DETERMINANTS OF EMERGENCY DEPARTMENT LENGTH OF STAY

Sharmistha Dev

PGY 3 EM/IM

Henry Ford Hospital
Objectives

• Scope of the problem
• Why is ED LOS important?
• Determinants of ED LOS
Scope

- 129.8 million ER visits annually
- Average length of stay nationally in 2010: 4hr 7min
- In 2009, 400,000 waited 24 hours or more

http://www.youtube.com/watch?v=geLAhqLI38s
Scope

Increasing Length of Stay Among Adult Visits to U.S. Emergency Departments, 2001–2005

Andrew Herring, MD, Andrew Wilper, MD, David U. Himmelstein, MD, Steffie Woolhandler, MD, MPH, Janice A. Espinola, MPH, David F.M. Brown, MD, and Carlos A. Camargo Jr., MD, DrPH

- 2001-05 NHAMCS (National Hospital Ambulatory Medical Care Survey)
- Retrospective analysis; 138,569 adult ED visits
- **Outcome measure**: ED LOS
- Of analyzed visits, 16% were admitted, with 1.7% to ICU
- ED LOS increased 3.5% per year-132 min in 2001, 154 min in 2005 (p<0.001)
- Larger increase among critically ill patients
  - ED LOS increased 7.5% per year -185 min in 2001 and 254 in 2005 (p<0.01)
- ED LOS longer for AA (10.6% longer) and Hispanic patients (13.9% longer)
Why is ED LOS important?

Emergency Department Length of Stay Is an Independent Predictor of Hospital Mortality in Trauma Activation Patients

Nathan T. Mowery, MD, Stacy D. Dougherty, MD, Amy N. Hildreth, MD, James H. Holmes, IV, MD, Michael C. Chang, MD, R. Shayn Martin, MD, J. Jason Hoth, MD, J. Wayne Meredith, MD, and Preston R. Miller, MD

Background: The early resuscitation occurs in the emergency department (ED) where intensive care unit protocols do not always extend and monitoring capabilities vary. Our hypothesis is that increased ED length of stay (LOS) leads to increased hospital mortality in patients not undergoing immediate surgical intervention.

Hour” has been taught and practiced for more than 3 decades. The belief that injury outcomes improve with a reduction in time to definitive care is a basic premise of trauma systems and emergency medical services systems. Currently, most, if not all, of the early resuscitation occurs in the emergency
Emergency Department Length of Stay Is an Independent Predictor of Hospital Mortality in Trauma Activation Patients

- Level 1 and 2 trauma admissions from Jan 2002-Jun 2009; N=3973
- Primary outcome: all cause in hospital mortality
  - Secondary outcomes: hospital LOS, ICU LOS, and ventilator days

- Results
  - Mean 3.2 hrs (SD = 1 hr)
  - Hospital mortality increases for each additional hour
  - ED LOS measured in min is an independent predictor of mortality
  - (OR 1.003, 95% CI (1.010-1.006); p=0.014)
  - Controlled for ISS, RTS, and age

Limitations:
- 1 center
- Only trauma ptx

Figure 2. Mortality as a function of time spent in the ED. p value represents linear association.
Why is ED LOS important?


The Association Between Length of Emergency Department Boarding and Mortality

Adam J. Singer, MD, Henry C. Thode Jr., PhD, Peter Viccellio, MD, and Jesse M. Pines, MD, MBA, MSCE

- Retrospective cohort study
- Population: All patients admitted and discharged Oct 2005 through Sept 2008
  - N=41,256
- Primary outcome: in-hospital mortality
  - Secondary outcomes: rate of transfer or upgrade to ICU, total hospital LOS
Mortality increased with increasing boarding from 2.5% - boarded less than 2 hours to 4.5% - boarded 12 or more hours (p<0.001)

Increased hospital LOS with increased boarding time (p<0.001)

Increased ICU admissions with increased boarding time, not statistically significant

Limitations:
- No determination of causality
- No external validation of internal database used
- 1 center
Prolonged Emergency Department Stays of Non–ST-Segment-Elevation Myocardial Infarction Patients Are Associated With Worse Adherence to the American College of Cardiology/American Heart Association Guidelines for Management and Increased Adverse Events


- CRUSADE initiative, voluntary multicenter observational study
- NSTEMIs, N=42,780 between 3/2003 and 12/2005
- Outcome measures: primary: adherence to 5 ACC/AHA acute process-of-care measures; secondary: occurrence of in-hospital adverse events (death, recurrent MI, and composite of death or recurrent MI)
- Ptx w/ longer ED stay were less likely to be treated with all acute medication, with greatest different in administration of ASA (OR 0.74)
Boarding Admitted Children in the Emergency Department Impacts Inpatient Outcomes

Arpi Bekmezian, MD* and Paul J. Chung, MD, MS†‡

Objective: This study aimed to assess the relationship between boarding of admitted children in the emergency department (ED) and cost, inpatient length of stay (LOS), mortality, and readmission.

Methods: This was a retrospective study of 1,792 pediatric inpatients admitted through the ED and discharged from the hospital between February 20, 2007 and June 30, 2008 at a major teaching hospital with an annual ED volume of 40,000 adult and pediatric patients.


- Retrospective observational study
- Outcome measures: inptx LOS and cost
- Increased inpatient LOS (p=0.01) and increased cost (p<0.01) with longer boarding times

Acutely ill patients. The ED is neither intended nor equipped to provide boarding and prolonged care. Studies in adult patients have linked boarding with increased mortality, inpatient LOS (I-LOS), nosocomial infections, ED waiting times and patients leaving without being seen, ambulance diversion (ie, declining to accept patients from other EDs or emergency medical services), adverse events, and patient dissatisfaction.
Conceptual Model

Input
- Patient Factors
- Wait Time
- Crowding
- Registration

Throughput
- Triage
- Diagnostic Tests
- Radiology
- Consultants

Output
- Boarding Time
- Transport Time
- Discharge Time
- Hospital Occupancy

Other
- Institutional Factors
- Staffing
Determinants of ED LOS

2006: SCIENCE OF SURGE

The Effect of Emergency Department Crowding on Length of Stay and Medication Treatment Times in Discharged Patients With Acute Asthma

Jesse M. Pines, MD, MBA, MSCE, Anjeli Prabhu, Joshua A. Hilton, MD, Judd E. Hollander, MD, and Elizabeth M. Datner, MD


• Retrospective study of adult ED patients w/ ICD-9 codes of asthma
• Setting: two urban inner city ED
  • Academic tertiary care center, 57,000 annual visits
  • Community ED, 35,000 annual visits
• Electronic recorded data used for triage time, room time, medication order time and discharge time
• ED crowding measures used:
  • ED occupancy rate
  • Total patient-care hours
  • Number of patients in waiting room
  • Inpatient number boarding in the ED
All 4 measures of overcrowding were associated with longer LOS and time to treatment (p<0.001)
- At highest level of ED occupancy, patients spent 75 min longer
- Treatment time:
  - Nebs: 6 min longer
  - Steroids: 16 min longer

### The Effect of Emergency Department Crowding on Length of Stay and Medication Treatment Times in Discharged Patients With Acute Asthma

Jesse M. Pines, MD, MBA, MSCE, Anjeli Prabhu, Joshua A. Hilton, MD, Judd E. Hollander, MD, and Elizabeth M. Datner, MD

**Table 3**
Total Treatment and Time to Nebulizer and Steroid Treatment (in Minutes) for Asthma Patients Who Were Treated and Discharged From Two EDs Over 2 Years (n = 1,716)

<table>
<thead>
<tr>
<th></th>
<th>Overall ED LOS in Minutes (IQR)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Q1 (95–238)</td>
</tr>
<tr>
<td>Crowding measures</td>
<td>Admitted patients*</td>
</tr>
<tr>
<td></td>
<td>ED occupancy*</td>
</tr>
<tr>
<td></td>
<td>Patient-hours*</td>
</tr>
<tr>
<td></td>
<td>Waiting room no.*</td>
</tr>
<tr>
<td>Time to first nebulizer</td>
<td>Admitted patients*</td>
</tr>
<tr>
<td></td>
<td>ED occupancy*</td>
</tr>
<tr>
<td></td>
<td>Patient-hours*</td>
</tr>
<tr>
<td></td>
<td>Waiting room no.*</td>
</tr>
<tr>
<td>Time to steroid</td>
<td>Admitted patients*</td>
</tr>
<tr>
<td></td>
<td>ED occupancy*</td>
</tr>
<tr>
<td></td>
<td>Patient-hours*</td>
</tr>
<tr>
<td></td>
<td>Waiting room no.*</td>
</tr>
</tbody>
</table>

Q1 – Q4 represent the quartiles of each particular crowding measure which Q1 is the least crowded and Q4 is the most crowded.
Each quartile is represents the level of crowding within the individual hospital.
IQR = interquartile range.
*Indicates a significant p-value for the trend at <0.0125.
Determinants of ED LOS

FACULTY TRIAGE

Faculty Triage Shortens Emergency Department Length of Stay

SIROUS N. PARTOVI, MD, BRIAN K. NELSON, MD, EARL D. BRYAN, MD, MATTHEW J. WALSH, MD


- Interventional study evaluating effect of faculty triage on ED LOS
- Setting: university hospital, 29 bed level II trauma center, 52,000 visits
- Patients triage either to trauma levels I-III, medical I-III, or urgent care
- Triage team normally includes 2 nurses and 1 EMT
  - Intervention included adding a physician to triage team
- Population: all ptx presenting on 5 mo period (1999) btwn 9AM-9PM
Faculty Triage Shortens Emergency Department Length of Stay

SIROUS N. PARTOVI, MD, BRIAN K. NELSON, MD, EARL D. BRYAN, MD, MATTHEW J. WALSH, MD


- Patients w/o FT n=814, w/ FT n=920
- Patients w/o FT: mean LOS of 445 min, w/ FT mean LOS 363 min
  - Mean difference of 83 min (95% CI -111 to -53 min), p=0.005
- Cost of FT: $11.98/patient;
  - Annual cost will be more than a million dollars for full time faculty triage
- Is decreasing LOS worth this relatively high cost?
- Limitations:
  - Did not control for ordering lab tests or EKGs
  - Faculty triage vs. Resident triage, can this help reduce cost?
  - May be applicable to their unique triage model
Determinants of ED LOS

Placing Physician Orders at Triage: The Effect on Length of Stay

Stephan Russ, MD, MPH, Ian Jones, MD, Dominik Aronsky, MD, PhD, Robert S. Dittus, MD, MPH, Corey M. Slovis, MD

From the Department of Emergency Medicine (Russ, Jones, Aronsky, Slovis), the Department of Biomedical Informatics (Aronsky), and the Department of Medicine, Division of General Internal Medicine and Center for Health Services Research (Dittus), Vanderbilt University Medical Center, Nashville, TN; and the Department of Veterans Affairs, National Quality Scholars Fellowship Program, Tennessee Valley Healthcare System, Nashville, TN (Russ, Dittus).


- Pre-experimental study using a matched design w/ data matched retrospectively
- Urban academic tertiary care medical center
- 23 month period (2/2007-12/2008)
- Triage team: attending physician, PCT, paramedic or nurse, presents for 12 hours a day (11AM to 1AM)-peak patient arrival times
- Population: patients in waiting room > 5min
Primary outcomes:
- Differences in waiting room time
- Time spent in an ED treatment bed
- Overall LOS

Emergency Department (ED) Visits Resulting in Formal Admission or Discharge (n = 104,386)

Patients Taken Directly to an ED Bed By Either EMS or the Triage Nurse (n = 30,790)

Patients Sent to the Waiting Room after Triage (n = 73,588)

Treated and Released from the Waiting Room (n = 6,621)

Patients Eventually Treated in an ED Bed (n = 66,967)

Erroneous Timestamps During Visit (n = 58)

Patient Visits Eligible for Matching (n = 66,909)

Physician Orders Placed Prior to Bed Assignment (n = 15,282)

Physician Orders Placed Prior to Bed Assignment - MATCHED by CPOE* Orders and Propensity Score (n = 10,901)

No Physician Orders Prior to Bed Assignment (n = 51,627)

No Physician Orders Prior to Bed Assignment - MATCHED by CPOE* Orders and Propensity Score (n = 10,901)

*Computerized Physician Order Entry
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Table 2. Unmatched length of stay for patients sent to the waiting room after triage and eventually treated in an ED bed.

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<tr>
<td>Waiting room time, min, median</td>
<td>16</td>
<td>83</td>
<td>56 (55 to 57)</td>
</tr>
<tr>
<td>Time in ED bed, min, median</td>
<td>211</td>
<td>200</td>
<td>−13 (−16 to −11)</td>
</tr>
<tr>
<td>Total length of stay until disposition, min, median</td>
<td>246</td>
<td>302</td>
<td>51 (48 to 54)</td>
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Limitations:
  • Single academic institution
  • Categorized by physician orders at triage, but orders may not have been implemented until patient was in an ED bed
  • Only a portion of the patients had physician eval → selection bias
Determinants of ED LOS

The role of a rapid assessment zone/pod on reducing overcrowding in emergency departments: a systematic review

Michael J Bullard,¹ Cristina Villa-Roel,¹,² Xiaoyan Guo,¹ Brian R Holroyd,¹ Grant Innes,³ Michael J Schull,⁴ Benjamin Vandermeer,⁵ Maria Ospina,²,⁶ Brian H Rowe¹,²,⁵


• Rapid assessment zones/pods to target throughput component
• RAZ/RAP: existing ED spaces adapted for clinical assessment and procedures

Table 1  Descriptive characteristics of studies included in the review

<table>
<thead>
<tr>
<th>Reference</th>
<th>Location</th>
<th>Sample</th>
<th>Duration</th>
<th>Design</th>
<th>Intervention</th>
<th>Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bullard, et al¹³</td>
<td>Canada</td>
<td>6217</td>
<td>6 weeks</td>
<td>RCT</td>
<td>Rapid assessment pod (RAP)</td>
<td>Non-RAP</td>
</tr>
<tr>
<td>Poczner, et al¹⁴</td>
<td>Canada</td>
<td>12305</td>
<td>120 days</td>
<td>Before-after</td>
<td>Rapid assessment zone (RAZ)</td>
<td>Non-RAZ</td>
</tr>
<tr>
<td>Ardagh, et al⁷</td>
<td>New Zealand</td>
<td>4467</td>
<td>5 weeks</td>
<td>CCT</td>
<td>Rapid assessment clinic (RAP)</td>
<td>Non-RAP</td>
</tr>
<tr>
<td>Bond¹⁵</td>
<td>Saudi Arabian</td>
<td>200</td>
<td>1 month</td>
<td>Before-after</td>
<td>Physician- and nurse-staffed patient assessment room (PAR)</td>
<td>One examination room</td>
</tr>
</tbody>
</table>

RCT, randomized controlled trial; CCT, clinical controlled trial.
The role of a rapid assessment zone/pod on reducing overcrowding in emergency departments: a systematic review

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Two studies showed a RAZ was associated with a reduced LOS
- Physician initial assessment also reduced
- Number of LWBS also reduced

Limitations:
- Small number of studies found
- Variable research methodologies and poor reporting
- Missing data → no subgroup analysis
- Generalizability?
Determinants of ED LOS
THE PRACTICE OF EMERGENCY MEDICINE/ORIGINAL RESEARCH

The Effect of In-Room Registration on Emergency Department Length of Stay

Marc H. Gorelick, MD, MSCE
Kenneth Yen, MD
Hyun J. Yun, PhD

From the Section of Emergency Medicine, Department of Pediatrics (Gorelick, Yen), and Division of Biostatistics (Yun), Medical College of Wisconsin; and the Children’s Research Institute, Children’s Hospital and Health System (Gorelick, Yen), Milwaukee, WI


- Observational study at a pediatric ED at an academic children’s hospital
- Intervention: in room registration
- Pre-intervention time: 1/2000-6/2003
- Post intervention time 6/2003-12/2003
- Primary outcome: LOS
THE PRACTICE OF EMERGENCY MEDICINE/ORIGINAL RESEARCH

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Kenneth Yen, MD

Hyun J. Yun, PhD

Table. Results of ARIMA model.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Effect on Length of Stay, min</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average daily ED census</td>
<td>+4.3</td>
<td>3.0–5.5</td>
</tr>
<tr>
<td>(per 10 additional patients)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summer month (July or August)</td>
<td>+5.1</td>
<td>0.5–9.7</td>
</tr>
<tr>
<td>Capacity for ED admissions (per 10% increase in hospital occupancy)*</td>
<td>+2.8</td>
<td>1.8–3.7</td>
</tr>
<tr>
<td>In-room registration</td>
<td>−15.0</td>
<td>−6.3 to −33.4</td>
</tr>
<tr>
<td>Attending staffing (per additional hour)</td>
<td>+0.14</td>
<td>−1.26 to 1.75</td>
</tr>
</tbody>
</table>

*At the mean value for ED admissions.

- All the factors were statistically significant with LOS, except of number of attending-hours staffed
- In-room registration decreased LOS by 15 min
- Limitations:
  - Pediatric ED
  - In-room registration process was new
  - Patient satisfaction not measured
Determinants of ED LOS

Effect of Mandated Nurse–Patient Ratios on Patient Wait Time and Care Time in the Emergency Department

Theodore C. Chan, MD, James P. Killeen, MD, Gary M. Vilke, MD, Jean B. Marshall, RN, and Edward M. Castillo, PhD

Acad Emerg Med. 2010 May;17(5):545-52

- California has mandated minimum NPR:
  - 1 nurse : 4 ptx
  - 1 nurse : 2 ptx-critical care ptx
  - 1 nurse : 1 ptx-critical trauma ptx
- Multicenter, prospective observation comparison study
  - Urban academic level 1 trauma teaching hospital (37,000 visits)
  - Suburban community hospital (23,000 visits)
- 1 year period (1/2008-12/2008)
- Outcome measures: patient wait time and ED care time
Effect of Mandated Nurse–Patient Ratios on Patient Wait Time and Care Time in the Emergency Department

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Table 2

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Hospital A</th>
<th>Hospital B</th>
<th>Both Facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number (%)</td>
<td>Median WT, Minutes (IQR)</td>
<td>Number (%)</td>
</tr>
<tr>
<td>Waiting**</td>
<td>19,608 (53.3)</td>
<td>55 (15–128)</td>
<td>10,796 (46.4)</td>
</tr>
<tr>
<td>Triage acuity†</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergent</td>
<td>1,081 (5.6)</td>
<td>17 (6–48)</td>
<td>181 (1.7)</td>
</tr>
<tr>
<td>Acute</td>
<td>9,897 (51.3)</td>
<td>85 (27–172)</td>
<td>4,953 (46.7)</td>
</tr>
<tr>
<td>Urgent</td>
<td>8,328 (43.1)</td>
<td>39 (11–88)</td>
<td>5,463 (51.6)</td>
</tr>
<tr>
<td>ED ratio status†</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In-ratio</td>
<td>17,116 (88.7)</td>
<td>52 (14–124)</td>
<td>9,805 (92.5)</td>
</tr>
<tr>
<td>Out-of-ratio</td>
<td>2,190 (11.3)</td>
<td>76 (24–154)</td>
<td>792 (7.5)</td>
</tr>
</tbody>
</table>

IQR = interquartile range; LWOT = left without treatment; WT = wait time.
*WT calculations exclude LWOT patients.
†Statistically significant difference proportions between Hospital A and Hospital B (p < 0.05).
‡At time patient went to waiting room.

Table 3
Median EDCTs and IQRs by Characteristics of Patients Who Were Seen and Discharged, January 1, 2008, Through December 31, 2008

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Hospital A</th>
<th>Hospital B</th>
<th>Both Facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number (%)</td>
<td>Median EDCT, Minutes (IQR)</td>
<td>Number (%)</td>
</tr>
<tr>
<td>Seen and discharged*</td>
<td>26,894 (73.8)</td>
<td>184 (97–311)</td>
<td>18,766 (80.6)</td>
</tr>
<tr>
<td>Triage acuity*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergent</td>
<td>1,804 (6.7)</td>
<td>318 (212–460)</td>
<td>665 (3.5)</td>
</tr>
<tr>
<td>Acute</td>
<td>15,415 (57.3)</td>
<td>244 (159–365)</td>
<td>9,172 (48.9)</td>
</tr>
<tr>
<td>Urgent</td>
<td>9,675 (36.0)</td>
<td>91 (60–143)</td>
<td>8,929 (47.6)</td>
</tr>
<tr>
<td>Nurse ratio status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In-ratio</td>
<td>24,949 (92.8)</td>
<td>179 (95–302)</td>
<td>17,356 (92.5)</td>
</tr>
<tr>
<td>Out-of-ratio</td>
<td>1,945 (7.2)</td>
<td>261 (150–429)</td>
<td>1,410 (7.5)</td>
</tr>
</tbody>
</table>

EDCT = ED care time; IQR = interquartile range.
*Significant difference proportions between Hospital A and Hospital B (p < 0.05).

- ED WTs were 16% longer when ED was out of ratio (p<0.001)
- EDCTs were 37% longer when ED was out of ratio (p<0.001)
Reduced length of stay in medical emergency department patients: a prospective controlled study on emergency physician staffing
Bruno Bucheli* and Benedict Martina

Prospective study
- Intervention: additional physician in the ED during evening shift
- Setting: Switzerland, 34,000 ED visits /year
  - Division between medical ED and surgical ED
- Studied patients for 3 weeks w/o additional physician and 2 subsequent weeks w/ additional physician
- Primary outcome: ED length of stay

Reduced length of stay in medical emergency department patients: a prospective controlled study on emergency physician staffing
Bruno Bucheli* and Benedict Martina

Table 3. Lengths of stay in the medical emergency department: observation period versus intervention period with additional physician in medical emergency department patients with emergency department entry between 15:00 and 21:00 hours.

<table>
<thead>
<tr>
<th></th>
<th>Intervention period</th>
<th></th>
<th>15:00–21:00 h (N=200)</th>
<th>15:00–21:00 h (N=160)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>LOS</td>
<td>N</td>
<td>LOS</td>
</tr>
<tr>
<td>Outpatients total</td>
<td>95</td>
<td>176±137</td>
<td>83</td>
<td>141±86</td>
</tr>
<tr>
<td>Inpatients total (without ICU)</td>
<td>91</td>
<td>219±106</td>
<td>70</td>
<td>212±95</td>
</tr>
<tr>
<td>ED inpatient ward</td>
<td>79</td>
<td>230±99</td>
<td>59</td>
<td>226±92</td>
</tr>
<tr>
<td>Regular inpatient beds</td>
<td>3</td>
<td>20±15</td>
<td>0</td>
<td>60±71</td>
</tr>
<tr>
<td>ICU</td>
<td>14</td>
<td>109±121</td>
<td>7</td>
<td>60±71</td>
</tr>
</tbody>
</table>

- Reduced LOS among patients that were discharged
- Not significant reduced LOS among patients that were admitted
- Additional physician costs $80,000/year (most likely more in the US
- Limitations:
  - Not necessarily generalizable
  - IM staff vs. ED staff?
  - Small sample size
Time Series Analysis of Emergency Department Length of Stay per 8-Hour Shift

Niels K. Rathlev, MD
Dan Obendorfer, MBA
Laura F. White, PhD
Casey Rebholz, MPH
Brendan Magauran, MD, MBA
Willie Baker, MD
Andrew Ulrich, MD
Linda Fisher, RN
Jonathan Olshaker, MD

Boston University Medical Center, Department of Emergency Medicine, Boston, Massachusetts


- Every 1% increase in hospital occupancy → increased LOS by 1.08 min
- Every additional admission from ED → increased LOS by 2.88-4.91 min, depending on time of day
- 3 or more admissions to ICU → increased LOS by 14.27 min
The impact of consultation on length of stay in tertiary care emergency departments

Craig Brick,¹ Justin Lowes,² Lindsay Lovstrom,² Andrea Kokotilo,² Cristina Villa-Roel,²,³ Patricia Lee,⁴ Eddy Lang,⁴ Brian H Rowe²,³


- Consultation decision time accounts for 33% of LOS for admitted patients and 54% for discharged patients
- Increased LOS with advanced age, longer latency between arrival and first consult request, dementia and multiple consults
- For every additional 1 min increase in LOS on shift 1, associated with 0.29 min increase in LOS on shift 2
Decreasing Lab Turnaround Time Improves Emergency Department Throughput and Decreases Emergency Medical Services Diversion: A Simulation Model

Alan B. Storrow, MD, Chuan Zhou, PhD, Gary Gaddis, MD, PhD, Jin H. Han, MD, MS, Karen Miller, RN, David Klubert, MD, Andy Laidig, Dominik Aronsky, MD, PhD


- Computer simulated model using real patient data
- As lab turn around time decreases from 120 to 10 minutes, ED LOS decreases from 2.7 → 2.17 hours

<table>
<thead>
<tr>
<th>Simulated TAT (Minutes)</th>
<th>Total Diversion Days</th>
<th>Average Diversion (Hours)</th>
<th>Diversion Days (%)</th>
<th>Average Patients Seen/Day</th>
<th>ED LOS (Hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td>57</td>
<td>10.8</td>
<td>63</td>
<td>103.51</td>
<td>2.77</td>
</tr>
<tr>
<td>100</td>
<td>56</td>
<td>11.0</td>
<td>62</td>
<td>106.7</td>
<td>2.6</td>
</tr>
<tr>
<td>80</td>
<td>49</td>
<td>9.9</td>
<td>54</td>
<td>110.02</td>
<td>2.43</td>
</tr>
<tr>
<td>60</td>
<td>42</td>
<td>8.5</td>
<td>47</td>
<td>113.52</td>
<td>2.27</td>
</tr>
<tr>
<td>40</td>
<td>33</td>
<td>6.8</td>
<td>37</td>
<td>116.98</td>
<td>2.17</td>
</tr>
<tr>
<td>20</td>
<td>30</td>
<td>6.2</td>
<td>33</td>
<td>119.88</td>
<td>2.17</td>
</tr>
<tr>
<td>10</td>
<td>29</td>
<td>6.0</td>
<td>32</td>
<td>120.08</td>
<td>2.17</td>
</tr>
</tbody>
</table>

ED = emergency department; LOS = length of stay.

Table 1
The Effect of Decreasing Lab Turnaround Time on ED Efficiency Measures
Determinants of ED LOS

Redesign of an Urban Academic Emergency Department: Action Research Can Make a Difference

Authors: Regina M. Ciambrone, MSN, RN, CNA-BC, Kathleen E. Zavotsky, MSN, RN, CCRN, CEN, ACNS-BC, Keeba Souto, MSN, RN, Katherine Baron, RN, Vincent D. Joseph, MHA, FACHE, Joyce E. Johnson, PhD, RN, NEA-BC, FAAN, and Kari A. Mastro, MSN, RN, NEA-BC, New Brunswick, NJ


• 3 categories to target solutions to ED crowding and LOS:
  • Increased resources
  • Demand management
  • Operations research
• Nurse-directed large scale ED transformation at RWJUH
  • Inventory management
  • Process redesign
  • Staffing realignment
- Reorganization of supply carts
- Nurse, physician, and support staff aligned with patient volume
- Mean 47 minute reduction of LOS

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Trial</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acuity code 3</td>
<td>213</td>
<td>172</td>
<td>104</td>
</tr>
<tr>
<td>Acuity code 4</td>
<td>113</td>
<td>88</td>
<td>98</td>
</tr>
<tr>
<td>Acuity code 5</td>
<td>60</td>
<td>55</td>
<td>57</td>
</tr>
<tr>
<td>Mean</td>
<td>163</td>
<td>116</td>
<td>138</td>
</tr>
</tbody>
</table>
Summary

- ED LOS has been increasing within the past decade
- Increased ED LOS linked to higher in-patient mortality, increased hospital LOS and costs
- ED crowding associated with longer ED LOS
- Equivocal data on impact of physicians at triage
  - may not be worth $
- Rapid Assessment Zones/Pods may decrease ED LOS
  - further research required
- Matching both nursing, physician, medical technician staffing to ED volume linked to reduced LOS
- Multilevel project groups may help identify site-specific areas of improvement for LOS