Throughput or Lack Thereof:
The Bothersome Aspects of Boarding

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Objectives

• To define “What is Crowding?”
• To determine why crowding important?
• To identify high impact solutions to alleviate crowding.
What is Overcrowding?

- Webster’s definition of overcrowded
  “To crowd together too much”

- Webster’s definition of crowded
  “To fill by pressing or thronging together”
  “To press force or thrust into a small space”

- Synonyms of crowded
  Cram, crush, jam, ram, sandwich, shoeborn, stuff, wedge
What is ED Overcrowding?

- High ED volume does not equal ED crowding

- Interplay of
  - ED volume (input)
  - Patient acuity
  - Physical space
  - Staffing
  - ED throughput
  - Inpatient capacity
  - Community resources
What is ED Overcrowding?

ED overcrowding exists when the institutional resources available are insufficient to meet the basic needs of emergency patient.

Early Beginnings

- 1990’s
  - Urban academic ED problem
  - Focused on homeless, uninsured and chronic problems that did not need to come to ED
    - Psychiatric illness
    - AIDS
    - Substance abuse

- 1993 – GAO report
Paradigm Shift

- 2003 new GAO report
  - Attributed crowding to the presence of hospital boarders in the ED

- It is not just Medicaid and the uninsured!!!
Low acuity – No problem

- Low acuity patients thought to contribute little to the issue of crowding.
  - Schull et al 2007 – 13 second delay in time to provider and 36 second increase in LOS
  - Rathlev et al 2007
    - No association in regards to input factors and ED crowding
    - Independent association between crowding and various output measures
IOM 2006

The Future of Hospital Based Emergency Care: At the Breaking point

- Boarding of Hospital patients
- Fragmentation of healthcare system
- Shortage of on call specialists
- Disaster responsiveness
- Pediatric care
Is Anyone Surprised?
Nature of What We Do...

- Screening for the threat to life.
- Model of care in evolution
  - The masters of acute care
  - Complex work ups
  - Overflow
  - Afterhours
- New gate keeper?
  - ED is admitting source ~50%
  - Not doing a bad job?
The cost of what we do..
The Safety Net

- It is the economy stupid

- Access to care in many communities
  - 50% of all Medicaid acute care visits
  - 67% of all uninsured acute care visits

- Only option
  - uninsured
  - under insured (Medicare & Medicaid)
Increasing Practice Intensity

- Aging population
- Movement to outpatient medicine
- Increased technology
- The work up doctor
- The gate keeper

Pitts et al 2012 – ED crowding is solely due to the intensity of the work up
Practice Intensity

- Pitts et al. 2012
- NAHCS database
- Measured occupancy as surrogate of crowding
- ED crowding is solely due to the intensity of the work up.

  - Increases in occupancy were throughput factors:
    - Blood tests, advanced imaging, intravenous fluids, procedures, and medication administration.
The Silent Killer

- Sun et al. 2013
  - Reviewed state data for 187 hospitals in California
  - On days measured in the top quartile for hospital diversion
    - 5% higher chance of death (300 additional deaths)
    - 1% longer hospital LOS (6200 additional inpatient days)
    - 1% higher cost (17 million addition costs)
Adverse Outcomes

- European study (Miro 1999) – incr. mortality associated with incr. ED weekly volume
- Australian ED 13 more deaths were attributable to high ED volume (Richardson 2006)
- Combined measure of hospital and ED crowding = incr. mortality at 2, 7 and 30 days
- Increased trauma mortality associated with ambulance diversion (Begley 2004)
Core Measures

- Pneumonia
  - Time to Abx
- AMI
  - STEMI
    - TPA
    - PTCA
Other

- Patient satisfaction
- Pain control – back pain and abd. pain
- Blood culture contamination rates
- Following standard protocols for asthma
Why does the hospital CEO care?

- Benchmarking
  - Are you a UHC hospital?
  - Are you in the window for a Joint commission visit?
  - Will this become a pay for performance measure?

- Publically reporting

- Financial impact
  - 50% of all hospital admission come via the ED
  - 10k revenue per average admit
You cannot manage what you do not measure
Measures of ED Crowding

- No universally accepted measure
- Varies across ED
- Ideal
  - Reproducible
  - Easy to calculate
Surrogate Measures

- LWBS
  - Correlates with waiting times and capacity measures
  - Financial impact
  - Risk
Surrogate Measures

- Ambulance Diversion
  - 40% of all hospitals during some point in year
  - 70% of urban hospitals
  - Impact?
EDWIN

\[ \sum n_{it} j_t / N_t (B - B_t) \]

- \( n_{it} \) # of patients in triage cat. I at time \( t \)
- \( j_t \) ordinal triage score (1-5) for the \( j \)th patient
- \( N_t \) # of attending physicians on duty at time \( t \)
- \( B \) total number of treatment beds available (constant)
- \( B_t \) Total number of admit holds at time \( t \)
### NEDOCS Calculator

<table>
<thead>
<tr>
<th>INSTITUTIONAL CONSTANTS</th>
<th>Number of ED Beds</th>
<th>Number of Hospital Beds</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMMON ELEMENTS</td>
<td>Total Patients in the ED</td>
<td>Number of Respirators in the ED</td>
</tr>
<tr>
<td>MODEL SPECIFIC</td>
<td>Total Admits in the ED</td>
<td>Waiting room wait time for last patient called (In hours)</td>
</tr>
</tbody>
</table>

**NEDOCS Score:**

- **Clear Fields**

**Interpretation of results**

<table>
<thead>
<tr>
<th>Score Range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 20</td>
<td>Not busy</td>
</tr>
<tr>
<td>21 to 60</td>
<td>Busy</td>
</tr>
<tr>
<td>61 to 100</td>
<td>Extremely busy but not overcrowded</td>
</tr>
<tr>
<td>101 to 140</td>
<td>Over-crowded</td>
</tr>
<tr>
<td>141 to 180</td>
<td>Severely over-crowded</td>
</tr>
<tr>
<td>181 to 200</td>
<td>Dangerously over-crowded</td>
</tr>
</tbody>
</table>

**Important points:**
- ED beds - published number of beds available for patient care.
- Total patients - add pts in normal beds plus those doubled up and those in hallways.
Occupancy rate

Total number of ED patients
Total # of ED licensed beds

- Simple to calculate
- Performs similar to NEDOCS, EDWIN and nurse/doctor perception
Where does Health Reform Fit?

- ACO’s
  - “Final Line of Defense”
    - Gate keepers
  - Shift from FFS to bundled payments
  - Chest pain centers (CDU) are a perfect example
    - Observation for need for admission
    - Observation units.
Model of Crowding

Input ➔ Throughput ➔ Output
Model of Crowding

Input
- Transfers
- Walk ins
- EMS
- Air EMS
- Referrals
- Providers
- Nursing

Throughput
- Labs
- Radiology
- ED beds
- Pharmacy
- Ancillary staff
- Tincture of time

Output
- Consultations
- Discharge
- Transfer
- AMA
- ICU
- Tele
- CDU
- Triage out
- ED beds
- Pharmacy
- Ancillary staff
- Tincture of time
Input Control (lack thereof)

- If you think this is the answer?
  - EMTALA implications
  - Triage out
  - Low acuity patients

- Diversion
  - 2003, ambulances diverted an average of once every minute
Optimize Front End Resources

- Bedside registration and Immediate bedding
- Provider at triage/team triage vs standing orders
- Split flow
- Flow cells –
- Incentive based compensation models
- IT advancements – kiosks, chips and tracking
- Scheduled visits- deferral of care
Throughput

- **McCarthy et al. 2009**
  - 1 year study at 4 ED’s
  - Crowding measured at 15 minute intervals

- **Outcomes**
  - ED LOS and WR time significantly associated with crowding
  - WR time and boarding time drove increase in LOS
  - ED throughput not associated with crowding
Variability

- Standardization
- Resource utilization
- Admission rates

Provider report cards
Throughput

- Productivity based compensation
  - We are all altruistic, but ....
  - Little in the literature base
Throughput

- Scribes
  - Couple studies
  - Arya et al (2010)
    - RVU/hr increase .24 for 10% increase in scribe usage
    - Pt/hr increase .08 for every 10% increase in scribe usage
    - Did not affect Throughput
    - Reduction in ED overall LOS by 23.26 minutes
    - Pt/hr increased from 1.81 to 2.09
    - No change in RVU/ pt.
DC patients
- What is the impact
- Room turn over
- Small changes can have impact

Full capacity protocol
- Vicellio et al. 2009 summarized findings
  - As safe as care in room on unit

http://hospitalovercrowding.com/
Output

- System wide transfers
  - Capacity management of entire systems
  - LA, CA experience
ACEP Task Force Report on Boarding

- April 2008
- Report on solutions to boarding
- Little financial costs
High impact

- Full capacity protocol
- Coordinate the DC of inpatients prior to noon
- Smoothing the OR schedule
- Smoothing scheduled admissions
  - 7 day a week hospital?
Other Options

- CDU
- Fast track units
- Provider at triage
- Cancelling elective surgeries (not without cost)
Not effective

- Hospital based specialists
  - Improve quality of care and hospital LOS, but not ED LOS
- Building a new ED
- Inpatient DC units
- Ambulance diversion
Urgent Matters

1. Hospital leadership must recognize that ED crowding is a hospital-wide problem
2. Multidisciplinary teams are needed
3. An institutional champion
4. Senior leadership must publicly support ED crowding reduction initiatives
5. Formal quality improvement tools are needed
6. Data collection is essential
7. Initiatives and data must be transparent
Caveat Emptor

- Quality in emergency care is driven by time, but...
  - Safe
  - Effective
  - Patient centered
  - Efficient
  - Timely
  - Equitable
Magic Bullet?

- Overcrowding is a chronic disease
  - Factors that cause it are common
  - Unpredictable to some degree
  - We will always have times of constraint

- You may be able to immunize against crowding!
Conclusions

- Crowding is a common, but complex problem.
- Our practice is in evolution.
- If you do not measure it, you cannot manage it.
- Not every solution will work for you.