Effectiveness of a Chair Model in a Tertiary Academic Emergency Department

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Variability, Error and the ED

- Only Unit with no predefined limits
- Maximal variation at the point of entry
  - All ages
  - All conditions
  - Any acuity
  - Unscheduled
  - All hours
- Variation creates unit with greatest instability
- Instability places a tremendous demand on process control to minimize error
Engineering Order within Chaos

• Identify the variables that drive ED workflow
• Design interventions to improve process control for these variables
• Measure improvement in outcomes that determine quality and safety in the ED
Critical Variable – Triage Level 3

EC patients Jan-June 08 by Acuity and Admits

- Total patients: 11,885
- 62% of total
- 35% admitted

Level 1 - Critical: 549
Level 2 - Emergent: 3,086
Level 3 - Urgent: 11,885
Level 4 - Non-Urgent: 3,439
Level 5 - Routine: 161

Percent admitted:
- Total: 90%
- Level 1: 90%
- Level 2: 74%
- Level 3: 35%
- Level 4: 6%
- Level 5: 3%

11,885 patients
62% of total
35% admitted
Critical Variable – Triage Level 3
Critical Variable – Time of Day

Focus for Chair Unit
• Level 3 Triage Urgent
  • 1:00 – 7:00 PM
Critical Variable – Time of Day

Percent of Patients Left Without Being Seen

UT HOUSTON MEDICAL SCHOOL
Critical Variable - Day of Week

TAT for Level 3 Patients
95% CI for the Mean

Day of Week

Fri Mon Sat Sun Thu Tue Wed
Critical Variables for Project Focus

• Level 3 patients
• Operate unit from 1 PM to 7 PM
• On Monday and Tuesday
Interventions to Improve Process Control

- Challenge 2 typical ED operational assumptions
  - ED Fast-track Models focus on *Level 4 and 5*
  - *All* patients require beds for the entirety or majority of their care
Interventions to Improve Process Control

• A 6-station chair unit was set up to treat *level 3 patients* with any complaint deemed amenable to seated care

• unit piloted during the month of September 2008 on *Mondays and Tuesdays* from 1:00 pm-7:00 pm
Primary measures of success included:
• Reduced total turnaround time (in minutes)
• Reduced time from patient arrival to MD contact (in minutes)
• Reduced number of patients who leave without being seen
• Improved patient satisfaction (as measured with an internal survey)
Results – Mean TAT

TAT for Level 3 EC Patients discharged Home vs Chair Unit Pilot

May- June 2008

Chair Pilot

UCL=596 min
Mean=239 min

TAT for Level 3 EC Patients discharged Home vs Chair Unit Pilot

Observation

Mean TAT in Minutes

0 200 400 600 800 1000 1200 1400

208 257 306 355 404 453 502 551 600 649 698

970min
323min
239min
596min

Results – Mean TAT
Results – Mean TAT

Mean Turnaround Time

Time in Minutes

Baseline
Chair
Chair >1:00 Home

323
239
144

Patients arriving after 1pm
Results – Mean Arrival to MD

![Bar chart showing mean arrival times to MD](chart.png)

- **Baseline**:
  - Mean arrival time: 119 minutes
- **Chair > 1 PM**:
  - Mean arrival time: 64 minutes

- **Patients arriving after 1 pm**

**Graph Details**:
- X-axis: Time in Minutes
- Y-axis: Patients Arriving After 1 PM
- Bars represent the mean arrival times for the baseline and after 1 PM.
Other Outcomes

- Patients who left without being seen decreased from 9% to 0% for patients who arrived during the “chair unit” hours of operation.
- Patient satisfaction was 98% for those treated in the unit.
- Potential revenue gain of $23,500 per month or $280,000 per year based on decrease in patients leaving without being seen and operation of 2 days per week between the hours of 1:00 and 7:00 PM.
On-Going Work: The LBJ Experience

- 100 per day capacity ED seeing 200 patients
- Triage process distorted by up-triaging or triage drift
- ED supersaturated with illegitimate level “2”s
- ED practice behavior changes due to pressure
- Inappropriate admissions fill inpatient beds
- Lose ED beds to admission holds
- Increase ED LOS, inappropriate discharges
- Self perpetuating safety hazard
Up-Triage Drift

EC Patient Acuity

<table>
<thead>
<tr>
<th>Level 1-Critical</th>
<th>Level 2- Emergent</th>
<th>Level 3- Urgent</th>
<th>Level 4-Non-Urgent</th>
<th>Level 5-Routine</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5%</td>
<td>16%</td>
<td>51.0%</td>
<td>18%</td>
<td>0.1%</td>
</tr>
<tr>
<td>46.9%</td>
<td>63%</td>
<td>51.0%</td>
<td>18%</td>
<td>0.1%</td>
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</tbody>
</table>

LBJ- Jan-May 09 MH_Jan-June08
Up-Triage Drift

Memorial Hermann

- Level 1-Critical: 1%
- Level 2-Emergent: 16%
- Level 3-Urgent: 63%
- Level 4-Non-Urgent: 18%
- Level 5-Routine: 1%

LBJ

- Level 1-Critical: 0.5%
- Level 2-Emergent: 46.9%
- Level 3-Urgent: 51.0%
- Level 4-Non-Urgent: 1.6%
- Level 5-Routine: 0.1%
Waiting room overwhelmed

ED overwhelmed with Level “2”s

Up-triage drift

Fewer inpatient beds increase ED LOS and decrease available ED beds

Critical oversaturation changes admitting behavior

Treatment area double capacity and overflow to hallways
LBJ Results

LBJ Chair Unit -- Turn Around Time

- Baseline:
  - UCL = 15:43:10
  - LCL = 8:13:43

- Chair Unit:
  - X = 11:58:04

TAT - Level 3 Patients - Hours

- X = 5:04:22
- LCL = 2:00:23
- UCL = 8:08:20
MHH Evolution

• Lack of attending staffing
• Split Flow Model
• Shift from bringing additional staff to patients to bringing additional patients to staff
Split Flow Dynamics

Entry / Exit

Evaluation

Physician

Results waiting
TAT for 3 Models

EC Flow - Level 3 Patients

<table>
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<tr>
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<th>Baseline</th>
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<tr>
<td>TAT (min)</td>
<td>323</td>
<td>239</td>
<td>269</td>
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Total TAT for discharged patients in minutes.
Future Outcomes

• Long Term Process Oriented Outcomes

• Process Oriented Outcomes vs. Patient Oriented Outcomes

• ED Medical Error Registry and Database

• Operations: Science vs. Economics
  – Reporting equilibrium
  – Lack of ability to do controlled assessment
    • i.e. CPOE