The Glasgow Admission Prediction Score

Allan Cameron
Consultant Physician, Glasgow Royal Infirmary

Outline

The need for an admission prediction score

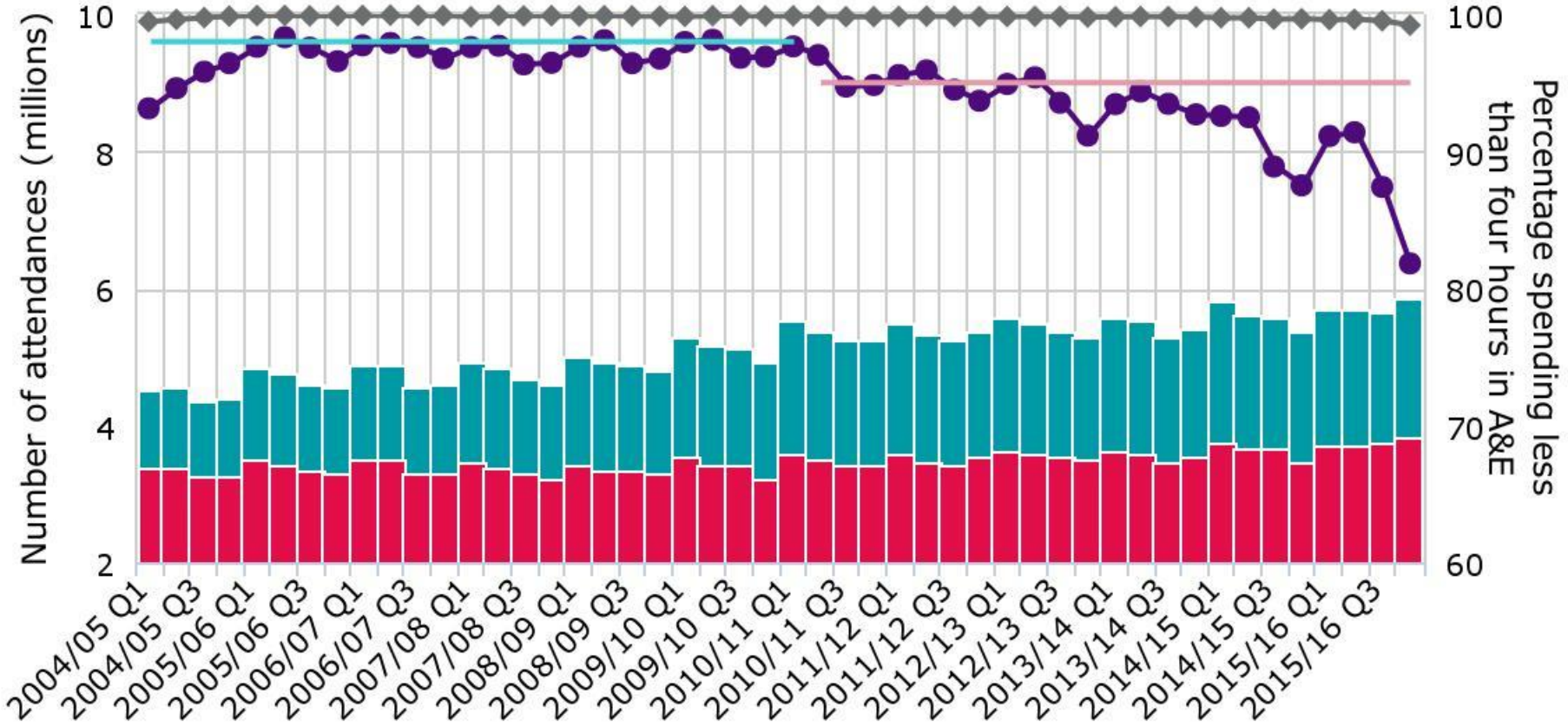
What is GAPS?

GAPS versus human judgment and Amb Score

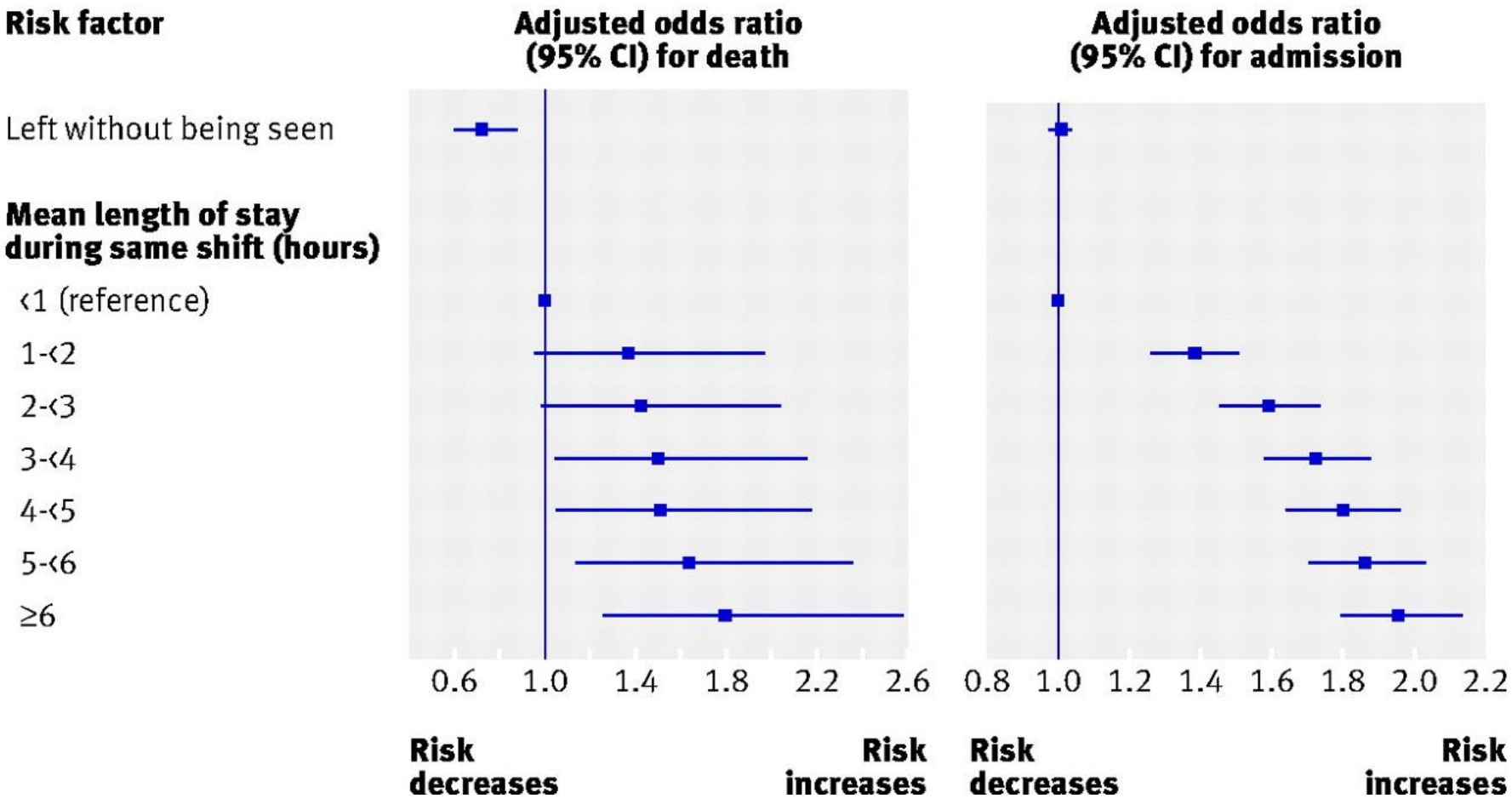
GAPS as a predictor of adverse outcomes

The role of GAPS in ambulatory care

How has the number of people spending more than four hours in A&E changed?



Mortality and admission odds against length of ED stay



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

Variable		**Points**
Age		*1 point per decade*
NEWS score		*1 point per point on NEWS score*
Triage category:	3	*5*
	2	*10*
	1	*20*
Referred by GP		*10*
Arrived in ambulance		*5*
Admission within 1 year		*5*

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

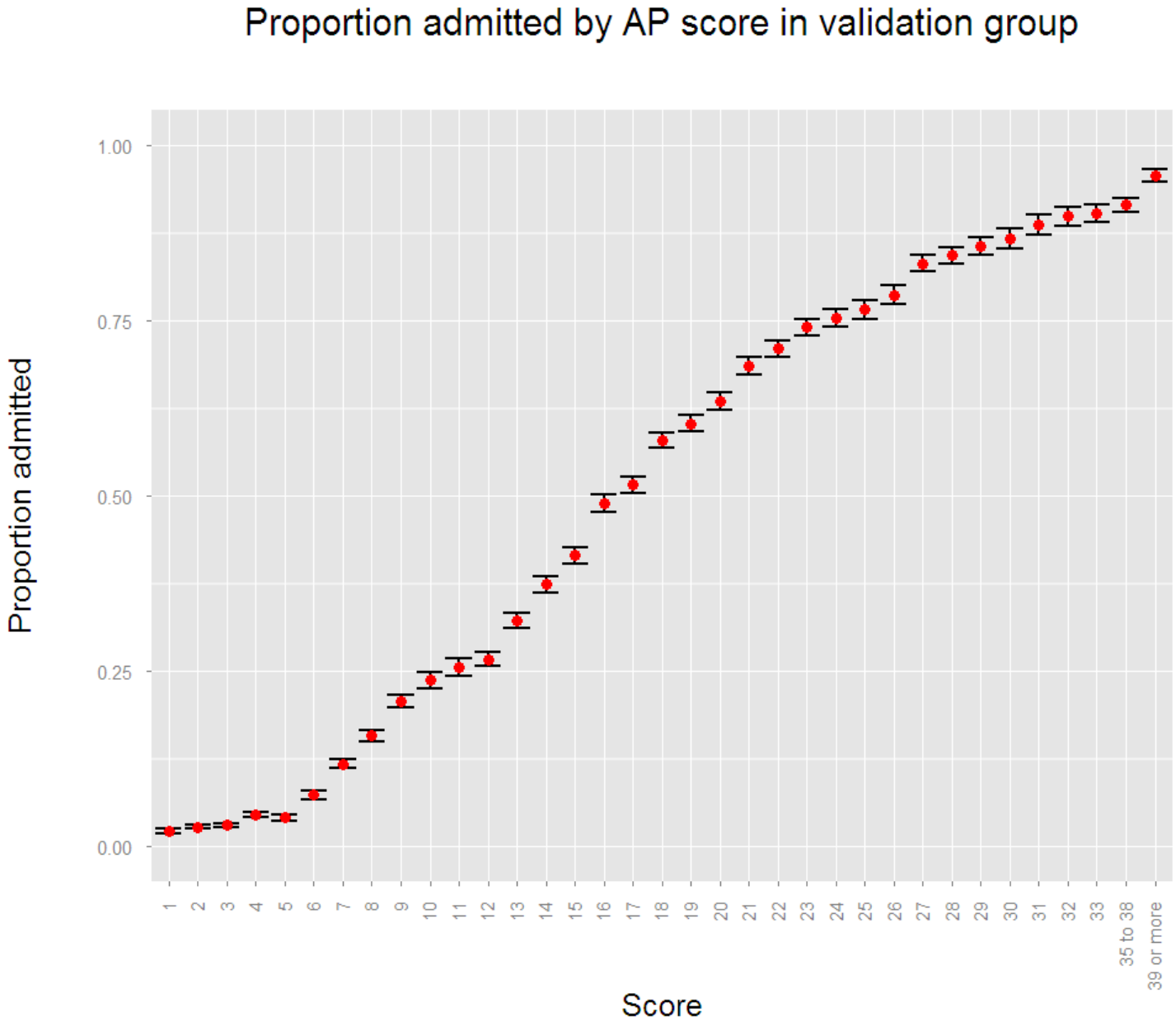
344,429 adult attendances over 2 years

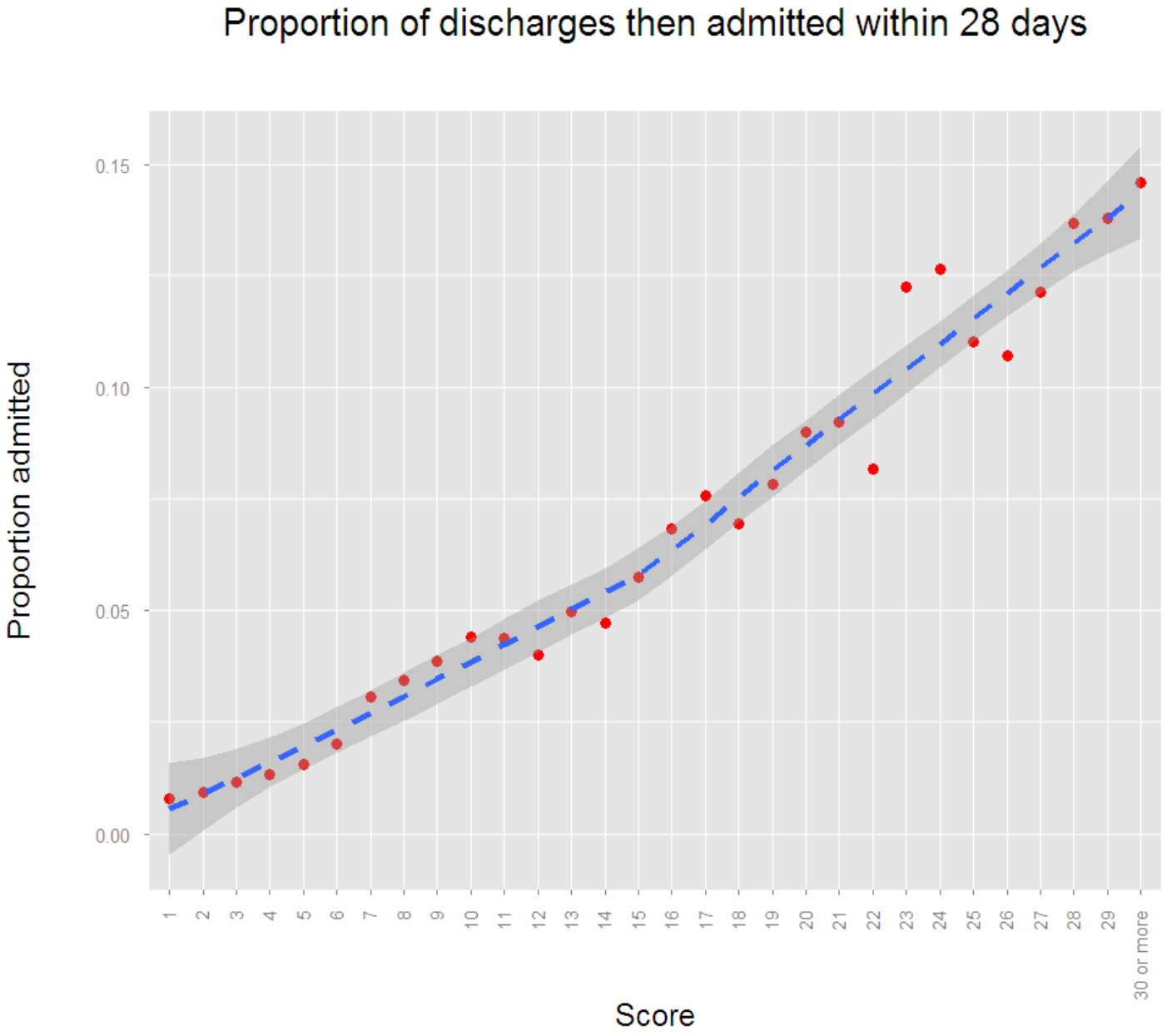
After discounting transfers between units and missing data, 322,846 attendances were available for analysis in 191,653 patients

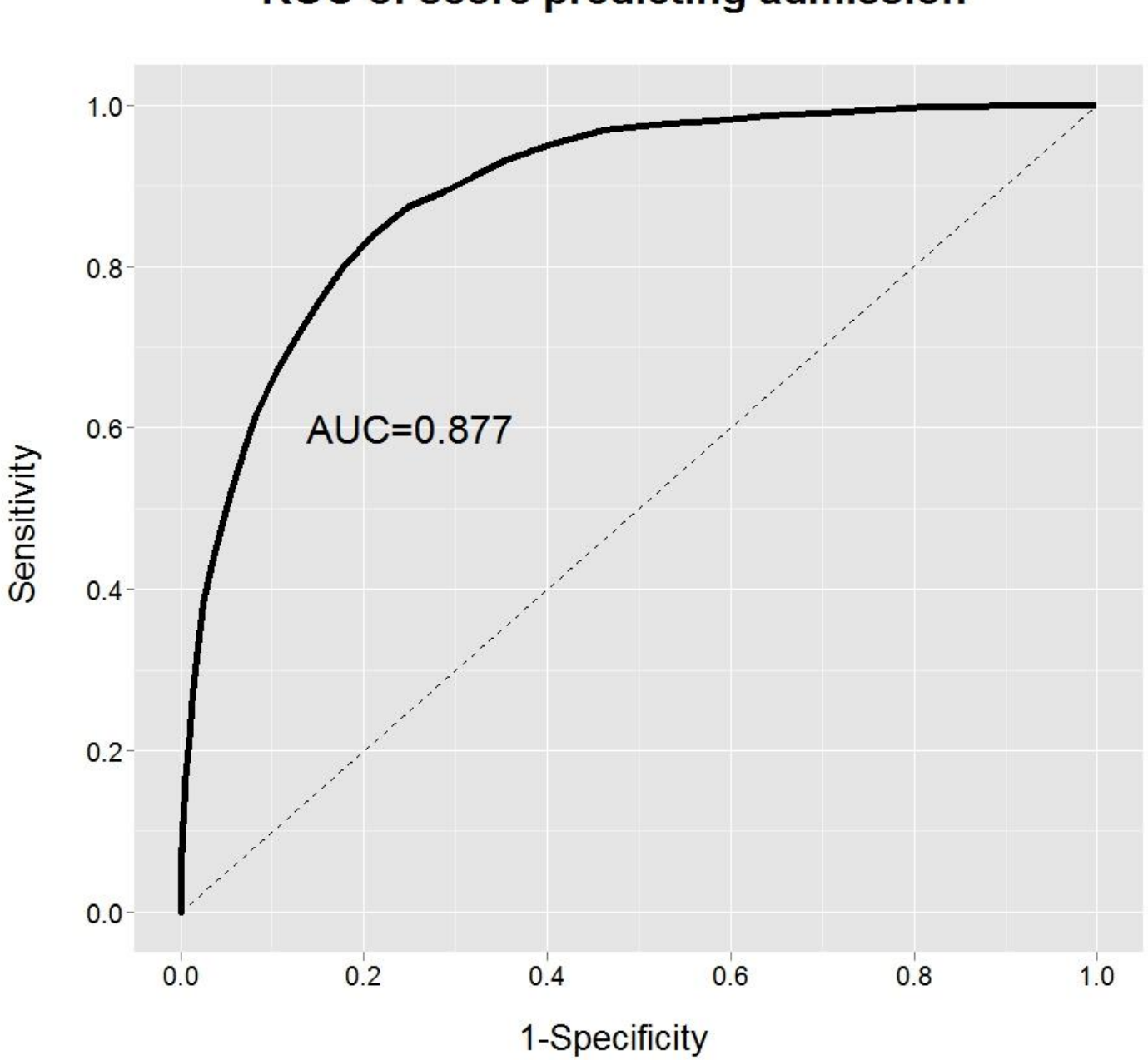
123,397 of the 322,846 attendances led to admission (38.22%)

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 admitted
1.00
0.75
0.50
0.25
0.00
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
35 to 38
39 or more
Score


Proportion of discharges then admitted within 28 days
Proportion admitted
0.15
0.10
0.05
0.00
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30 or more
Score


ROC of score predicting admission
Sensitivity
1-Specificity
AUC=0.877
0.0
0.2
0.4
0.6
0.8
1.0

Criticism

Do we really need another score? Whatever happened to clinical judgement?

GAPS versus human judgment

Comparison of accuracy of triage nurses and GAPS

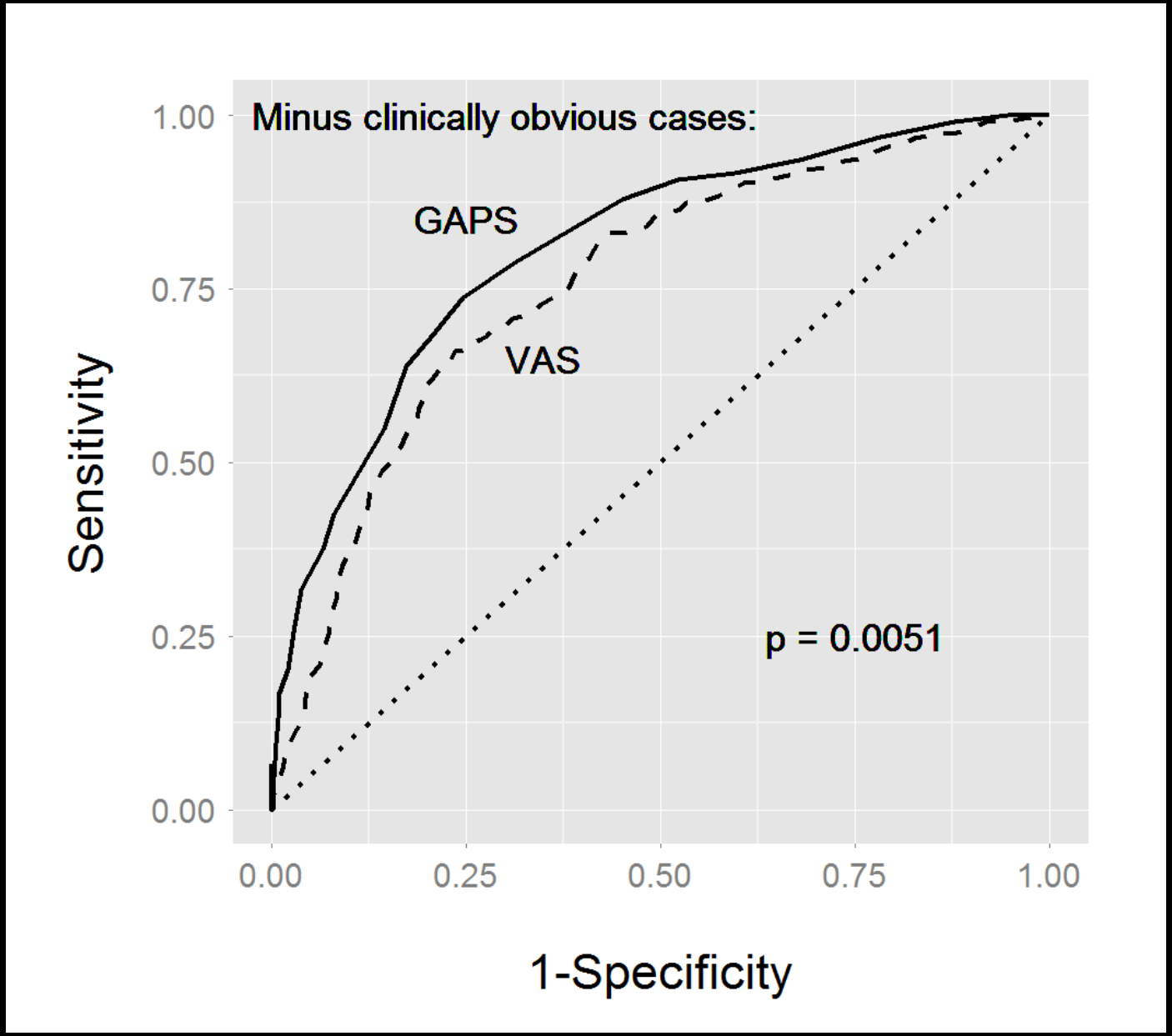
Prospective study of 1,838 ED attendances

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
Sensitivity
1-Specificity
1.00
0.75
0.50
0.25
0.00
0.00
0.25
0.50
0.75
1.00

Criticism

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

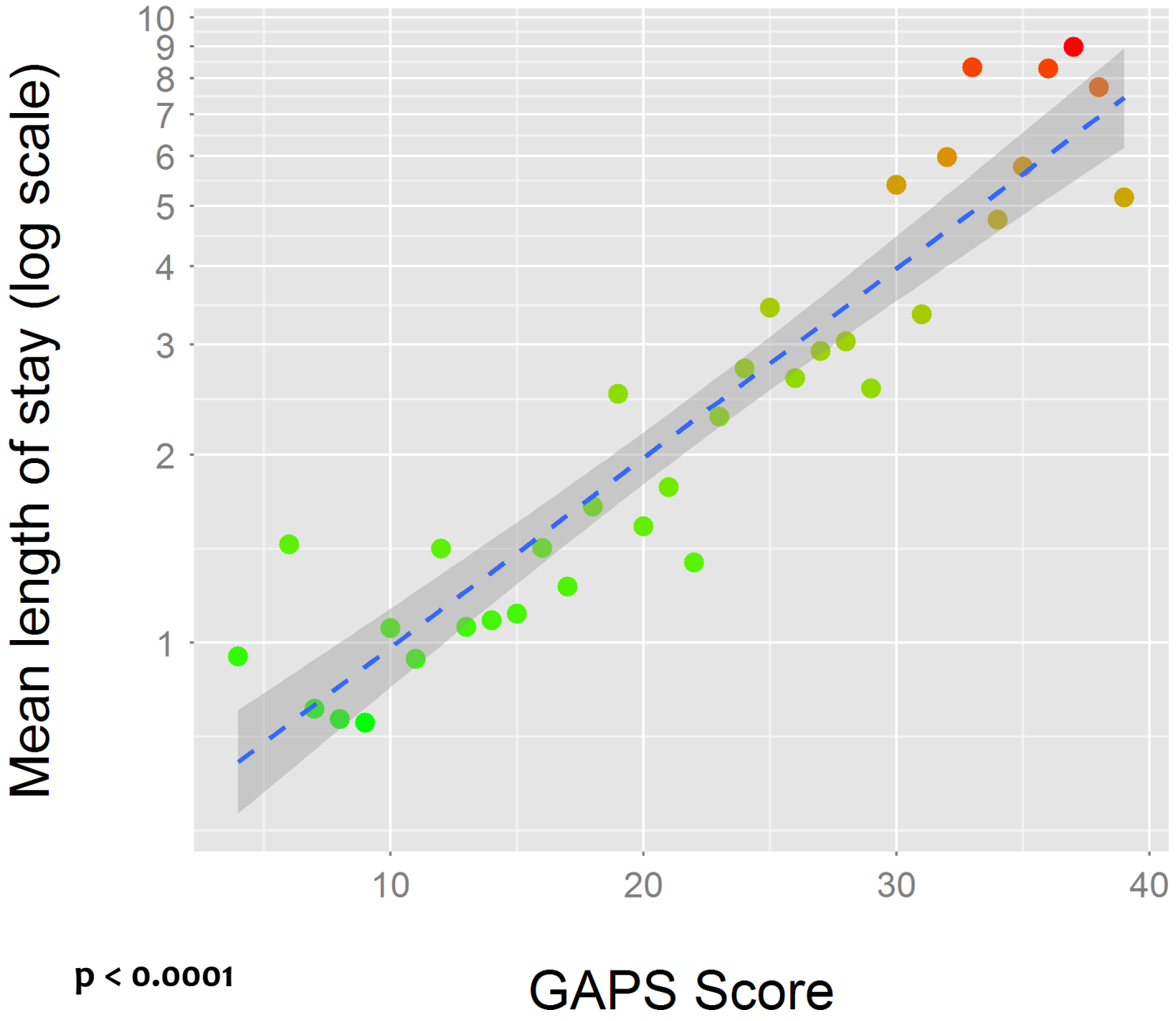
LOS calculated from computerised records

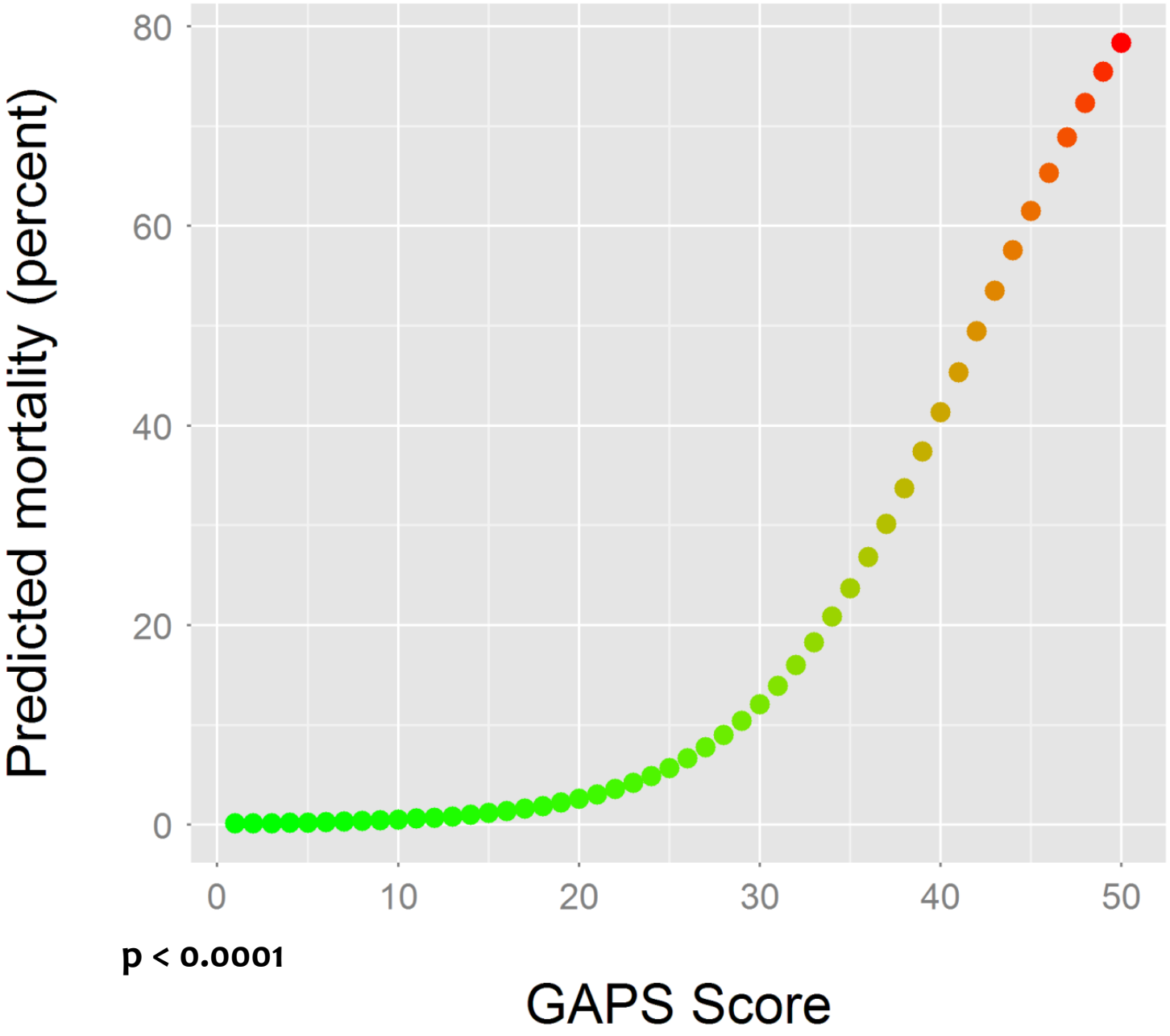
Mortality during hospital stay recorded

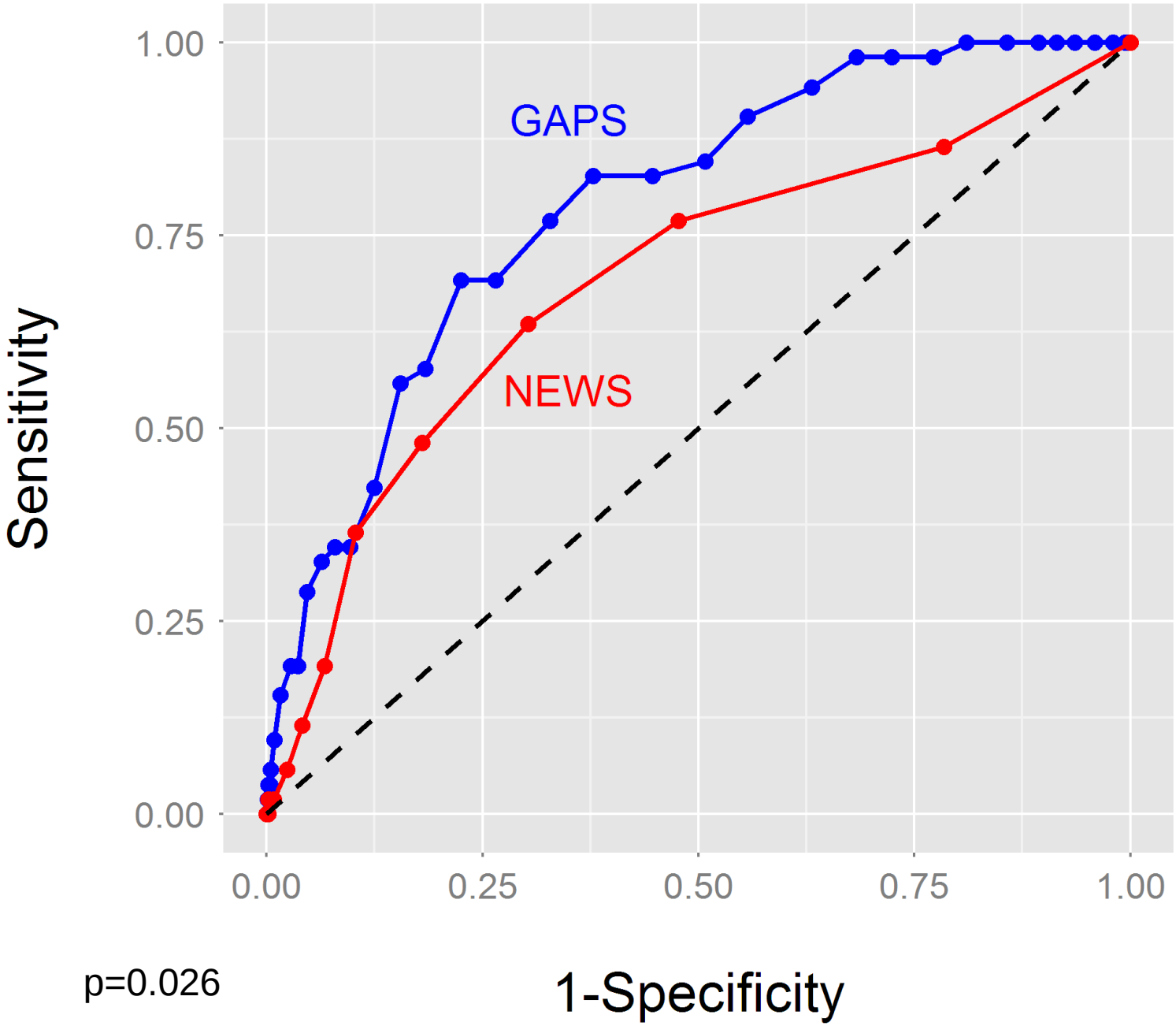
1,279 admissions

81 deaths (6.3%)

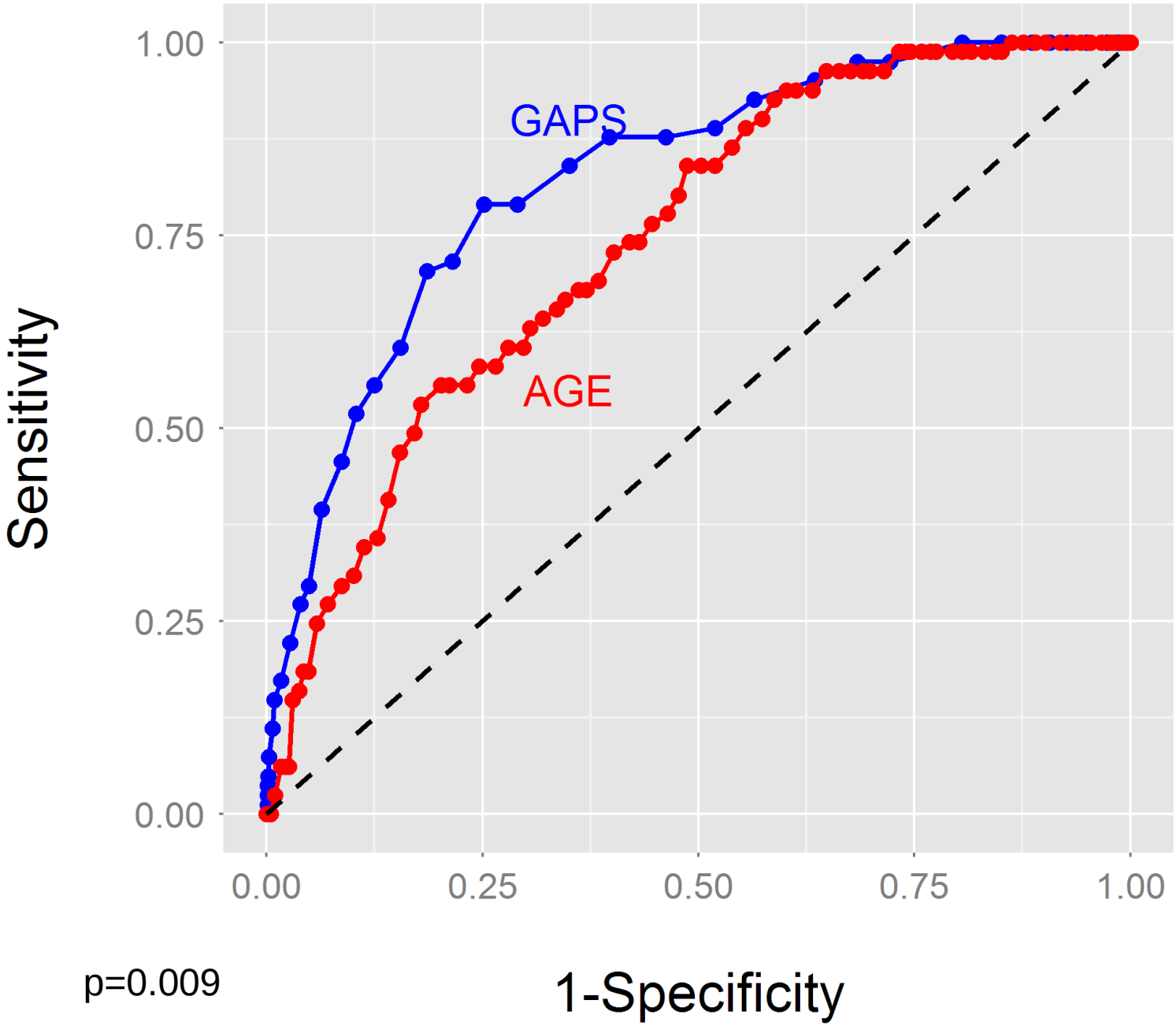
Average LOS 7.5 days


Mean length of stay (log scale)
10
9
8
7
6
5
4
3
2
1
10
20
30
40
GAPS Score
p < 0.0001


Predicted mortality (percent)
80
60
40
20
0
0
10
20
30
40
50
p < 0.0001
GAPS Score


1.00
0.75
0.50
0.25
0.00
Sensitivity
GAPS
NEWS
0.00
0.25
0.50
0.75
1.00
1-Specificity

p=0.026


1.00
0.75
0.50
0.25
0.00
Sensitivity
GAPS
AGE
0.00
0.25
0.50
0.75
1.00
p=0.009
1-Specificity

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.