Emergency department overcrowding: Swiss application of the Emergency Department Work Index (EDWIN)

Aline Herzog

Attending physician
Emergency Department University Hospital Zurich, Switzerland

Background

Increasing emergency department visiting rates all over Switzerland

![Chart showing increase in emergency department visits]

Anzahl Konsultationen (ambulant und mit Hospitalisierung) in Schweizer Notfallstationen, 2007-2011

Abb. 1

<table>
<thead>
<tr>
<th>Year</th>
<th>Ambulant +32%</th>
<th>With hospitalization +16%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Quelle: Mobilitäts-Statistik der Einkommensberuf (EES) © Etzner und Staffel der SAAG AG, 2007-2011

Gesundheitsobservatorium, S. OBSAN Bulletin 2013

Emergency Department of the University Hospital Zurich

Overcrowding as a public health problem

Emergency department overcrowding is associated with:

- prolonged length of stay (ED-LOS)
- prolonged length of stay in hospital
- decreased quality of care / poor patient outcomes
- increased preventable errors
- delayed treatment

Risk factor for violence

How to assess overcrowding?

- Numerous validated scores (e.g. EDWIN, NEDOCS, CEDOCS, OI…)

- EDWIN (Emergency department work Index)
  - Validated and established score
  - real-time warning system


Emergency Department Work Index (EDWIN)

<table>
<thead>
<tr>
<th>Input</th>
<th>Throughput</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients per triage level</td>
<td>Number of emergency physicians</td>
<td>Patients waiting for in-house admission</td>
</tr>
<tr>
<td></td>
<td>Available treatment beds</td>
<td></td>
</tr>
</tbody>
</table>

Occupancy Index (OI)

- the ration between the total number of inpatients in the ED and the total number of ED treatment beds
- Simple!
- Accurate instrument to describe ED overcrowding
- Not ideal but a feasible assessment of crowding

Aim

- To assess the applicability of the EDWIN in a Swiss ED
- To investigate further predictors for ED overcrowding
- To evaluate the OI (occupancy index) as an instrument to describe the crowding in our emergency department.
Methods

Retrospective data collection from Dec. 1st. to Dec 31st. 2016:

Following data elements were extracted from the clinical information system at every full hour and during 31 days:
• number of patient in each triage level
• number of patients in isolation due to an infectious disease
• number of patients admitting in beds
• longest waiting time for admitting
• number of patients in the waiting room and the longest waiting time in waiting room

No patient data was collected!

EDWIN (emergency department work index)

$$\sum n_i t_i / N_a (B_T - B_A)$$

$n_i$ = number of patients in the ED in triage category $i$
$t_i$ = triage category
$N_a$ = number of attending physicians on duty
$B_T$ = the number of treatment beds
$B_A$ = total number of admitted patients in the ED.
**EDWIN scale**

0 to 1.5 = “active but manageable”
1.5 - 2.0 = “very busy but not overcrowded”
>2 = “extremely busy and severely overcrowded”

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**Methods**

**Occupancy index (OI)** = total patients in ED / total number of treatment beds

e.g. 25 total patients in ED
  20 treatment beds (blue print)
  OI = 1.25
Results

<table>
<thead>
<tr>
<th>EDWIN/hr</th>
<th>Number of observations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N = 744</td>
</tr>
<tr>
<td>-0 -1.4</td>
<td>394 (53.0%)</td>
</tr>
<tr>
<td>-1.5 -2.0</td>
<td>189 (25.4%)</td>
</tr>
<tr>
<td>-&gt; 2.0</td>
<td>161 (21.6%)</td>
</tr>
<tr>
<td>Occupancy Index</td>
<td></td>
</tr>
<tr>
<td>-&lt;1</td>
<td>0.7 (0.3)</td>
</tr>
<tr>
<td>=1</td>
<td>566 (76.1%)</td>
</tr>
<tr>
<td>&gt;1</td>
<td>139 (18.7%)</td>
</tr>
</tbody>
</table>

All results were reported as mean (standard deviation) or median (interquartile range).

- In average, the ED was severely overcrowded 6 times per day (EDWIN)

EDWIN and OI during the day

Strong correlation between EDWIN and OI (rho 0.69, p<0.001)
Results

<table>
<thead>
<tr>
<th></th>
<th>Number of observations N =744</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of patients in the ED</strong></td>
<td></td>
</tr>
<tr>
<td>• During week (Monday to Friday 5 pm)</td>
<td>15 (7)</td>
</tr>
<tr>
<td>• During weekend (Friday 5 pm to Sunday)</td>
<td>14 (7)</td>
</tr>
<tr>
<td>• During weekend (Friday 5 pm to Sunday)</td>
<td>17 (6)</td>
</tr>
<tr>
<td><strong>Maximal waiting time for inhouse admission (minutes)</strong></td>
<td>45 (20 -85)</td>
</tr>
<tr>
<td><strong>Maximal waiting time of patients for the ED treatment (minutes)</strong></td>
<td></td>
</tr>
<tr>
<td>• Of all</td>
<td>21 (0 – 57)</td>
</tr>
<tr>
<td>• Only of those who are waiting</td>
<td>39 (17– 72.5)</td>
</tr>
</tbody>
</table>

**ESI categories during the day**

[Diagram showing ESI categories during the day]
Prediction of overcrowding

<table>
<thead>
<tr>
<th></th>
<th>EDWIN ≤ 2 N = 583 (78.4%)</th>
<th>EDWIN &gt;2 N = 161 (21.6%)</th>
<th>Adjusted difference (95% CI, p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Attendings</td>
<td>2 (1 – 2)</td>
<td>1 (1 – 1)</td>
<td>-0.6 (-0.7 to -0.5, p&lt;0.001)</td>
</tr>
<tr>
<td>Number of patients in the ED</td>
<td>14 (7)</td>
<td>17 (5)</td>
<td>4.8 (3.6 – 5.6, p&lt;0.001)</td>
</tr>
<tr>
<td>Number of patients waiting for hospital admission</td>
<td>0 (0 – 1)</td>
<td>1 (0 - 2)</td>
<td>0.5 (0.4 – 0.7, p&lt;0.001)</td>
</tr>
<tr>
<td>Weekend (%)</td>
<td>162 (27.8%)</td>
<td>85 (52.8%)</td>
<td>3.5 (2.4 – 5.2, p&lt;0.001)</td>
</tr>
<tr>
<td>Isolation (%)</td>
<td>315 (54.0%)</td>
<td>114 (70.8%)</td>
<td>2.4 (1.6 – 3.6, p&lt;0.001)</td>
</tr>
</tbody>
</table>

CI = Confidence Interval; OR = Odds ratio, ED = Emergency Department; all results were adjusted for possible confounders such as time of day

Conclusion

The EDWIN was easily applicable in a tertiary care Swiss ED

In 21.6% of time the ED severely overcrowded
  • During the week: mainly between 11pm and 1am
  • During weekend: mainly between 8pm to 5am

The highest EDWIN was reported on weekend

Identification of predictors for overcrowding
  • number of attending physicians, patients in the treatment area, patients in bed waiting for hospital admission, isolated patients due to infection diseases

Strong correlation between EDWIN and OI (rho 0.69, p<0.001), the OI was unable to map the situation in the ED!
Thank you

Besten Dank

Merci beaucoup