the future is now
are we ready?

The 8th Annual Behavioral Health Care Symposium

CALIFORNIA HOSPITAL ASSOCIATION
Center for Behavioral Health
ED Overcrowding and CEDOCS: The Community Emergency Department Overcrowding Scale

Steven Weiss, MD
Professor of Emergency Medicine
University of New Mexico Health Sciences Center
Overcrowding

- Introduction
- Causes
- Consequences
- Solutions
- NEDOCS studies
- CEDOCS
Introduction

- EDs provide an important public service mission
- Overcrowding diminishes the capability of the ED to manage emergencies effectively
Introduction

• In the 1990s
  o US hospitals: due to downsizing, mergers and closures lost
    • > 100,000 beds
    • 7800 medical/surgical ICU beds
  o # ED visits grew 15%
Introduction

How crowded is overcrowded?

“Although ED crowding has been a topic of frequent investigation, current definitions of the problem are often implicit or focus on factors outside of the ED itself”

“A more consistent approach to defining ED crowding would help to clarify the distinctions between causes, characteristics, and outcomes.”
Introduction

• No gold standard
• No standardized scale or definition
• “We do not know what overcrowding is but we know it when we see it!”
Academic ED overcrowding

- Survey of 84/120 Academic EDs
- 51% reported daily overcrowding
- 94% reported overcrowding 3+ days/wk
- Causes
  - Hospital Beds 88%
  - Consultant delays 82%
  - Radiology delays 80%
  - Nursing shortage 78%
Rochester NY

• Multiple strategies tried
• ED internal strategies “less successful”
• Best results were from rapid removal of inpatients from the ED.
Arizona

- Diversion 30-50% of the time
- Long ED waits
- Major cause is shortage of inpatient beds
### Publications on ED crowding

<table>
<thead>
<tr>
<th>Year</th>
<th># Publications</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>38</td>
</tr>
<tr>
<td>2012</td>
<td>31</td>
</tr>
<tr>
<td>2011</td>
<td>27</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>2001</td>
<td>13</td>
</tr>
<tr>
<td>2000</td>
<td>7</td>
</tr>
</tbody>
</table>
### International Publications on ED crowding

<table>
<thead>
<tr>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>Honk Kong/China</td>
</tr>
<tr>
<td>Australia</td>
<td>Netherlands</td>
</tr>
<tr>
<td>Italy</td>
<td>Israel</td>
</tr>
<tr>
<td>Taiwan</td>
<td>Canada</td>
</tr>
<tr>
<td></td>
<td>India</td>
</tr>
<tr>
<td></td>
<td>Australia</td>
</tr>
</tbody>
</table>
Overcrowding

- Introduction
- Causes
- Consequences
- Solutions
- Previous studies
- CEDOCS
Causes of Overcrowding

1. Increases in ED patient volumes
2. Increased complexity of diseases and associated evaluations
3. Lack of inpatient hospital beds and resources
4. National shortage of nursing and other hospital staff
5. On-call physician issues
Causes of Overcrowding (cont.)

6. Reduced primary care services
7. Managed care barriers
8. Inadequate funding
9. Prudent layperson standard
10. Non-urgent use of the ED
11. The uninsured
Overcrowding

• Introduction
• Causes
• **Consequences**
• Solutions
• Previous studies
• CEDOCS
Consequences of Overcrowding

1. Patients who leave without being seen
2. Patient dissatisfaction
3. Ambulance Diversion
4. Increased ED length of Stay
5. Quality Indicators
Consequences of Overcrowding

6. Medical Errors
7. Death and disability
8. Resident Education
9. Loss of autonomy
10. Issues of justice
Overcrowding

• Introduction
• Causes
• Consequences
• Solutions
• Previous studies
• CEDOCS
Short term solutions

A. EMS Practices
B. ED Practices
C. Hospital Practices
A. EMS Practices

1. Medical Direction
2. Diversion protocols
3. Regional information management systems
4. Regional diversion saturation override
B. ED Practices

1. Real time monitoring of ED crowding metrics
2. Expanded observation services
3. Best demonstrated practices
4. Advanced triage protocols
5. Flexible triage staffing
B. ED Practices (cont.)

6. Intra-ED communications
7. Flexible bed assignments
8. Flexible staffing
9. State-of-the-art fast-track
10. ED case management
B. ED Practices (cont.)

11. Foreign language translators
12. Point-of-care payment/testing
13. Staff support and moral boosters
14. Diversion criteria
15. Use of temporary facilities
C. Hospital Practices (cont.)

1. Changing hospital culture
2. Bed monitoring process
3. Focus on inpatient operational metrics
4. Practitioner control and oversight
5. Streamlining discharges
6. Rapid admission unit
C. Hospital practices (cont.)

7. Discharge hospitality suite
8. High patient census management – e.g. boarding
9. Diversion readiness
10. Expedite admissions
11. Code Help”
12. Internal disaster plans
Overcrowding

- Introduction
- Causes
- Consequences
- Solutions
- Previous studies
- CEDOCS
Part 2 Results – NEDOCS score

- The reduced model of overcrowding
  - number of ED patients
  - number of respirators in use in the ED
  - Total admits in the ED
  - Waiting room time for last patient called
  - Longest admit time
### NEDOCS CALCULATOR

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

#### Interpretation of results:

- 00 to 20: Not busy
- 21 to 60: Busy
- 61 to 100: Extremely busy but not overcrowded
- 101 to 140: Over-crowded
- 141 to 180: Severely over-crowded
- 181 to 200: Dangerously over-crowded
Limitations

• Lack of a true gold standard definition
• Differences in definition of terms such as “diversion” and “critical care patients”
• Generalizable only to other academic EDs
• Pediatric EDs not specifically addressed
• Community hospitals not specifically addressed
Comparison with EDWIN

- EDWIN is defined as
  \[ \sum n_i t_i / Na \times (BT - BA), \]
  - \( n_i \) = number of patients in the ED in triage category \( t_i \)
  - \( t_i \) = triage category based on ESI categories (1-5, 5 being most acute)
  - \( Na \) = number of attending physicians on duty
  - \( BT \) = number of treatment bays
  - \( BA \) = number of admitted/Obs patients in the ED
LWBS

- Overcrowding was found in 44% of our sampling times
- There was a significant correlation between LWBS and the NEDOCS score
- Correlation was best for LWBS and overcrowding scale 2 hours after patient registration
Overcrowding

• Introduction
• Causes
• Consequences
• Solutions
• Previous studies
• CEDOCS
Prospective Validation of stage 3B

Academic ED Overcrowding Scale

Development of Full scale (Site Evaluation form)

Stage 1A

Evaluation of Full scale and Reduced scale development

Stage 2A

Prospective Validation of scale

Stage 3A

Community ED Overcrowding scale

Development of Full scale (Site Evaluation form)

Stage 1B

Evaluation of Full scale and Reduced scale development

Stage 2B

Prospective Validation of scale

Stage 3B

Fusion of the scales for evaluation of entire community ED overcrowding issues.

Stage 4

Application of scale to complex issues
1. Patients leaving prior to full medical care.
2. Medical Errors
3. Diversion
4. Patient ED Acuity levels.
5. Patient Satisfaction

Stage 5
## 16 Total Hospital
(Red=lowest, Bold=Highest)

<table>
<thead>
<tr>
<th>Hospnum</th>
<th>Annual ER Visits (1000s)</th>
<th>Licensed Beds</th>
<th>Licensed ED Beds</th>
<th>Acute Routinely-Used Inpatient Beds</th>
<th>Trauma center (level)</th>
<th>Base Hospital</th>
<th>Annual Admissions (1000s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>31</td>
<td>64</td>
<td>26</td>
<td>62</td>
<td>-</td>
<td>Yes</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>56</td>
<td>320</td>
<td>27</td>
<td>194</td>
<td>2</td>
<td>Yes</td>
<td>16</td>
</tr>
<tr>
<td>4</td>
<td>66</td>
<td>290</td>
<td>28</td>
<td>286</td>
<td>2</td>
<td>No</td>
<td>11</td>
</tr>
<tr>
<td>5</td>
<td>19</td>
<td>100</td>
<td>7</td>
<td>69</td>
<td>-</td>
<td>Yes</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>41</td>
<td>460</td>
<td>36</td>
<td>423</td>
<td>-</td>
<td>Yes</td>
<td>18</td>
</tr>
<tr>
<td>7</td>
<td>47</td>
<td>220</td>
<td>36</td>
<td>221</td>
<td>2</td>
<td>Yes</td>
<td>12</td>
</tr>
<tr>
<td>8</td>
<td>30</td>
<td>170</td>
<td>12</td>
<td>118</td>
<td>2</td>
<td>No</td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>46</td>
<td>350</td>
<td>34</td>
<td>304</td>
<td>2</td>
<td>Yes</td>
<td>18</td>
</tr>
<tr>
<td>12</td>
<td>44</td>
<td>270</td>
<td>20</td>
<td>140</td>
<td>-</td>
<td>Yes</td>
<td>11</td>
</tr>
<tr>
<td>13</td>
<td>43</td>
<td>200</td>
<td>19</td>
<td>114</td>
<td>-</td>
<td>Yes</td>
<td>9</td>
</tr>
<tr>
<td>14</td>
<td>52</td>
<td>640</td>
<td>49</td>
<td>407</td>
<td>2</td>
<td>Yes</td>
<td>18</td>
</tr>
<tr>
<td>15</td>
<td>49</td>
<td>380</td>
<td>36</td>
<td>316</td>
<td>-</td>
<td>Yes</td>
<td>17</td>
</tr>
<tr>
<td>16</td>
<td>67</td>
<td>310</td>
<td>34</td>
<td>313</td>
<td>2</td>
<td>Yes</td>
<td>16</td>
</tr>
</tbody>
</table>
Spearman rho-squared

Percent Occupancy

- # of admitted critical care pts in the ED
- # of pts on ventilators in the ED
- # of pts in the triage area ("Tweeners")
- ED pts to ED bed ratio
- # of pts in waiting room
- Longest time a patient is waiting to be seen
- # of pts in the ED

Total # of licensed nurses
- # of nurses with direct care responsibilities

Hosp size (dichotomized at <=45k)
- Total # of ED beds

Total # of hospital beds
- Longest time admitted psych patient is waiting
- # of psych pts in the ED

- Longest time admitted pt is still waiting in the ED

- # of admitted and transfer pts in the ED
- Admitted pts to hospital bed ratio
The Psychiatric Patients

- 35% of sampling times had at least 1 psychiatric patient on hold
- Median of 2 patients (1, 2)
- Median time was 8 hrs (4, 14hrs)
- Maximum was 27 patients and 109 hours waiting in the ED
The Psychiatric Patients
NEDOCS vs CEDOCS

NEDOCS
• Number of ed beds
• Number of hosp beds
• ED patients
• Respirators
• Admits in the ED
• Admitted patient wait time
• Waiting room wait time

CEDOCS
• Number of ed beds
• Number of ED visits/year
• ED patients
• Critical care patients
• Waiting room patients
• Admitted patient wait time
## Correlation Values

<table>
<thead>
<tr>
<th></th>
<th>VAS OUTCOME</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEDOCS</td>
<td>0.673</td>
</tr>
<tr>
<td>NEDOCS</td>
<td>0.623</td>
</tr>
</tbody>
</table>

R\(^2\) comparison to Overcrowding

NEDOCS – 39%
CEDOCS – 47%
## Special Feature:

### CEDOCS CALCULATOR

<table>
<thead>
<tr>
<th>FIXED VARIABLES</th>
<th>ED visits per year</th>
<th>Number of ED beds</th>
</tr>
</thead>
<tbody>
<tr>
<td>COUNT VARIABLES</td>
<td>Total Patients in the ED (see below)</td>
<td>Number of admitted critical care pts in the ED</td>
</tr>
<tr>
<td>TIME VARIABLES</td>
<td>Waiting time of longest admitted patient (since admission)</td>
<td>Code:</td>
</tr>
</tbody>
</table>

### CEDOCS SCORE-

<table>
<thead>
<tr>
<th>Level</th>
<th>1 to 20</th>
<th>21 to 60</th>
<th>61 to 100</th>
<th>101 to 140</th>
<th>141 to 180</th>
<th>181 to 200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>41</td>
</tr>
<tr>
<td>Level 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Interpretation of results:
Website

- http://hsc.unm.edu/emerged/
  - CEDOCS
  - NEDOCS
QUESTIONS?
Thank you

Steven Weiss, MD
505-514-5087
SWeiss52@aol.com