Research into ED Access Block

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University of Calgary and Calgary Health Region
Research Into Access Block

• Published Research
  – The causes
  – The Solutions

• Some grey literature

• Data that makes a difference

• Measuring and reporting operational change
  – Ex. ED Intake strategies
  – Ex. Overcapacity (full capacity) protocols

• Limitations of the research, and directions for future work
Conceptions and misconceptions

The problem is **input**. We need . . .
- Better preventive care and chronic disease management
- Better primary care access

The problem is **outflow**. We need . . .
- More inpatient capacity
- More community capacity
- Greater inpatient and community efficiency

The problem is **throughput**. We need . . .
- To increase ED efficiency
- To move non-urgent patients to a more appropriate, cost-effective setting
The Causes of Access block

Commonly studied causes of ED overcrowding:

- nonurgent visits,
- influenza season,
- inadequate staffing,
- inpatient boarding (and hospital bed shortages).
Independent hospital surveys and qualitative focus groups

Main causes:
- Inability to move admitted patients to inpatient beds
- Lack of critical care beds

Contributing causes:
- Increasing patient complexity,
- ED’s changing role (more investigation and prolonged treatment to avoid hospitalization)
- Staff shortages
- Poor access to home care, diagnostic testing, social services and specialist care

<Lewin, GAO, Estey, Schull>
Inflow of low acuity patients?

Low Acuity Patient: a pt that a GP would not refer to an ED.

- Correlated ambulance diversion hours with LAP ED visits

Results:

- Inverse correlation for LAP rates & ambulance diversion
- Strategies to reduce LAP attendance are unlikely to reduce ambulance diversion

Impact of non-urgent patients in a Canadian Tertiary Care Centre

- 23,573 consecutive ED visits
- ~7000 were non-urgent; 202 of these went to staffed stretchers, 82/202 were hospitalized
- 120 non-urgent pts (1.7%) went to an acute stretcher & were discharged: ~ 2.7% of ED acute care capacity
- Of 4336 patients who required admission, 316 (7.3%) came from non-urgent triage categories
- Non-urgent patient diversion would free up 2.7% of ED capacity, but lead to a 7.3% “miss rate” for patients requiring hospital care
**Inflow:** Do non-urgent patients cause ED overcrowding?

- Non-urgent patients consume a small fraction of ED resources, generate minimal incremental costs, and do not displace sick patients who need emergency care.

- Non urgent ED use may lead to overcrowding in the waiting room, but not in ED treatment areas."

*ACEP report on overcrowding*
**Inflow** (of urgent patients)

- Correlated patient inflow (EMS vs ambulatory) with ambulance diversion over 1 year

- Ambulance-patient volume was associated with increased diversion; walk-in patient volume was not

**Conclusion**: Admitted patients in the ED are important determinants of ambulance diversion. Reducing walk-in patient volume is unlikely to reduce diversion.
ED Outflow: Hospital Occupancy

- Six year database study of hospital occupancy vs. ED care delays
- ED length of stay (LOS) increased dramatically when hospital occupancy exceeded 90%.

Conclusion: Hospital occupancy is strongly associated with ED LOS (we need more beds).

<Forster, Stiell>
Computer simulation modeling

- ED crowding related to hospital **occupancy rates**
- Risks discernible when bed occupancy >85%.
- Regular bed shortages and periodic crises if >90%

  <Massachusetts Department of Public Health>
  <Bagust, British Medical Journal>
  <Vertesi, Vancouver Coastal Health Modeling Data>

- No hospitals with an occupancy rate above 84% met the 8 hour performance benchmark for access block

  <Government of New South Wales>
ED *outflow* and hospital capacity

**Methods:** Prospective documentation of arrival volume, ED occupancy, and reasons for prolonged ED stay

**Results:** Arrival volume similar in crowded and non-crowded periods. Main delay was *patient waits for hospital beds*

**Conclusion:** Politicians and administrators should not focus on inappropriate ED visits, but rather assure there are enough resources to provide timely hospital care for those who need it

*<Espinosa, et al>*

- Study replicated by *Sanchez*: Same findings
MPH Ambulance Diversion Study

• Prospective hourly ED data for 6-weeks (8000 pts)
• Correlated EMS diversion with hospital utilization data

Three a priori hypotheses were tested:

1. ED *arrival rate is too high*, leading to overcrowding

2. ED *processing is inefficient*, causing backups

3. There are not enough hospital beds to accommodate admissions, leading to a *back-up of admitted patients*
MPH Study Results: *Inflow or outflow?*

**ED Inflow and EMS Diversion?**
- No correlation between inflow and diversion ($r = 0.076$)
- No correl’n between “non-boarding” ED census & diversn ($r = -0.051$)

**ED Outflow and EMS Diversion:**
- Strong relationship between # of boarded pts and diversion ($r = 0.812$)

**Conclusions:**
- ED inflow volume is not an important causative factor of diversion
- *Lack of inpatient capacity* is the most important factor
Access block, ED overcrowding and ambulance diversion

Methods: A 2-yr Australian study of ED workload, EMS diversion, overcrowding, and ED waiting times (to MD).

Results: Access block ED occupancy (the % of ED occupied by boarded patients) strongly correlates with:

- ED crowding \((r = 0.96)\),
- ambulance diversion \((r=0.75)\)
- ED waiting times for care \((r = 0.83)\).

Total ED volume and low acuity patient visits were not associated with ambulance diversion.

Solutions to Overcrowding

Commonly studied solutions for ED overcrowding:

- ambulance diversion,
- Ambulatory patient diversion,
- observation units,
- hospital bed access strategies
Reducing Inflow: Do after-hours clinics reduce low acuity patient visits

- Database study at seven Perth hospitals
- Low acuity patients ~8.2% of ED inflow
- Used only 2.5% of ED resources
- Excess LAP cost: $142k /hospital/yr ($41/hr)
- After-hours GP clinics would be more expensive,
- Diversion of LAP would not relieve ED pressures.

Reducing inflow with extended hours primary care emergency centers

**Methods:** These investigators studied ED volume and case mix before and one year after the introduction of nearby primary care emergency centres (PCEC).

**Results:**
- No difference in ED volume/case mix
- Fewer pts consulted their GP

**Conclusion:** PCEC services may compete more with 1o care providers than with emergency departments

<Stoddart>
Universal influenza immunization to reduce ED demand?

**Background**: In 2000 the Ontario MOH launched a universal influenza vaccination program to decrease the impact of influenza on ED visits.

**Results**:
- Influenza rates fell and ED visits rose.
- No correlation between influenza rates and ED volume

**Conclusion**: Universal flu immunization is a good public health policy but is unlikely to reduce ED volumes

Groll and Henry. 2002
Summary of Evidence

- **INFLOW** of low urgency pts does not cause access block
- **THROUGHPUT** (ED efficiency) is a limited concern
- Compromised **OUTFLOW** of admitted (boarded) patients is the main causal factor
- *Access block ED occupancy* may be used as a single variable to predict ED access block
Grey Literature

- Not controlled by commercial publishers
- Not easily found through conventional methods
- Limited or ill-defined peer review
- Lower quality? (but sometimes higher impact)
  - Conference proceedings,
  - Newsletters, technical reports, working papers, etc
  - Abstracts and unpublished studies
  - Operational data
Canadian ED Directors:

- ED overcrowding (in their facilities) is a severe problem.
- ED overcrowding has a serious or major negative impact on:
  - stress level among nurses,
  - nursing staff recruitment and retention,
  - ED staff satisfaction, and
  - stress among physicians.
Evidence of Benefit:
• Fast track reduces wait time, LWBS and EDLOS

Likely benefit:
• EMS diversion, CDU, MD staff, system-wide interventions

No benefit:
• Triage, homecare workers in the ED, overcapacity on the wards, overload units for inpatients

NOTE: Study Quality generally low
ACEP: High Impact Solutions

What Works in the hospital?
• OCP/FCP, Discharge Planning, Smoothing:

What Works in the ED?
• Match ED staffing to demand, Fast Track, CDU

What Works up-front?
• Minimize triage, Triage MD, Close the waiting room
What doesn’t work?

• Expanded emergency departments
• More hospital beds
• Discharge lounges
• Hospitalists
• Ambulance diversion

*More community care spaces?
Data that makes a difference
(Data that drives decisions)
Recent comment from an administrator

“Oh No!! . . . . More data.”
Research Question (Inflow):
Why are there no ED stretchers available to admit patients to?

In 2010, admitted patients occupied 8,760,000 hours of ED stretcher and nursing time (24,000 pt days) waiting for an inpatient bed.
Areas for future research:

- *Do we need to worry about this?*

- *Is it true that the Canadian Healthcare system is “second to none?”*
Research Question (Inflow):

What proportion of ED stretchers are blocked (unavailable for emergency care)?

Total N=51 stretchers
Areas for future research:

Try to determine what other units are 60-70% occupied by patients awaiting downstream placement?
Research Question (Safety): Is this really a problem? Does access block cause safety concerns for patients?

Figure 1: Safety Learning Reports by Location

Conclusion: A disproportionate % of safety events occur in the ED
Research Question (Outflow):
*Why are there no hospital beds available to admit patients to?*

**Increasing ALC Days in Calgary Hospitals: 1999-2009**

- 60,000 ALC Days
- 1.44 million bed hrs; >400,000 ED pts
Hypothesis generated:
- Is this a problem?
- Will it affect access to acute care?
- Should someone do something about this?
"If we get rid of the patients with sprained ankles, our problem will be solved."  

Myth Busted!
Research Question (Outflow):

“If we just improve outflow of admitted patients, our problem will be solved.”

Hospital B: Impact of Improved Outflow on Block Rate

- No visits removed, LOS as is
- No visits removed, max ED LOS = 6h
- No visits removed, max ED LOS = 10h

90% Access / 10% Block

26 stretchers

29 stretchers

38 stretchers

12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48

0% 20% 40% 60% 80% 100% 120%

Block rate

Stretcher
Research Question (Outflow):

Do admission delays lead to longer hospital lengths of stay?

RVH Hospital Data-2009

LOS (hrs)

Time from Triage to admission order

Mean Hospital LOS

P<0.001
Research Question (Outflow):

*Can ED access block be solved without a huge increase in hospital bed base?*

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St. Paul's Hospital

**Patients in the ED**

**Physical stretchers**

<table>
<thead>
<tr>
<th></th>
<th>Sunday</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
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<tbody>
<tr>
<td>6:00</td>
<td>30</td>
<td>20</td>
<td>15</td>
<td>25</td>
<td>15</td>
<td>20</td>
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<td>12:00</td>
<td>40</td>
<td>30</td>
<td>25</td>
<td>30</td>
<td>25</td>
<td>30</td>
<td>25</td>
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<tr>
<td>18:00</td>
<td>50</td>
<td>40</td>
<td>35</td>
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</tbody>
</table>
Conclusion: If we could improve outflow rates (moving the same patients to existing beds) we would profoundly reduce ED access block
Research Question: Can you quantify your access block problem?

<table>
<thead>
<tr>
<th></th>
<th>FMC  n=67301</th>
<th>PLC  n=72087</th>
<th>RGH  n=66280</th>
<th>Total n=205668</th>
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</thead>
<tbody>
<tr>
<td>Mean Hrs</td>
<td>1.8</td>
<td>1.55</td>
<td>1.57</td>
<td>1.64</td>
</tr>
<tr>
<td>N</td>
<td>46,629</td>
<td>44,279</td>
<td>49,631</td>
<td>140,539</td>
</tr>
<tr>
<td>Total Hrs</td>
<td>84,080</td>
<td>68,802</td>
<td>77,871</td>
<td>230765</td>
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Conclusion: CTAS 1-3 emergent and urgent patients spent 231,000 hours in Calgary ED waiting rooms in 2008
Research Question:

How big is the access block problem relative to the system’s ability to address it (i.e. acute capacity)?

Emergency Access Block

(CTAS 1-3 WR time)

80,000 hrs
FMC Funded Care Hours:
8,000,000 care hours!!!

Emergency Access Block: 80,000 hrs
**Conclusion:**
The level of access block is small relative to the level of system resources available to address it.

**Hypothesis generated:**
A 1-2 % improvement in efficiency/hospital LOS would make a profound difference in emergency and acute care access.
Measuring and Reporting Operational Change

Waiting Room Care? vs. Close the Waiting Room?
Research Question (Inflow):
What are you doing to assure pt access despite limited stretcher availability?

Number of Patients Seen in WRs & WRC/Intake Areas at Adult EDs

Incl. Main ED WRs, WRC and Intake areas

Phase 1: WR Care: 3/09-3/10

25% of CTAS 2 and 50% of CTAS 3 patients seen in WR or intake spaces adjacent to the ED

Phase 2: Triage in – Intake zones
Conclusion:
We are standing on our heads! What are other programs doing to assure patient access despite limited bed availability?
Research Question (Inflow):  
Do novel intake strategies reduce patient time in waiting rooms?
Research Question (Inflow):
Do novel intake strategies reduce patient wait time to see a physician?

P<0.001
Research Question (Inflow):

Do novel intake strategies reduce patient time in waiting rooms?

LWBS Rate – CTAS 1-3

P<0.001
Measuring and Reporting Operational Change

Implementation of Full Capacity (Overcapacity) Care Plans
Question from a CEO
(upon agreeing to implement the Overcapacity Plan)

“This better work!”
St. Paul’s Hospital (VCH)

Before OCP
Research Question (Outflow):

Does a hospital overcapacity protocol reduce EMS offload delays?

<table>
<thead>
<tr>
<th>Time Interval</th>
<th>FHA Hrs/d</th>
<th>VCH Hrs/d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-12 mo</td>
<td>42.5</td>
<td>20</td>
</tr>
<tr>
<td>Pre-6 mo</td>
<td>45.6</td>
<td>22</td>
</tr>
<tr>
<td>Post-6 mo</td>
<td>47.1</td>
<td>23.2</td>
</tr>
</tbody>
</table>

P < 0.001
Conclusion:

- EMS offload delays fell immediately after OCP Implementation

- EMS offload delays increased in nearby hospitals without OCP
Research Question (Outflow):
*What impact does an OCP have on ED and hospital lengths of stay?*

<table>
<thead>
<tr>
<th>OUTCOMES:</th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>ED LOS for ADM pts (hrs): MED</td>
<td>20.2</td>
<td>11.2</td>
</tr>
<tr>
<td>ED LOS for ADM pts (hrs): SURG</td>
<td>9.2</td>
<td>7.6</td>
</tr>
<tr>
<td>ED LOS for ADM pts (hrs): PSYCH</td>
<td>56.3</td>
<td>47.1</td>
</tr>
<tr>
<td>ADM-to-bed xfer delay (hrs): MED</td>
<td>11.1</td>
<td>3.3</td>
</tr>
<tr>
<td>ADM-to-bed xfer delay (hrs): SURG</td>
<td>3.6</td>
<td>2.1</td>
</tr>
<tr>
<td>ADM-to-bed xfer delay (hrs): PSYCH</td>
<td>54.3</td>
<td>41.8</td>
</tr>
<tr>
<td>Hosp LOS for typical pts (days): MED</td>
<td>7.7</td>
<td>6.7</td>
</tr>
<tr>
<td>Hosp LOS for typical pts (days): SRG</td>
<td>4.5</td>
<td>3.7</td>
</tr>
<tr>
<td>Hosp LOS for typical pts (days): PSYCH</td>
<td>12.8</td>
<td>12.0</td>
</tr>
<tr>
<td>ED LOS for Discharged pts (hrs)</td>
<td>3.0</td>
<td>3.2</td>
</tr>
</tbody>
</table>
Conclusion:
-45% reduction in ED Length of Stay for admitted patients

-1-day reduction in hospital Length of Stay for Medical Patients
EDLOS for admitted medical pts

SPH - Average ED Waiting Times for ED Patients Admitted to Medicine/Ambulatory Program

Time (hours)

P<0.001

Fiscal Period

Triage - Consult Request
Consult Request to Decision to Admit
Decision to Admit - Leave ED

Data source: NERD, SCM
EDLOS for admitted cardiac pts

SPH - Average ED Waiting Times for ED Patients Admitted to Heart Centre Program

Time from admit order to ward transfer

OCP in Effect

P<0.001

Data source: NERD, SCM
EDLOS for admitted Surgery pts

SPH - Average ED Waiting Times for ED Patients Admitted to Surgery Prog

Time from admit order to ward transfer

Data source: NERD, SCM

P<0.001
Implementation of the Alberta Provincial OCP Protocol (Dec. 2011)
Recent question from a CEO
(upon agreeing to implement the Overcapacity Plan)

“This better work!”
Research Question (Outflow):

Can OCP success be replicated in another jurisdiction on a larger scale?

**Median Total Length of Stay for Admitted ED Patients**

<table>
<thead>
<tr>
<th></th>
<th>Jan '10</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan '11</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
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<tbody>
<tr>
<td>FMC</td>
<td>11.6</td>
<td>11.7</td>
<td>12.9</td>
<td>11.9</td>
<td>12.08</td>
<td>13.22</td>
<td>9.9</td>
<td>10.63</td>
<td>14.4</td>
<td>10.92</td>
<td>10.92</td>
<td>11.13</td>
<td>8.68</td>
<td>8.91</td>
<td>9.17</td>
<td>8</td>
</tr>
</tbody>
</table>

*P*<0.001
Research Question (Outflow):

Does OCP reduce ED Length of Stay for Admitted Patients?

![Chart showing ED Length of Stay comparison between Mar '10 and Mar '11 for FMC, PLC, and RGH.](chart.png)

- **FMC**
  - Mar '10: [Value]
  - Mar '11: [Value]

- **PLC**
  - Mar '10: [Value]
  - Mar '11: [Value]

- **RGH**
  - Mar '10: [Value]
  - Mar '11: [Value]

P<0.001
OCP Outflow Measures:
Admit order to inpatient transfer

Mar '10
Mar '11

FMC
PLC
RGH

P<0.001
Research Question (Outflow):

Does OCP reduce the number of admitted patients boarding in the ED?

![Graph showing comparison of Mar '10 and Mar '11 across FMC, PLC, and RGH with P<0.001]
Research Question (Outflow):

What is the impact of OCP on ED Stretcher Block?

ED stretcher block = # Admitted + Consulted patients held at 10:00
Research Question (Inflow):
Does OCP reduce EMS offload delays?

% of EMS Transfer of Care within 30 Minutes

- FMC: 58% 58% 50.1 57% 57% 54% 71% 70% 53% 67% 67% 83% 80% 84% 82% 89%
- PLC: 48% 52% 42.2 49% 51% 49% 55% 58% 40% 57% 63% 79% 68% 69% 64% 69%
- RGH: 69% 73% 62.3 74% 71% 52% 62% 73% 56% 69% 72% 91% 79% 83% 83% 86%
- Target: 80% 80% 80% 80% 80% 80% 80% 80% 80% 80% 80% 80% 80% 80% 80% 80%

P<0.001
Research Question (Inflow):

*Does OCP increase EMS offload success within 30 minutes?*

![Bar chart showing percentage offload success for different hospitals and months.](chart.png)

- **FMC**: Mar '10: 50%; Mar '11: 60%
- **PLC**: Mar '10: 40%; Mar '11: 50%
- **RGH**: Mar '10: 30%; Mar '11: 80%

*P* < 0.001
Research Question (Inflow): Does OCP reduce Left Without Being Seen (LWBS) rates?

% of ED Visits Left Without Being Seen by Physician for CTAS 1-3

- FMC
- PLC
- RGH

Target

P<0.001
Research Question (Inflow):

*Does OCP reduce Left Without Being Seen (LWBS) rates?*

<table>
<thead>
<tr>
<th></th>
<th>Mar '10</th>
<th>FMC</th>
<th>PLC</th>
<th>RGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mar '10</td>
<td>4%</td>
<td>7%</td>
<td>8%</td>
<td>8%</td>
</tr>
<tr>
<td>Mar '11</td>
<td>3%</td>
<td>3%</td>
<td>4%</td>
<td>1%</td>
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</table>

*P*<0.001
Research Question (Outflow):  
*Does OCP reduce waiting time to physician?*

**Median Triage to MD Signups for CTAS 3 ED Visits**

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<tr>
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<th>Jan '10</th>
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<th>Jan '11</th>
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<tbody>
<tr>
<td>FMC</td>
<td>131</td>
<td>147</td>
<td>138</td>
<td>143</td>
<td>143</td>
<td>152</td>
<td>142</td>
<td>139</td>
<td>145</td>
<td>115</td>
<td>100.5</td>
<td>87</td>
<td>101</td>
<td>102</td>
<td>99</td>
<td>101</td>
</tr>
<tr>
<td>PLC</td>
<td>129</td>
<td>132</td>
<td>152</td>
<td>148</td>
<td>137</td>
<td>165</td>
<td>135</td>
<td>135</td>
<td>149.5</td>
<td>122</td>
<td>102</td>
<td>86</td>
<td>95</td>
<td>117</td>
<td>97</td>
<td>87</td>
</tr>
<tr>
<td>RGH</td>
<td>88</td>
<td>81</td>
<td>87</td>
<td>88</td>
<td>100</td>
<td>102</td>
<td>116</td>
<td>110</td>
<td>136</td>
<td>86</td>
<td>82</td>
<td>82</td>
<td>101.5</td>
<td>103</td>
<td>96.5</td>
<td>99</td>
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**Conclusion:** Interestingly, not by itself
CTAS 3 Wait time before/after OCP

- FMC: Mar '10 (P<0.001), Mar '11
- PLC: Mar '10 (P<0.001), Mar '11
- RGH: Mar '10, Mar '11
OCP Throughput Measures: ED Processing Time (Admitted Patients)

Median Triage to Consult Requested for Admitted Patients

<table>
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<tr>
<th>Jan '10</th>
<th>Feb</th>
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<th>Jan '11</th>
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<td>FMC</td>
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<td>RGH</td>
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</table>
Research Question (throughput):

Does OCP improve ED throughput (ED processing time for admitted patients)

Conclusion: Perhaps, but not impressively
Research Question (throughput):
Does OCP improve ED throughput (processing time for discharged patients)

Median Triage to Discharge for Discharged CTAS 1-3 Patients

<table>
<thead>
<tr>
<th>Month</th>
<th>FMC</th>
<th>PLC</th>
<th>RGH</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan '10</td>
<td>4.8</td>
<td>4.4</td>
<td>4.0</td>
<td>4.0</td>
</tr>
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Matching capacity to demand: a regional dashboard reduces EMS avoidance

**OBJECTIVES:** Can electronic destination selection (REPAC) enhance access and flow.

**METHODS:**
- REPAC captures real-time capacity and acuity data for all 3 adult Calgary EDs,
- Assigns next EMS pt based on favorable (green/yellow) or not (orange/red) status
- 6-months pre-, 6-months post, and 6-months post-post

**OUTCOMES:**
- % spent in favorable versus unfavorable status **and**
- EMS avoidances for all sites (% of time with a site on bypass).

**RESULTS:**
- More time in favorable status (57.5% vs. 64.1%) and (78.7% at 1 year).
- Fewer EMS avoidances: 4.4% to 1.8% (0.6% at 1 year)

**CONCLUSIONS:** Proactive EMS destination selection enhances capacity and flow management while reducing EMS diversions.

Limitations

• Variable compliance at different sites
• Hawthorne effect
• Cointerventions
• Temporal and seasonal trends
• Measurement is different at different sites
• Questionable data (e.g. Discharge times, MD sign-on)
• Data dredging /multiple outcomes (only what is available)
• All outcomes of interest? Not!
• No controls; no randomization or blinding
• Statistical significance with huge datasets?
• Potential for presenter bias
• Take heart: Remember the parachute study
Future Directions
Questions?