Outline

The need for an admission prediction score
What is GAPS?
GAPS versus human judgment and Amb Score
GAPS as a predictor of adverse outcomes
The role of GAPS in ambulatory care
How has the number of people spending more than four hours in A&E changed?

![Graph showing the number of attendances and percentage spending less than four hours in A&E over time.](chart)

- **Total attendances**
- **Type 1 Departments - Major A&E**
- **Percentage in 4 hours or less (type 1)**
- **Percentage in 4 hours or less (type 2&3)**
- **Old target**
- **New target**
Mortality and admission odds against length of ED stay

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Adjusted odds ratio (95% CI) for death</th>
<th>Adjusted odds ratio (95% CI) for admission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left without being seen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean length of stay during same shift (hours)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;1 (reference)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-&lt;2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-&lt;3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-&lt;4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-&lt;5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-&lt;6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥6</td>
<td></td>
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</tr>
</tbody>
</table>

Risk decreases  |  Risk increases  | Risk decreases  |  Risk increases  |
Advantages of predicting admission

Identifying as early as possible which patients are likely to be admitted and which are likely to be discharged could promote efficiency:

- Identifying patients for ambulatory care
- Bed management
- Decision support
- Patient streaming

Triage is first clinical assessment made in ED

Triage staff cannot accurately predict admission
Background

Several tools have been created to predict admission at the point of triage
The simpler tools lack accuracy
The accurate tools lack simplicity
We have lacked a simple but accurate tool to assess the probability of admission at the time of triage
# Glasgow admission prediction score

<table>
<thead>
<tr>
<th>Variable</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1 point per decade</td>
</tr>
<tr>
<td>NEWS score</td>
<td>1 point per point on NEWS score</td>
</tr>
<tr>
<td>Triage category:</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Referred by GP</td>
<td>10</td>
</tr>
<tr>
<td>Arrived in ambulance</td>
<td>5</td>
</tr>
<tr>
<td>Admission within 1 year</td>
<td>5</td>
</tr>
</tbody>
</table>
Methods

Multi-centre, retrospective, cross-sectional study

322,846 unscheduled secondary care attendances in North Glasgow over a two-year period

Two-thirds of attendances were selected at random to create the prediction score using variables already available at triage

Score created from mixed-effects multiple logistic regression model

The score was then tested for accuracy on the remaining third by assessing its ROC curve
Results

344,429 adult attendances over 2 years
After discounting transfers between units and missing data, 322,846 attendances were available for analysis in 191,653 patients
123,397 of the 322,846 attendances led to admission (38.22%)
215,231 attendances used to create the score
107,615 attendances used to test the score
Proportion admitted by AP score in validation group
Proportion of discharges then admitted within 28 days

Proportion admitted

Score
ROC of score predicting admission

AUC = 0.877
Criticism

Do we really need another score? Whatever happened to clinical judgement?
GAPS versus human judgment

Comparison of accuracy of triage nurses and GAPS
Prospective study of 1,838 ED attendances
Of these, 766 (41.7%) were admitted
Triage staff asked to estimate probability of admission (VAS)
Nurses were only accurate in predicting admission when they were very confident of the outcome (92.4%) but accuracy was poor in the majority of cases (68.8% accurate)
When the nurses were less confident, GAPS was significantly more accurate and better calibrated
Minus clinically obvious cases:

- GAPS
- VAS

p = 0.0051
This score predicts admissions. How can we use it to facilitate ambulatory care? Don’t we already have a score for that?
GAPS versus Amb Score

Prospective study, GRI-led multi-site collaboration
Consecutive patients presenting for ED triage
Researchers worked in shifts to cover all 168 hours of the week
Each patient interviewed to calculate GAPS and Amb Scores
Patients followed up to 30 days
Endpoint was admission to hospital or ED discharge
Comparison of AUC of ROC using DeLong’s method
Results

1496 adults attending ED triage during study
Of these, 64 IRDs, leaving 1432 for analysis
570 (39.8%) admitted
AUC 0.808 for GAPS, compared to 0.743 for Ambs, p<0.00001
GAPS had net classification improvement of 6% over Amb
Criticism

Surely this just tells you whether someone will be admitted, not whether they should be admitted?
Ability of GAPS to predict mortality and LOHS

All admissions from ED over two-week period
GAPS calculated automatically from electronic triage data
LOS calculated from computerised records
Mortality during hospital stay recorded
1,279 admissions
81 deaths (6.3%)
Average LOS 7.5 days
\( p < 0.0001 \)
$p < 0.0001$
Implementation

We have been using GAPS at our Acute Assessment Unit in Glasgow Royal Infirmary for over a year.

Of 1600 monthly GP referred medical attendances, around 30% can be sent directly to our ambulatory unit using the single criterion of low GAPS (<25).

Achieves a high discharge rate from ambulatory first assessment of >90% with excellent safety record.

Allows ambulatory care to be patient-based rather than condition-based.

GAPS has now been taken up by several UK sites.
Conclusions

We have derived a simple but accurate way to assess probability of admission at triage.
It predicts death, reattendance and readmission within 28 days.
It usually outperforms experienced triage staff.
It outperforms the current method recommended by the RCP toolkit for streaming to ambulatory care.
It can be used to measure (or control for) patient factors when looking at admission rates.
Further challenges

How can we better use the information GAPS gives us in real time?
How can we use the information GAPS gives us for service planning?
Dissemination and implementation.