Ambulance Diversion and Offload Delay
ED Crowding and the EMS System

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Declaration

• I have no financial conflicts to report.

• I am a member of the Board of Directors of the National Association of EMS Physicians.

• I am a Medical Director of a number of EMS agencies.

• Like everyone else, I am a potential patient.
Objectives

• Describe what ambulance diversion and offload are and how they differ
• Describe the literature on diversion and offload delay
• Discuss the relationship between the two
• Discuss the emerging importance of AOD as a benchmark for ED quality
• Discuss potential strategies to decreasing AOD
Definitions

**Ambulance diversion**: redirecting or limiting destination of an ambulance carrying a patient to a hospital as its destination

**Ambulance offload delay**: the time between arrival of an ambulance, and the time that the patient is both (1) off the stretcher and (2) EMS report has been given
Historical Prospective

- Ambulance diversion used to decompress crowded ED by directing ambulances to an ED with less patient volume at the time
- First paper describing success was published in 1990
- More recently, diversion sited as cause of patient harm and EMS System dysfunction
  - COBRA / EMTALA
Ambulance Diversion


- First paper to describe phenomenon of diversions
- Used as a novel way to decompress ED
- Originally described for patients with “relatively minor injuries.”
- ≥ ten admitted patients were awaiting inpatient beds or all inpatient monitors were in use
- 3/4 hospitals on diversion - send to outlying hospitals
- Limited effect - lasting only 4 months
Ambulance Diversion

While ambulance diversion may decompress the ED, there is concern that diversion may also cause harm.
Ambulance Diversion


- Five month prospective study
- 911 diversions compared to 5% random sample of non-diversions
- Mean transport time non-diverted 11.5 min vs. 16.5 min (p < 0.002)
- Distance to intended destination 1.3 to 4.6 miles further for diverted
- Suggested was related to unavailability of specialty services
- Recommended research into outcome differences
Ambulance Diversion


- Studied influence of hospital bypass on prehospital times and patient survival
- Direct transport patients (n = 66) vs. those that required bypass (n = 137)
- Travel time in bypass group 3 min longer (p < 0.05)
- No difference in survival 86% vs. 85%
- Additional 3 min added only 5% to total transport time
Ambulance Diversion


- Observational cohort study over a 4 year period
- 153,167 total transports; 5% diverted
- Longer transport time 13.3 min (±7.5) vs 11.6 min (±6.9); p < 0.005
- No difference in rate of transport associated death
Ambulance Diversion

Still a concern that diversion is harmful and reduction is favorable...
Ambulance Diversion


- Retrospective review of procedures for reducing diversion
  - system-wide exchange of information on diversion status
  - hospital commitment to providing resources needed to reduce diversion
  - individual hospitals spot checking by management level personnel
- Between 2000 and 2001 hours on diversion were reduced by 33.3%
- Previous paper (2002) by Lagoe, Hunt, et al. showed 51% time on diversion
Ambulance Diversion


- Retrospective study post implementation of a diversion protocol
- Pre-trial 12 months / Trial 3 months / Post-trial 9 months
- Authorization of diversion required ED attending and charge nurse. After 3 hours then authorization by hospital administrator
- Outcomes: number of patients transported by ambulance; number of patients taken to another ED due to diversion; number of hours on diversion
  - Decreased hours on diversion
    - Pre-trial = 4,007 / During trial = 1,079 / Post-trial = 1,774
  - Decreased number of patients diverted
    - Pre-trial = 1320 / During trial = 322 / Post-trial = 499
    - 75% reduction of diversion away from requested ED
Ambulance Diversion

• What do we know so far??
  – Ambulance diversion may decompress an overwhelmed ED in the system
  – Ambulance diversion may increase transport times
  – Policies to decrease diversion hours have been effective
Diversion and Transport Time


- Retrospective study during consecutive 3 months
- case matched controls of patients not diverted were compared to diverted patients
- 2,534 ALS runs: 147 (5.8%) diverted; 123 analyzed
- Most common reasons for diversion
  - Patient request = 69
  - ED saturation = 45
- Non-patient request diversions vs. Non-diverted
  - Total pre-hospital interval
    - 33.35 min (95% CI 31.14 - 35.55) vs. 33.43 min (95% CI 32.13 - 34.70)
Diversion and Transport Time


- Analysis of two 4 month periods in 1997 and 1999 that correlated with low and high ED bypass

- Types of bypass
  - Normal - i.e. no bypass
  - Redirect - Accept only critical care
  - Critical care bypass - cannot accept critical care
  - Gridlock - all hospitals in quadrant on bypass

- Total prehospital interval
  - 44.8 min vs. 46.2 min; change of 1.4 min; p = 0.2
Diversion and Transport Time


- Retrospective data on consecutive ambulance patients with chest pain
- 11,400 patients over 2 year period
- Study of out-of-hospital intervals for patients transported on days with gridlock vs. days without gridlock
- Main outcome studied: 90% transport interval from scene to hospital
- 4,223 (37%) of patients transported on day with gridlock

Results
- Transport interval
  - 17.4 min (95% CI 16.8 - 17.8) vs. 15.5 (95%CI 15.3 - 15.9)
- Every hour of gridlock increased transport by 0.2 min
- All other forms of diversion not associated with longer intervals
Diversion and Transport Time


- Retrospective study of periods on diversion vs. periods off diversion
- Only one hospital in system on diversion at a time
- Diversion can last up to 1 hour with extension granted by health department
- Results - No difference in:
  - Response time
  - On-scene time
  - Transport time
  - Hospital turnaround time
  - Out-of-service time
Diversion and Transport Time

So what?

– Ambulance diversion in and of itself may NOT increase transport time
– If there is an increase in transport time it is nominal
Diversion

  - Systematic review and meta-analysis of ambulance diversion literature
  - Paucity of studies on the effects of AD
  - No adequate studies on the effect of AD on ED crowding, or morbidity/mortality
Diversion

Say it isn’t so... diversion has to be evil!
NAEMSP Position Statement


- Diversion may have negative impact on patient care and EMS system
- Necessary that EMS systems take measures to avoid diversion which may result in...
  • Unacceptably prolonged transport times
  • Prolonged out of hospital care when definitive care needed for unstable patients
  • Inappropriate attempts by field personnel to predict resources needed
  • Delays in or lack of ambulance availability to community because of diversion to distant hospitals
Diversion – Clinical Effect

Mostly unimpressive, but...

Shen YC, Hsia RY. Association between ambulance diversion and survival among patients with acute myocardial infarction. JAMA. 2011 Jun 15;305(23):2440-7

- exposure to <6, 6 to <12, and ≥12 hours of diversion
- <12 hours of diversion = no difference
- >12 or more hours of diversion was associated with higher 30-day mortality 392 patients [19%] vs 545 patients [15%]
  - higher 90-day mortality (537 patients [26%] vs 762 patients [22%])
  - higher 9-month mortality (680 patients [33%] vs 980 patients [28%])
  - higher 1-year mortality (731 patients [35%] vs 1034 patients [29%])
Diversion Reduction


- Retrospective study of a countywide diversion protocol
- Hospital could go on divert for 1 hour only and then off diversion for next 8 hours
- Outcomes: number of hours on diversion and drop off times for diversion periods compared to non-diversion periods.
- Results
  - Protocol decreased diversion by 82%
  - Increased unit time = 178 hours/month (95% CI 74 - 283)
    - (Unit time = [90% drop off time - 15 min] X no of transports)/60 min)
  - Also, little effect on ED overcrowding
  - Increased dropoff time = 1.66 min/month (95% CI 0.33 - 2.98)
    - Increase of 32%
Diversion Reduction

...for every action there may be unintended consequences.
EMS System

- What is the bottom line for the EMS system?
  - Units back in service in timely manner
  - Maintain acceptable response times
  - Coverage in the community at the lowest cost possible
    - requiring more units to meet community needs = higher cost to the community (ie: lower UHU)
  - Highlighted another factor - “dropoff time” (offload delay)
AMBULANCE OFFLOAD DELAY
Intervals

Ambulance Offload Delay

  - Commitment from all stakeholders is the fundamental requirement for improvement in emergency department overcrowding and ambulance offload delay.
    - Cannot focus solely on the emergency department
    - ED overcrowding is a symptoms of systemic issues; no the source of the problem
  - Stakeholders must be held accountable
  - Principle cause of off-load time is lack of capacity to treat hospital in-patients
  - Solution to problem must look at in-patient capacity
  - Set goal of 30 minutes for offload
Ambulance Offload Delay

  - CMS has received reports from EDs concerning patients being left on stretchers for extended periods of time, possibly in violation of EMTALA.
  - CMS recognizes the strain on EDs; however this practice is not a solution.
  - “Parking” patients in hospitals impacts the ability of the EMS personnel to provide emergency services to the community.
Ambulance Offload Delay

- CMS. EMTALA Issues related to emergency transport services. April 27, 2007. [Clarification of 7/13/06 letter]
  - EMTALA responsibility of hospital begins when an individual arrives and not when the hospital “accepts” the individual from the gurney
  - Hospital has an obligation to provide appropriate medical screening exam and necessary stabilization
  - Failure to meet these requirements constitutes a violation of EMTALA
    » But then they went on to say....
Ambulance Offload Delay

- Not necessarily a violation if the hospital does not immediately assume care of patient
- It may be reasonable for hospital to “ask” EMS providers to stay with patient until such time as the ED staff is able to care for patient. Such an instance would occur in time of managing multiple trauma patients or other critically ill patients.
- However, the hospital MUST triage the patient’s condition immediately upon arrival to ensure that an emergent intervention is not required and the EMS providers can care for the patient.

- Reviewed literature and noted lack of data supporting specific need to use or lose concept of diversion
- Noted possible significant patient care impact of offload delay
- Supported NAEMSP position
- Recommended AOD be tracked by EM and EMS administrators
Ambulance Offload Delay


<table>
<thead>
<tr>
<th>Ambulance offload delay times: total and by NEDOCS score group</th>
<th>Range</th>
<th>25th Percentile</th>
<th>Median</th>
<th>75th Percentile</th>
<th>% of total sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total sample</td>
<td>0–157 min</td>
<td>5 min</td>
<td>11 min</td>
<td>21 min</td>
<td>100%</td>
</tr>
<tr>
<td>NEDOCS group 1 (0–100)</td>
<td>0–130 min</td>
<td>5 min</td>
<td>9.5 min</td>
<td>19 min</td>
<td>23.6%</td>
</tr>
<tr>
<td>NEDOCS group 2 (101–140)</td>
<td>0–85 min</td>
<td>5 min</td>
<td>10 min</td>
<td>18 min</td>
<td>41.3%</td>
</tr>
<tr>
<td>NEDOCS group 3 (141–180)</td>
<td>0–121 min</td>
<td>6 min</td>
<td>14.5 min</td>
<td>31.75 min</td>
<td>29.8%</td>
</tr>
<tr>
<td>NEDOCS group 4 (&gt;180)</td>
<td>1–157 min</td>
<td>6 min</td>
<td>13.5 min</td>
<td>39.25 min</td>
<td>5.4%</td>
</tr>
</tbody>
</table>

Key outcomes are summarized above. Significant variability in AOD was noted across all NEDOCS groups, and therefore times are related as quartiles. There was a statistical difference between the NEDOCS score groups ($p < 0.001$).

- Offload delay was associated with NEDOCS score
Ambulance Offload Delay

SUNY Upstate unpublished data

- A 12-month convenience sample of 1892
- AOD ranged from 0 min. to 122 min. with a mean of 14.01 min. (SD±14.2).
- Mean AOD for pediatric patients (10.77 min.) was less than adults (14.92 min.) (p<0.001).
- NEDOCS groups (p<0.001):
  - 1=9.18 min.
  - 2=12.72 min.
  - 3=18.14 min.
  - 4=20.62 min.
- ESI was evaluated
  - level 3 was the longest mean
Ambulance Offload Delay

Hospitals and EMS System, Lee County, Florida – Six Sigma Project 2007

- Identified offload delay as a problem
- Estimated cost of AOD at $350,000/yr
- Goal of 15 min 90% of the time and 30 min 100%
- Three interventions
  - Transportation Destination Coordinator contact prior to transport
  - EMSystems update by hospitals
  - ED nurse finding bed space prior to EMS arrival
Ambulance Offload Delay

Hospitals and EMS System, Lee County, Florida – Six Sigma Project 2007

Average Offload Times In Season 2006 & 2007

Time In Minutes

- Feb-07: 13.21883657
- Feb-Mar 2006: 44.2
Ambulance Offload Delay

Hospitals and EMS System, Lee County, Florida – Six Sigma Project 2007

Results:
- Pilot proved a statistically significant reduction in the average off-load times for Lee Memorial Hospital
- A decrease in the variation (range)

Table 2
Workload Rates (Patient LOS Hours per ED Bed) for Days With and Without Ambulance Diversion by Sites

<table>
<thead>
<tr>
<th>Site</th>
<th>N</th>
<th>Workload Rate on Days With Diversion</th>
<th>Workload Rate on Days Without Diversion</th>
<th>Adjusted Mean Difference in Workload Rate*</th>
<th>Percentage Increase in Workload Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Crude (SE)</td>
<td>Adjusted (SE)</td>
<td>N</td>
<td>Crude (SE)</td>
</tr>
<tr>
<td>1</td>
<td>51</td>
<td>17.1 (2.9)</td>
<td>15.9 (0.9)</td>
<td>314</td>
<td>14.7 (3.1)</td>
</tr>
<tr>
<td>2</td>
<td>49</td>
<td>21.7 (2.8)</td>
<td>21.2 (0.9)</td>
<td>316</td>
<td>20.8 (2.9)</td>
</tr>
<tr>
<td>3</td>
<td>160</td>
<td>18.8 (2.2)</td>
<td>17.4 (0.5)</td>
<td>205</td>
<td>15.3 (2.7)</td>
</tr>
<tr>
<td>4</td>
<td>316</td>
<td>27.5 (5.3)</td>
<td>26.7 (4.4)</td>
<td>49</td>
<td>22.3 (3.9)</td>
</tr>
<tr>
<td>5</td>
<td>20</td>
<td>20.4 (4.9)</td>
<td>19.2 (1.4)</td>
<td>345</td>
<td>15.8 (4.0)</td>
</tr>
<tr>
<td>6</td>
<td>274</td>
<td>26.8 (5.7)</td>
<td>25.9 (0.4)</td>
<td>91</td>
<td>22.5 (5.5)</td>
</tr>
<tr>
<td>7</td>
<td>18</td>
<td>25.2 (8.1)</td>
<td>23.1 (1.5)</td>
<td>347</td>
<td>20.3 (9.4)</td>
</tr>
<tr>
<td>8</td>
<td>259</td>
<td>62.1 (11.8)</td>
<td>61.1 (0.4)</td>
<td>106</td>
<td>59.3 (11.5)</td>
</tr>
<tr>
<td>9</td>
<td>61</td>
<td>39.6 (7.0)</td>
<td>38.0 (0.8)</td>
<td>304</td>
<td>32.4 (6.6)</td>
</tr>
</tbody>
</table>

Results are reported as mean (SE) or rate (95% CI).
*With Bonferroni correction.
†Statistically significant (p < 0.05).
AD/AOD and Crowding


Figure 2. REPAC real-time situation status for a particular site (Foothills Medical Center). REPAC = Regional Emergency Patient Access and Coordination.

**Figure 3.** EMS display screen. EMS choose from the priority column, which incorporates site status and avoidance and, if two sites are at the same status, calculates at a detailed level which site is of greater priority. EMS Park is an area that is set aside to receive patients transported to the ED via EMS when treatment beds are not available for them. EMS patients remain in EMS Park until they are placed in the transfer-of-care area or are moved into a treatment location within the ED. PLC = Peter Lougheed Center; FMC = Foothills Medical Center; RGH = Rockyview General Hospital.

Table 2
Primary Outcomes: Avoidance and Favorable Status Both Preimplementation of REPAC and in Both Post Phases

<table>
<thead>
<tr>
<th></th>
<th>April to September 2008, Pre</th>
<th>October 2008 to March 2009, Post1</th>
<th>April to September 2009, Post2</th>
<th>Statistical Significance for Three-way Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of hours on avoidance</td>
<td>198</td>
<td>83</td>
<td>27</td>
<td>p &lt; 0.001</td>
</tr>
<tr>
<td>% of total time on avoidance</td>
<td>0.7</td>
<td>0.3</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>% of time on favorable status</td>
<td>57.5</td>
<td>64.1</td>
<td>78.7</td>
<td>p &lt; 0.001</td>
</tr>
</tbody>
</table>

REPAC = Regional Emergency Patient Access and Coordination.
AD/AOD and Crowding

  - Before and after diversion ban
    - Ambulance Turn-around-time unchanged
      - Not same as offload
    - ED LOS for patients unchanged as well
The Big Picture

• EDs are concerned that crowding is “unsafe”
• EMS system is a critical part of the safety net
  ➢ need to get units back in service as quickly as possible
• Dropoff delay the critical factor in getting units back in service (rest of Turn-Around-Time can be controlled)
• EMS providers should not be held up at hospitals caring for patients
• EMTALA violation for hospital to not accept patient
Position Statement

Position Statement: Ambulance Diversion and Emergency Department Offload Delay

The National Association of EMS Physicians® believes that:

• EMS systems, and their patients, are significantly impacted by emergency department (ED) crowding.
• Despite previous statements, no data support that there is direct patient harm from organized systems of ambulance diversion in a modern EMS system. In addition, ambulance diversion has not been shown to improve ED patient throughput.
• Protocols designed to limit diversion may lead to an increase in ED offload delay, the interval between hospital arrival and transfer of the patient from the ambulance stretcher and assumption of care by ED staff.
• ED and hospital leadership should work with the EMS agencies and system leadership to limit the time that ambulances are out of service due to diversion or offload delay.
• Overall improvement of ED crowding by hospital throughput initiatives will likely decrease both ED offload delay and hours on diversion.
• Surveillance and communication of ED offload delay, diversion status and other factors related to ED crowding should be employed throughout the EMS system.
• Regular review of benchmarks should be used to guide local system and institutional initiatives.
• Regulators, accrediting bodies, and quality improvement organizations should track ED crowding benchmarks.
AOD: a Quality Marker

- Ambulance offload delay represents a delay in patient care
- In some states EMS providers are not allowed to care for patients inside the hospital
- Patient satisfaction and privacy at risk during AOD
- EMTALA in opposition to AOD
- AOD will be forwarded to JCAHO and DNV
AOD: a Quality Marker

• Where to set the bar?
  – Establishing a baseline
  – Evaluating the risk
  – Considering a goal

• Available data suggests
  – <15 minute ideal (90% of the time) = high quality
  – >60 minute = reportable incident
Future Study

- Identify risk factors related to increased AOD
  - NEDOCS scoring (ED Crowding)
  - ??? Other factors
  - Patient specific
  - Staffing specific
  - Facility specific
Future Study

• Quantify effects on EMS System
  – UHU
  – Response times
  – Provider satisfaction / attrition
Future Study

• Evaluate the cost of AOD
  – EMS System – UHU decline
  – ED/hospital – cost of interventions
  – Patients
    • morbidity/mortality
    • patient satisfaction
Future Strategies

• Identify interventions
  – Offload nurse/provider (Canada)
  – Prehospital dashboard of system hospitals
  – ED bed assignment prior to arrival
  – NEDOCS score triggers throughput response
  – Ambulance Diversion
    • Based on NEDOCS score or AOD
    • Limitations
      – Time limits?
      – Type of patients?
      – Built-in reassessment triggers AD off
  – Hospital throughput initiatives
    • General improvement in performance
Thanks...
Key Points

• Ambulance diversion may be a useful tool if utilized judicially and in context with hospital throughput advancement
• Ambulance offload delay is an evolving marker of ED patient care quality
• AOD and AD are inter-related and hospital throughput is a key causative factor
• AOD represents a real and potential delay in patient care
  – In the ED
  – In the prehospital environment
• Further study is needed