Elderly in the Emergency Department – At Risk of Undertriage?

Christian Nickel
Emergency Department, University Hospital Basel, Switzerland
Demographics

Anti-Aging:
old = who hasn`t prevented getting old…

Young old, middle old, old old

Casanova * 2.4.1725; † 4.6.1798

Norway 2006
Dr. Paal Naals, Geriatrician
Healthy degree of paranoia - Outcomes

- Return visits, often with the same problem
  [Aminzadeh F et al. 2002]

- Functional decline, dependence, institutionalization
  [McCusker et al. 2001]

- Misdiagnosis, high admission rates and death
  [Samaras N et al. 2010, Aminzadeh F et al. 2002]
Elderly in the ED... – What are the problems?

- communication problems [Rogers et al. 2009]

- „atypical presentation“ of common diseases [Salvi et al. 2007]


- complex combination of medical & social problems [Shanley et al. 2009]

Are elderly ED patients at risk of undertriage?
Emergency Severity Index

1. does the patient require immediate life-saving intervention?

2. is it a high risk situation or is the patient confused/lethargic/disoriented or is there severe pain/distress?

3. how many different resources are needed?
   - none
   - one
   - many

4. consider danger zone vitals:
   - <3 m <180 <50
   - 3-8 m >180 >50
   - >8

5. if yes, proceed to step 3; if no, proceed to step 4.
Emergency Severity Index – 4 decision points

1. A Life-saving intervention required?
   - NO
   2. B Shouldn`t wait?
      - NO
   3. C How many resources?
      - NONE
      - ONE
      - MANY
   4. D danger zone
      - NO
   5. NO
### Emergency Severity Index

**danger zone vitals?**

<table>
<thead>
<tr>
<th>Alter</th>
<th>HF</th>
<th>AF</th>
<th>SpO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 3 M</td>
<td>&gt; 180</td>
<td>&gt; 50</td>
<td></td>
</tr>
<tr>
<td>3M-3J</td>
<td>&gt; 160</td>
<td>&gt; 40</td>
<td></td>
</tr>
<tr>
<td>3-8J</td>
<td>&gt; 140</td>
<td>&gt; 30</td>
<td>&lt; 92%</td>
</tr>
<tr>
<td>&gt;8J</td>
<td>&gt; 100</td>
<td>&gt; 20</td>
<td></td>
</tr>
</tbody>
</table>

- **no**  (not in danger zone)
- **consider**
- **3**
Emergency Severity Index

Interrater Reliability

Do 2 experts agree on a given ESI level?

Predictive Validity

Disposition, resources, ED LOS, and mortality
**Reliability:** cross-classification between experts

\[
\begin{array}{ccccccc}
\text{Expert 1 ESI Score} & 1 & 2 & 3 & 4 & 5 & \text{Total} \\
\text{Expert 2 ESI Score} & \text{22} & \text{0} & \text{0} & \text{0} & \text{0} & \text{22} \\
1 & \text{1} & \text{29} & \text{0} & \text{0} & \text{0} & \text{30} \\
2 & \text{0} & \text{0} & \text{22} & \text{2} & \text{0} & \text{24} \\
3 & \text{0} & \text{0} & \text{3} & \text{25} & \text{1} & \text{29} \\
4 & \text{0} & \text{0} & \text{0} & \text{0} & \text{20} & \text{20} \\
5 & \text{23} & \text{29} & \text{25} & \text{27} & \text{21} & \text{125} \\
\end{array}
\]

(random sample out of total n = 2211 / 30d)

\[\kappa = 0.985\]
95% CI [0.973; 0.997]

Grossmann FF, Nickel CH, Christ M, Schneider K, Spirig R, Bingisser R
Validity: survival

[n = 2211 / 30d]

log-rank
\[ \chi^2 = 36.06 \]
\[ df = 3; p < 0.001 \]
Elderly ED patients - at risk of undertriage?

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>N</th>
<th>72/79/84</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y</td>
<td>519</td>
<td></td>
</tr>
<tr>
<td>Sex, male, % (frequency)</td>
<td>519</td>
<td>45.9 (237)</td>
</tr>
<tr>
<td>ESI level, % (frequency)</td>
<td>519</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>1.3 (7)</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>18.7 (97)</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>57.2 (297)</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>20.8 (108)</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>1.9 (10)</td>
</tr>
</tbody>
</table>

[519 elderly out of n = 2211 / 30d]
Reliability in elderly: Experts and triage nurse

<table>
<thead>
<tr>
<th>experts' ESI level</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>85</td>
<td>86</td>
<td>1</td>
<td>0</td>
<td>173</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>10</td>
<td>208</td>
<td>25</td>
<td>1</td>
<td>244</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>80</td>
<td>1</td>
<td>83</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>total</td>
<td>7</td>
<td>97</td>
<td>297</td>
<td>108</td>
<td>10</td>
<td>519</td>
</tr>
</tbody>
</table>

Undertriage ESI 3 versus 2

Undertriage ESI 4 versus 3
**Validity:**

\[ \tau = 0.452 \ (95\% \ CI \ [-0.516, -0.387]) \]

**Disposition:** \[ \chi^2 = 92.5, \ df = 4, \ p < 0.001 \]

Reasons for undertriage

\[ n = 519 \text{ elderly} \]
\[ 117 \text{ patients untertriaged} \]

**High Risk (B)**
- 29 (24.8%)
  - In comb w abnorm v s 4 (3.4%)
  - in comb w pain/dist 3 (2.6%)
  \[ = 30.8\% \]

**Vital Signs (D)**
- 20 (17.1%)
  - In comb w high risk 4 (3.4%)
  - in comb w pain/dist 3 (2.6%)
  \[ = 23.1\% \]

**Resources (C)**
- 25
  \[ = 21.4\% \]
Vital signs in the elderly….

serious disease is possible in patients with subtle vital sign changes

Conclusions:

- Elderly ED patients are at risk of undertriage (vital signs, high risk situation)
- When correctly applied - the ESI is a reliable, valid, and accurate triage tool for elderly patients.
The **ESI65** Study Group

Florian Grossmann MSc.RN, Basel  
Anna Frauchiger cand. med., Basel  
Thomas Zumbrunn MSc., CTU, Basel  
Karen Delport MD, Basel  
Roland Bingisser MD, Basel

**Contact:**  
Christian Nickel MD  
nickelc@uhbs.ch
Comparison of results in patients < 65 vs > 65 y/o

<table>
<thead>
<tr>
<th>ESI level, % (frequency)</th>
<th>Patients Aged ≥65 Years (N=519)</th>
<th>Patients Aged &lt;65 Years (N=1,559)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.3 (7)</td>
<td>1.0 (15)</td>
</tr>
<tr>
<td>2</td>
<td>18.7 (97)</td>
<td>8.5 (132)</td>
</tr>
<tr>
<td>3</td>
<td>57.2 (297)</td>
<td>35.2 (548)</td>
</tr>
<tr>
<td>4</td>
<td>20.8 (108)</td>
<td>51.3 (800)</td>
</tr>
<tr>
<td>5</td>
<td>1.9 (10)</td>
<td>4.1 (64)</td>
</tr>
</tbody>
</table>

Association of ESI level with
- Resource consumption: $p = -0.449$, 95% CI −0.519 to −0.379
- Disposition: $\tau = -0.452$, 95% CI −0.516 to −0.387
- ED length of stay: $\chi^2 = 92.5, df = 4, P < .001$
- Hospital length of stay: $\chi^2 = 4.5, df = 3, P = .21$
- Survival: $\chi^2 = 37.04, df = 3, P < .001$
- AUC for the ability to predict
  - Admission in general: AUC = 0.741, 95% CI 0.734 to 0.747
  - Admission to an ICU: AUC = 0.749, 95% CI 0.727 to 0.770

AUC, area under the curve.
*This table shows distributions of ESI levels and results of the validity tests.*

Total n = 2211 / 30d

## Reasons for undertriage

<table>
<thead>
<tr>
<th>Reason</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lifesaving intervention required</td>
<td>4</td>
<td>3.4</td>
</tr>
<tr>
<td>High-risk situation</td>
<td>29</td>
<td>24.8</td>
</tr>
<tr>
<td>Confused/lethargic/disoriented</td>
<td>3</td>
<td>2.6</td>
</tr>
<tr>
<td>Severe pain/distress</td>
<td>17</td>
<td>14.5</td>
</tr>
<tr>
<td>Resources</td>
<td>25</td>
<td>21.4</td>
</tr>
<tr>
<td>Vital signs in danger zone</td>
<td>20</td>
<td>17.1</td>
</tr>
<tr>
<td>Severe pain/distress + vital signs in danger zone</td>
<td>3</td>
<td>2.6</td>
</tr>
<tr>
<td>High risk situation + vital signs in danger zone</td>
<td>4</td>
<td>3.4</td>
</tr>
<tr>
<td>Severe pain/distress + high risk situation</td>
<td>3</td>
<td>2.6</td>
</tr>
<tr>
<td>Confused/lethargic/disoriented + vital signs in danger zone</td>
<td>1</td>
<td>0.9</td>
</tr>
<tr>
<td>Unknown</td>
<td>8</td>
<td>6.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>117</strong></td>
<td>100.0</td>
</tr>
</tbody>
</table>

*Undertriage was defined as cases in which the ESI level assigned by the triage nurse was higher (indicating lower acuity) than the experts’ retrospectively assigned consensual ESI level. Experts were blinded both to the ESI level assigned by the triage nurse and to any other patient outcome. Percentages do not add to 100% because of rounding.*

Do patients with ESI 1 receive a life-saving intervention?

Are patients, who receive a LSI triaged ESI 1?

<table>
<thead>
<tr>
<th>ESI level</th>
<th>immediate life-saving intervention received</th>
<th>immediate life-saving intervention not received</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>92</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>295</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>108</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>10</td>
</tr>
</tbody>
</table>
Sample characteristics (n = 2114)

- No. patients: 2114

<table>
<thead>
<tr>
<th>ESI category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.0%</td>
</tr>
<tr>
<td>2</td>
<td>11.1%</td>
</tr>
<tr>
<td>3</td>
<td>40.4%</td>
</tr>
<tr>
<td>4</td>
<td>44.0%</td>
</tr>
<tr>
<td>5</td>
<td>3.4%</td>
</tr>
</tbody>
</table>