push later throughout the day as OR and GI/ENDO volumes *increase* with each year.

• Since no other resource was impacted significantly, a *recommendation* would be to *shift* GI/ENDO *first case start time* 0:45 – 1:00 later all weekdays.
### Lessons Learned

- You must **be flexible** when brainstorming possible solutions and **choosing** simulation method.
- Manage **expectations**; customer does not know how **arduous** is to build the model and to verify and validate it.
- Find the **balance** between building a **realistic** and an **optimal** model.
- Engineers should work in **teams** and in **parallel planning**.
- **Subject Matter Experts** are needed from tech as well as from medical side.
- GI / Endo needed to **redefine** and update roles.
- Work **cross-coverage issues** prior to go-live.

The first 5 are related to the ME team, the last 2 are related to the GI / Endo team.
Recap

- Background
- Problem Assessment
- Opportunity
- Methodology
- Results Achieved
- Conclusions
- Lessons Learned
Contact Us

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