

**Scottish Trauma Audit Group
National Meeting
28th October 2015**



Audit of Trauma Management in
Scotland 2015
Reporting on 2013-2014

Presented by
Mr Malcolm WG Gordon
Chairman, Scottish Trauma Audit Group

- Impact of trauma on Scottish population
- Background to data set
- Questions raised by the data
- How the outcome prediction works
- How Scotland compares with England

2014: commonest cause
death <45 years old

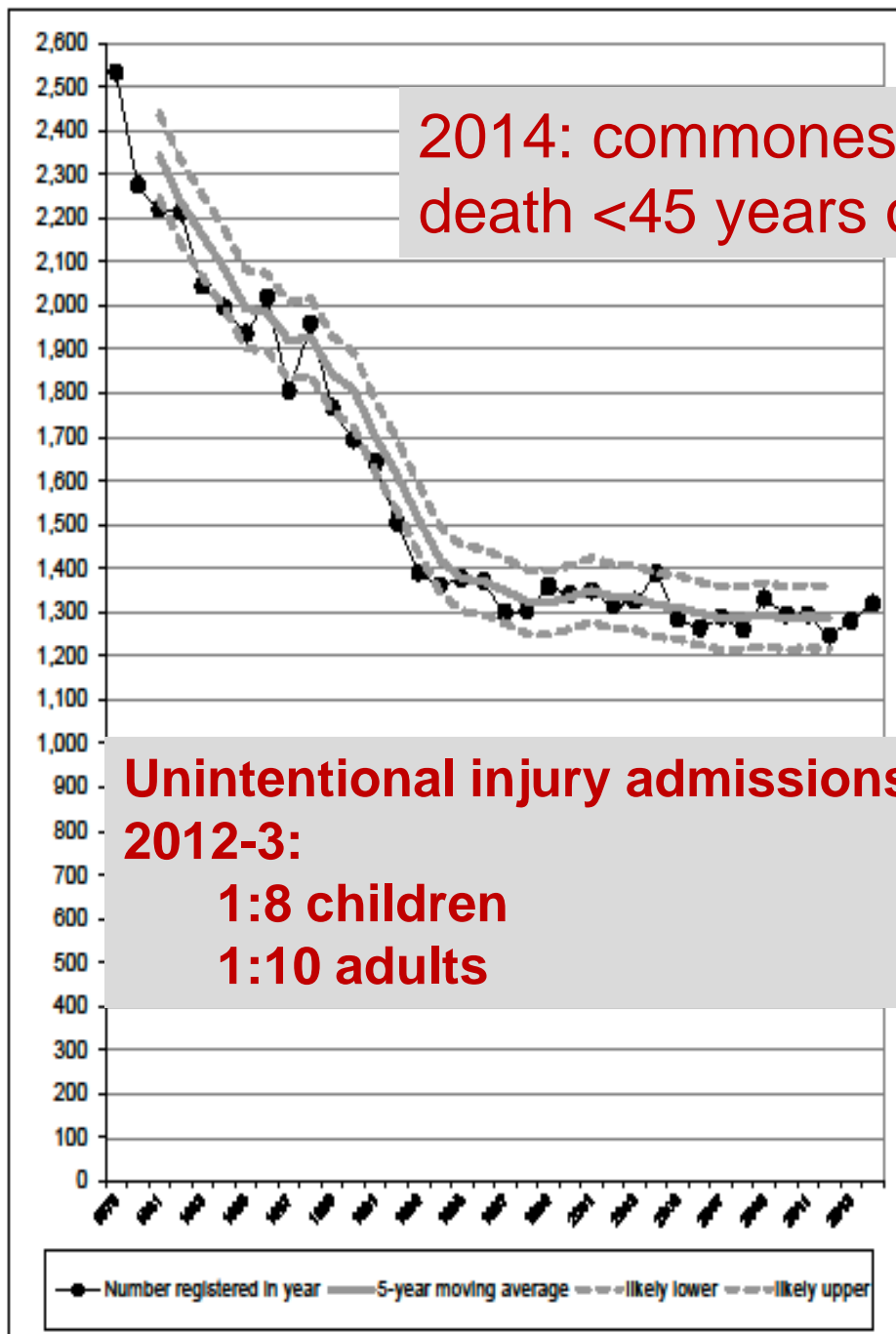
Accidental deaths registered in Scotland, 1979 to 2014

Unintentional injury admissions
2012-3:

1:8 children

1:10 adults

<http://www.nrscotland.gov.uk/files//statistics/accidental-deaths/2014/accidents-14-chart-1.pdf>





Background to Data



Data completeness



Figure 1.1 Data completeness by hospital (2013)

Key: Data submitted 
No data submitted 

Hospital	2013												Patients Included
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Aberdeen Royal Infirmary													387
University Hospital Ayr													79
University Hospital Crosshouse, Kilmarnock													149
Dumfries & Galloway Royal Infirmary													84
Forth Valley Royal Hospital													205
Glasgow Royal Infirmary													295
Hairmyres Hospital, East Kilbride													34
Inverclyde Royal Hospital													98
Monklands Hospital, Airdrie													100
Ninewells Hospital, Dundee													276
Perth Royal Infirmary													56
Raigmore Hospital, Inverness													137
Royal Alexandra Hospital, Paisley													228
Royal Infirmary of Edinburgh													333
Queen Elizabeth University Hospital, previously Southern General Hospital, Glasgow													138
Victoria Hospital, Kirkcaldy													166
Victoria Infirmary, Glasgow													113
Western Infirmary, Glasgow													209
Wishaw Hospital													106
Patients Included	251	214	240	230	282	314	294	288	283	250	282	265	3193

Note In 2013, eight audit patients attended two STAG EDs during a single episode of care. Only the first STAG ED attendance has been analysed in this report (N=3185).

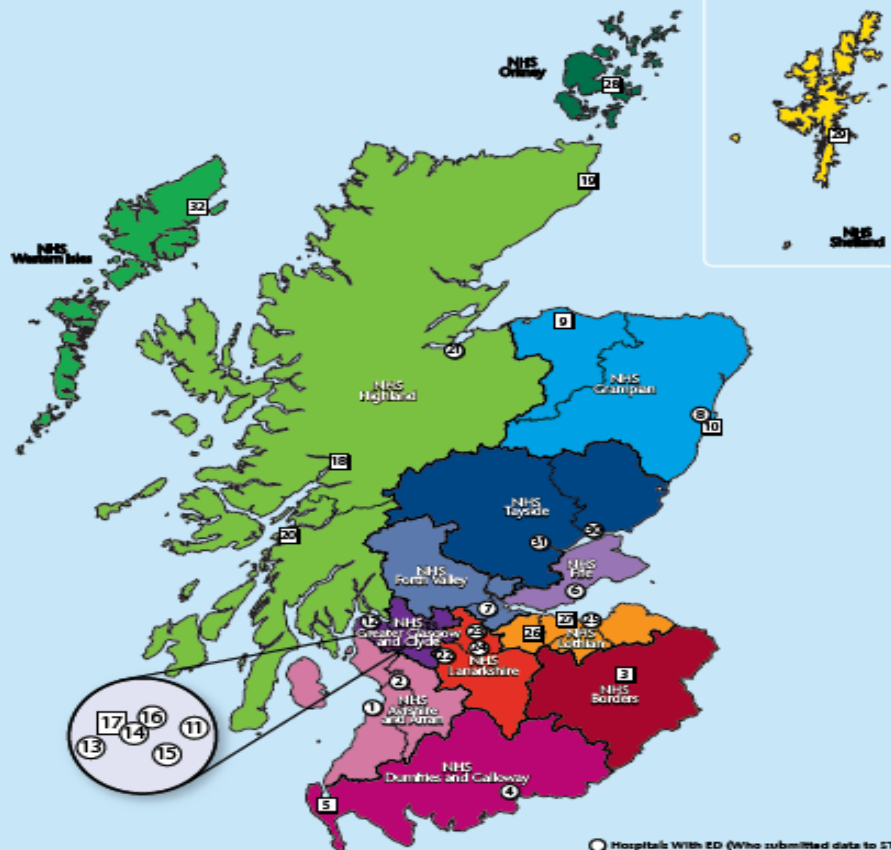
Figure 1.2 Data completeness by hospital (2014)

Key: Data submitted 
No data submitted 

Hospital	2014												Patients Included
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Aberdeen Royal Infirmary													72
University Hospital Ayr													94
University Hospital Crosshouse, Kilmarnock													187
Dumfries & Galloway Royal Infirmary													92
Forth Valley Royal Hospital													180
Glasgow Royal Infirmary													292
Hairmyres Hospital, East Kilbride													86
Inverclyde Royal Hospital													84
Monklands Hospital, Airdrie													90
Ninewells Hospital, Dundee													272
Perth Royal Infirmary													59
Raigmore Hospital, Inverness													165
Royal Alexandra Hospital, Paisley													238
Royal Infirmary of Edinburgh													351
Queen Elizabeth University Hospital, previously Southern General Hospital, Glasgow													50
Victoria Hospital, Kirkcaldy													97
Victoria Infirmary, Glasgow													48
Western Infirmary, Glasgow													217
Wishaw Hospital													85
Patients Included	275	201	186	201	209	216	258	234	222	238	222	297	2759

Note In 2014, 12 audit patients attended two STAG EDs during a single episode of care. Only the first STAG ED attendance has been analysed in this report. A further two patients were removed from this analysis because there was not enough information available to code the trauma injury. (N= 2745).

Location map



Note - The Western Infirmary and Victoria Infirmary in Glasgow both closed its EDs in summer 2015

○ Hospitals With ED (Who submitted data to STAG in 2013/14)
 □ Hospitals With ED (Not part of STAG in 2013/14)

- | | | | |
|---|-------------------------------------|--|---|
| ① University Hospital Ayr | ⑨ Dr Gray's Hospital | ⑯ Western Infirmary Glasgow | ⑳ Wishaw General Hospital |
| ② University Hospital Crosshouse | ⑩ Royal Aberdeen Childrens Hospital | ⑰ Royal Hospital for Children, Glasgow | ㉑ Royal Infirmary Edinburgh |
| ③ Borders General Hospital | ⑪ Glasgow Royal Infirmary | ⑱ Belford Hospital | ㉒ St John's Hospital |
| ④ Dumfries and Galloway Royal Infirmary | ⑫ Inverclyde Royal Hospital | ⑲ Caithness General Hospital | ㉓ Royal Hospital Sick Children, Edinburgh |
| ⑤ Galloway Community Hospital | ⑬ Royal Alexandra Hospital | ㉔ Lorn and Islands District General Hospital | ㉔ Balfour Hospital |
| ⑥ Victoria Hospital | ⑭ Southern General Hospital | ㉕ Raigmore Hospital | ㉕ Gilbert Bain Hospital |
| ⑦ Forth Valley Hospital | ⑮ Victoria Infirmary Glasgow | ㉖ Hairmyres Hospital | ㉖ Ninewells Hospital |
| ⑧ Aberdeen Royal Infirmary | | ㉗ Monklands General Hospital | ㉗ Perth Royal Infirmary |
| | | | ㉗ Western Isles Hospital |

Figure 2.3 Percentage of patients with blunt or penetrating trauma, by Health Board

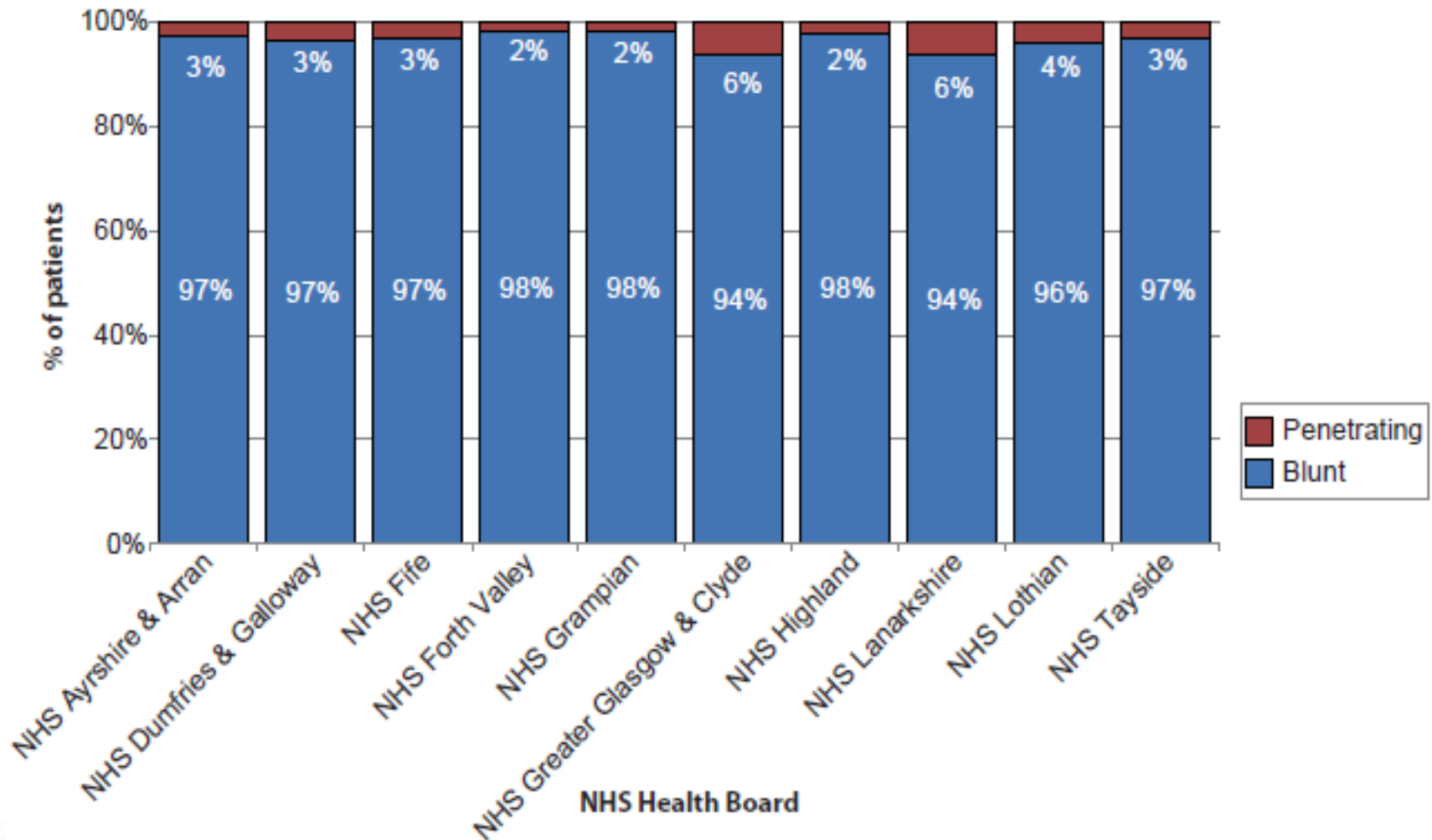


Figure 2.2 Percentage of patients with minor, moderate and major trauma

- Inclusion: admitted for at least 3 days or died
- Exclusions: isolated peripheral injury

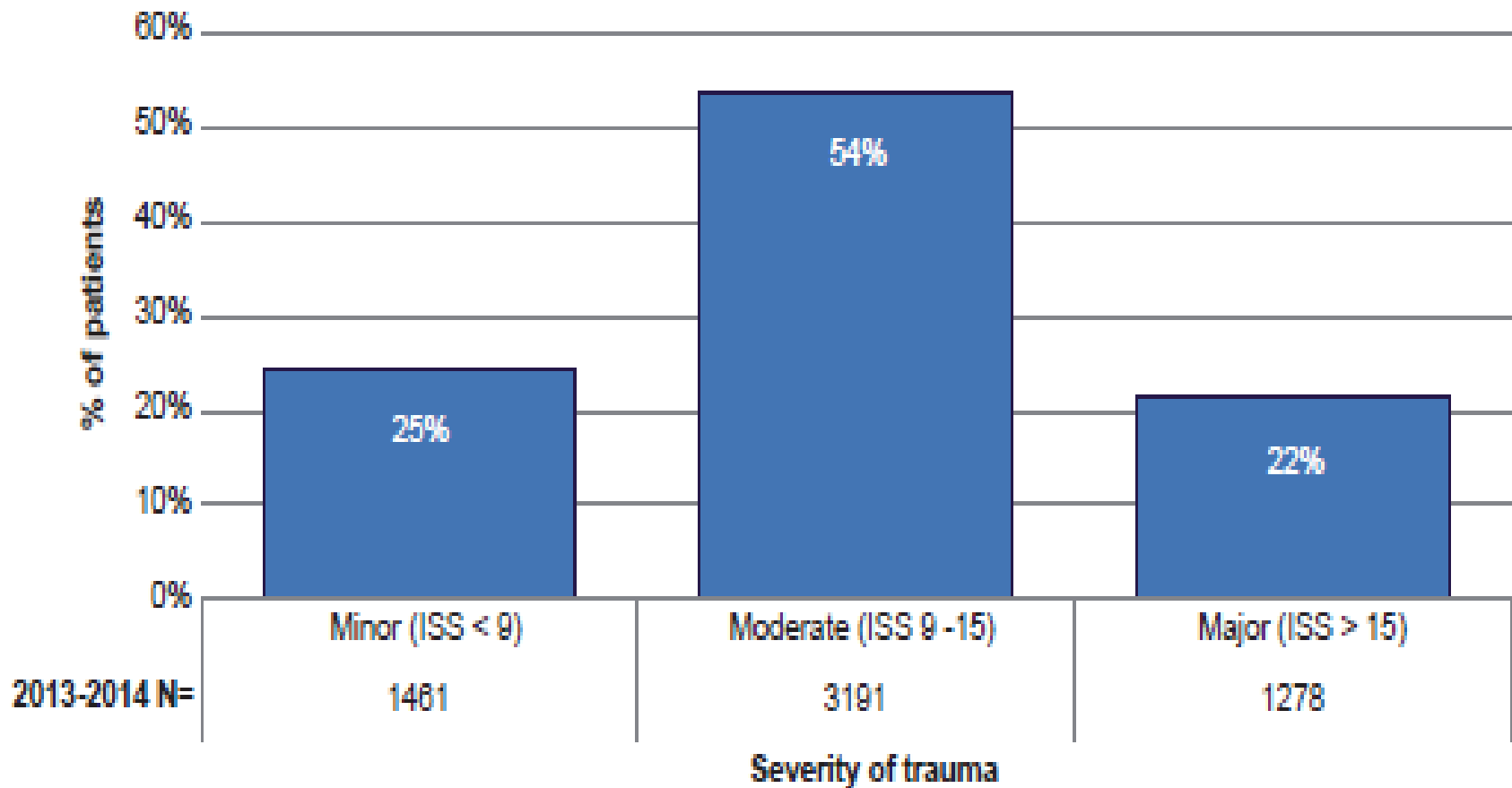
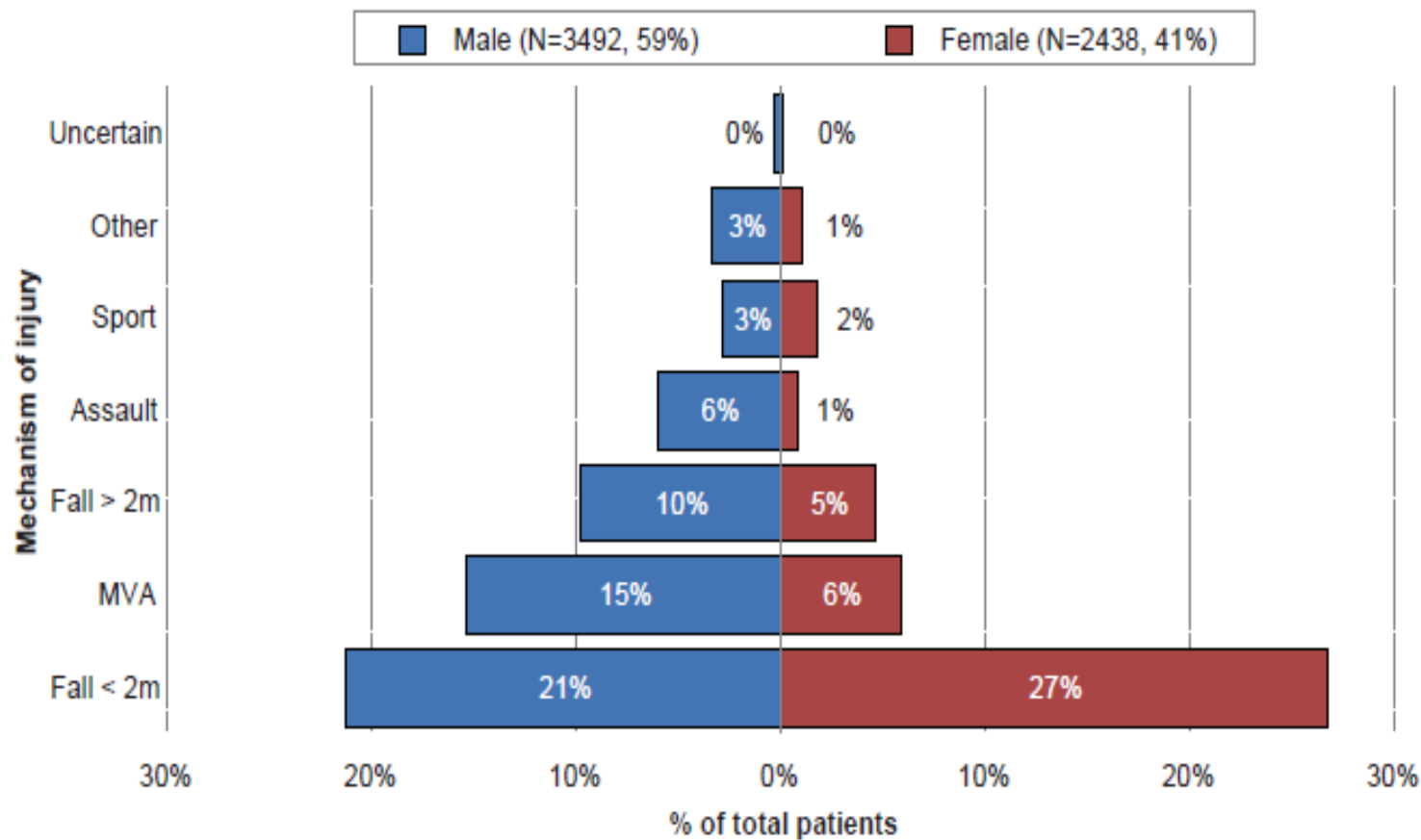


Figure 2.4 Percentage of male and female patients by mechanism of injury

Evidence of alcohol involvement significantly more common in males



MVA: Motor vehicle accident.

Other: mechanisms of injury such as deliberate self harm, contact with a moving object (not MVA) and accidents involving machinery.

Figure 3.1 Percentage of patients arriving by air, ambulance or self, by severity of trauma

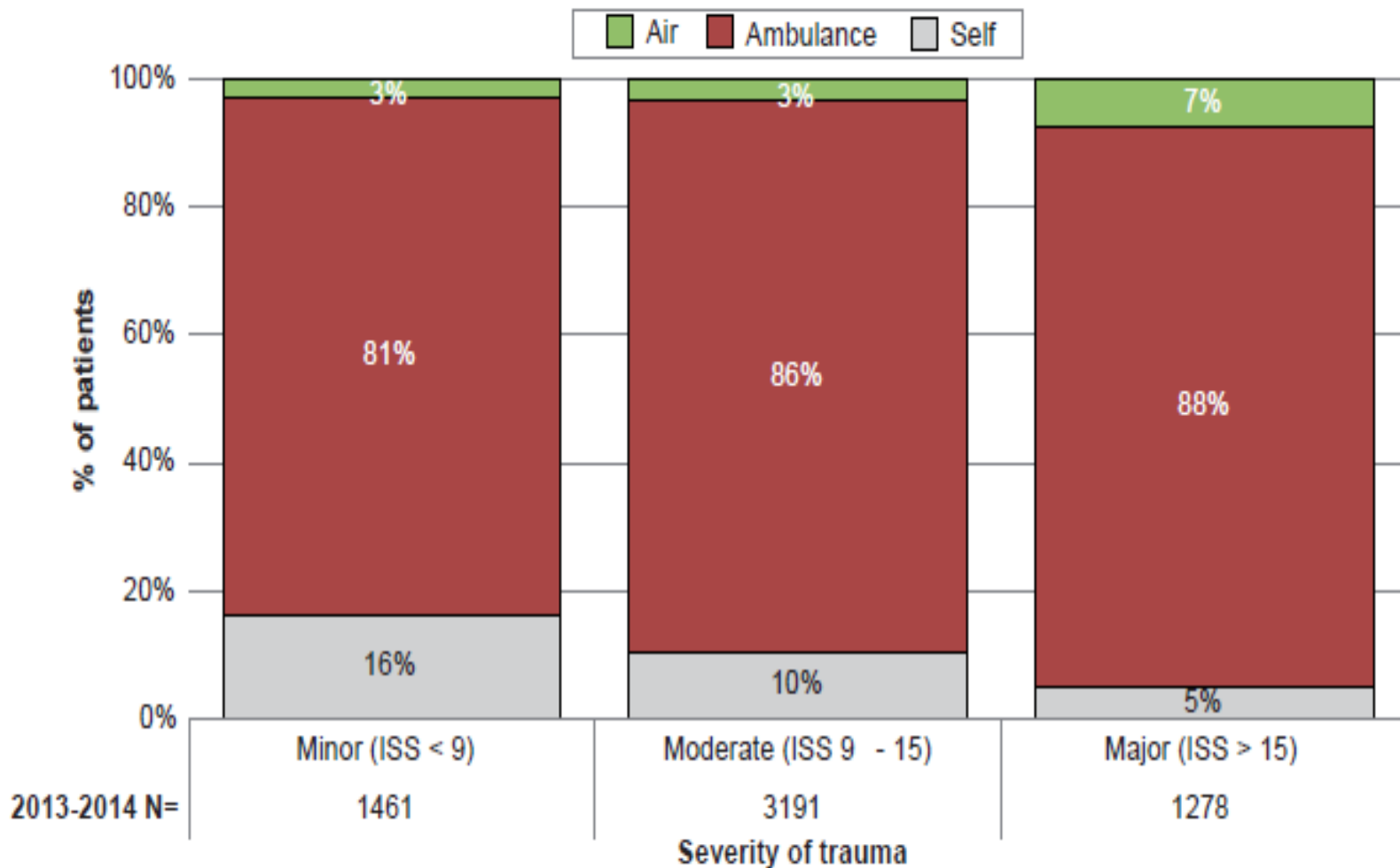
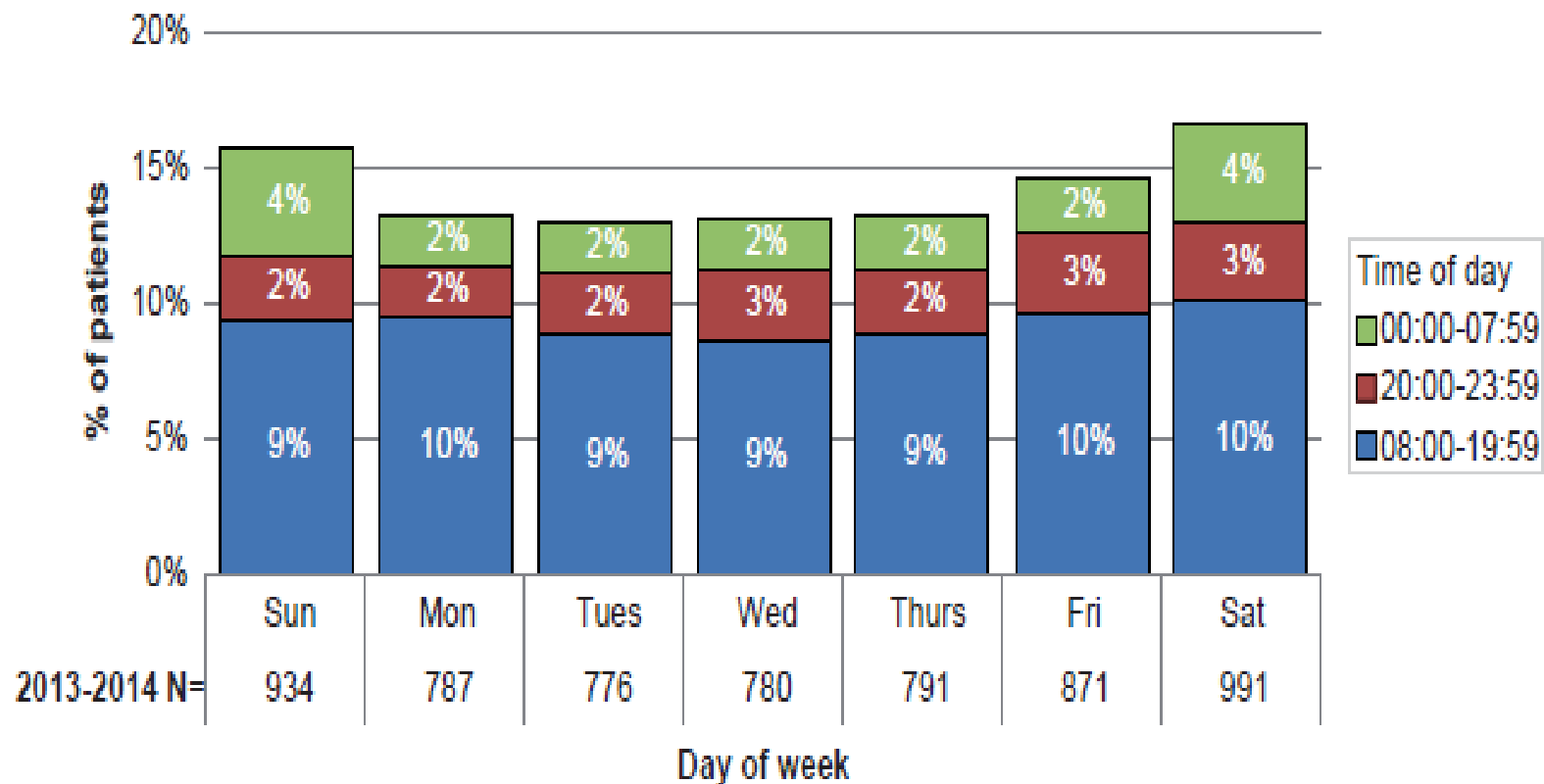
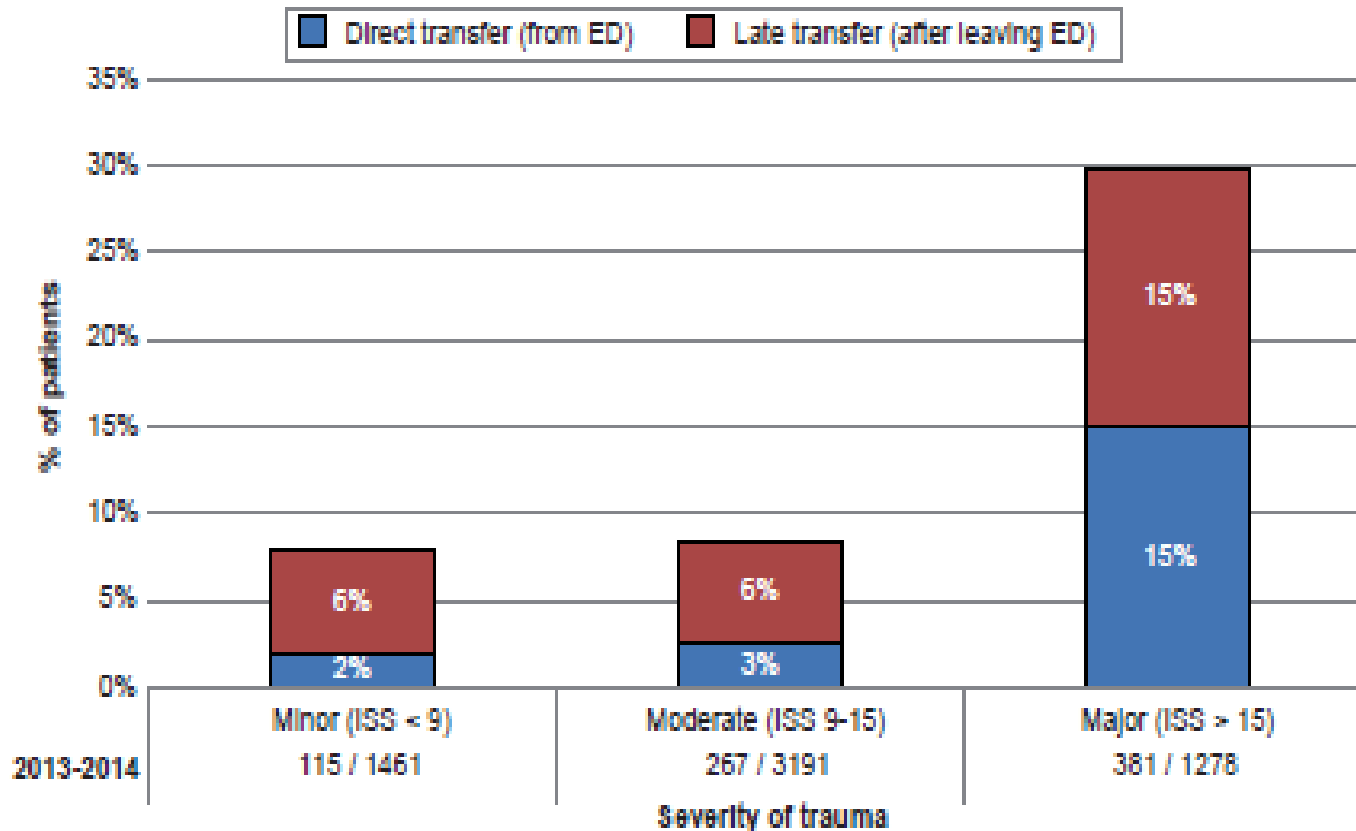


Figure 3.2.1 Percentage of patients by day and time of attendance



Note: 'Out of hour' attendances are those that took place at the weekend or between the hours of 8:00pm and 7:59am.

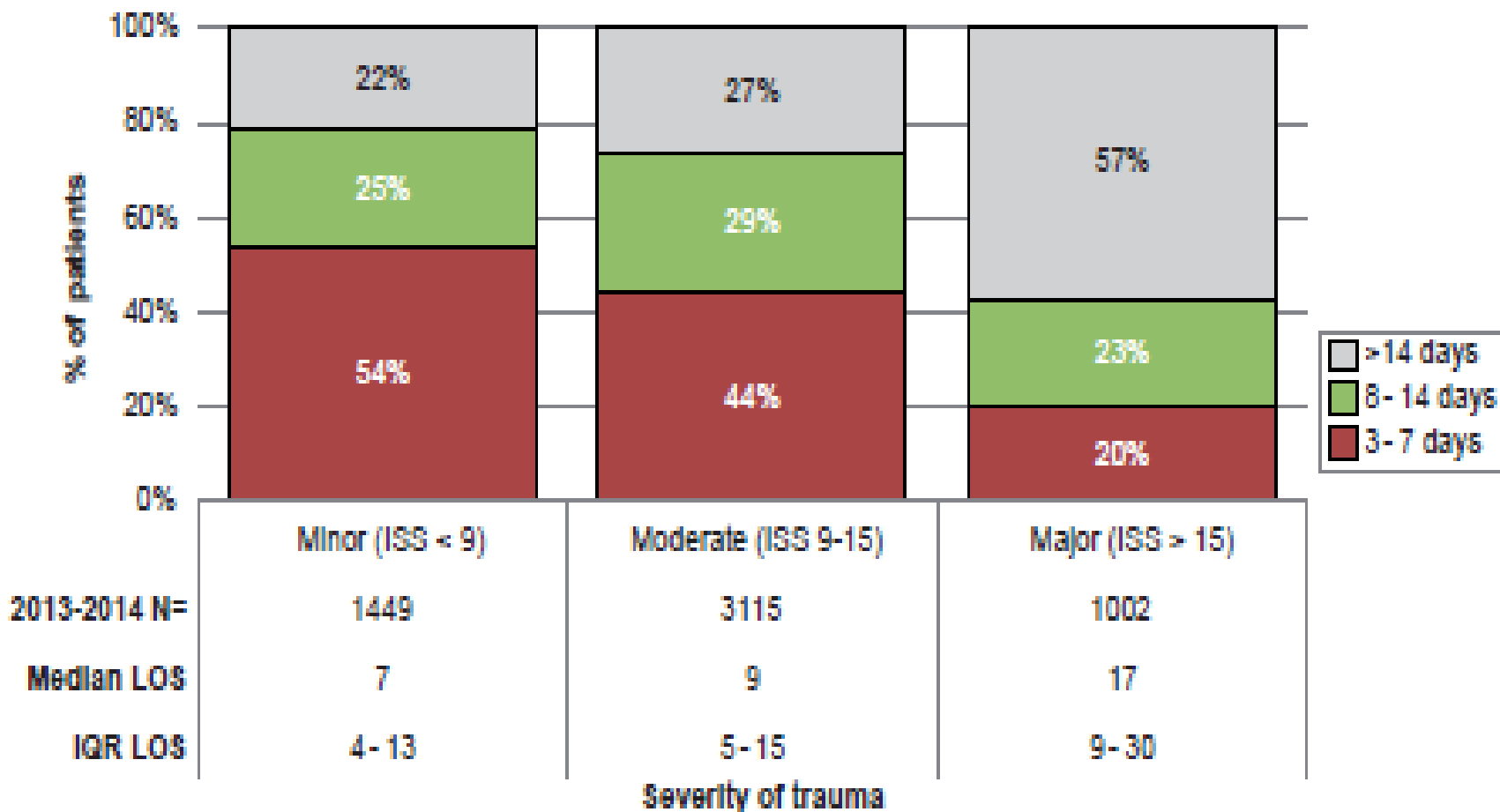
Figure 3.3 Percentage of patients transferred to another STAG hospital or regional centre, by severity of trauma



N = number of cases where the patient was transferred / number of cases with this severity of trauma.

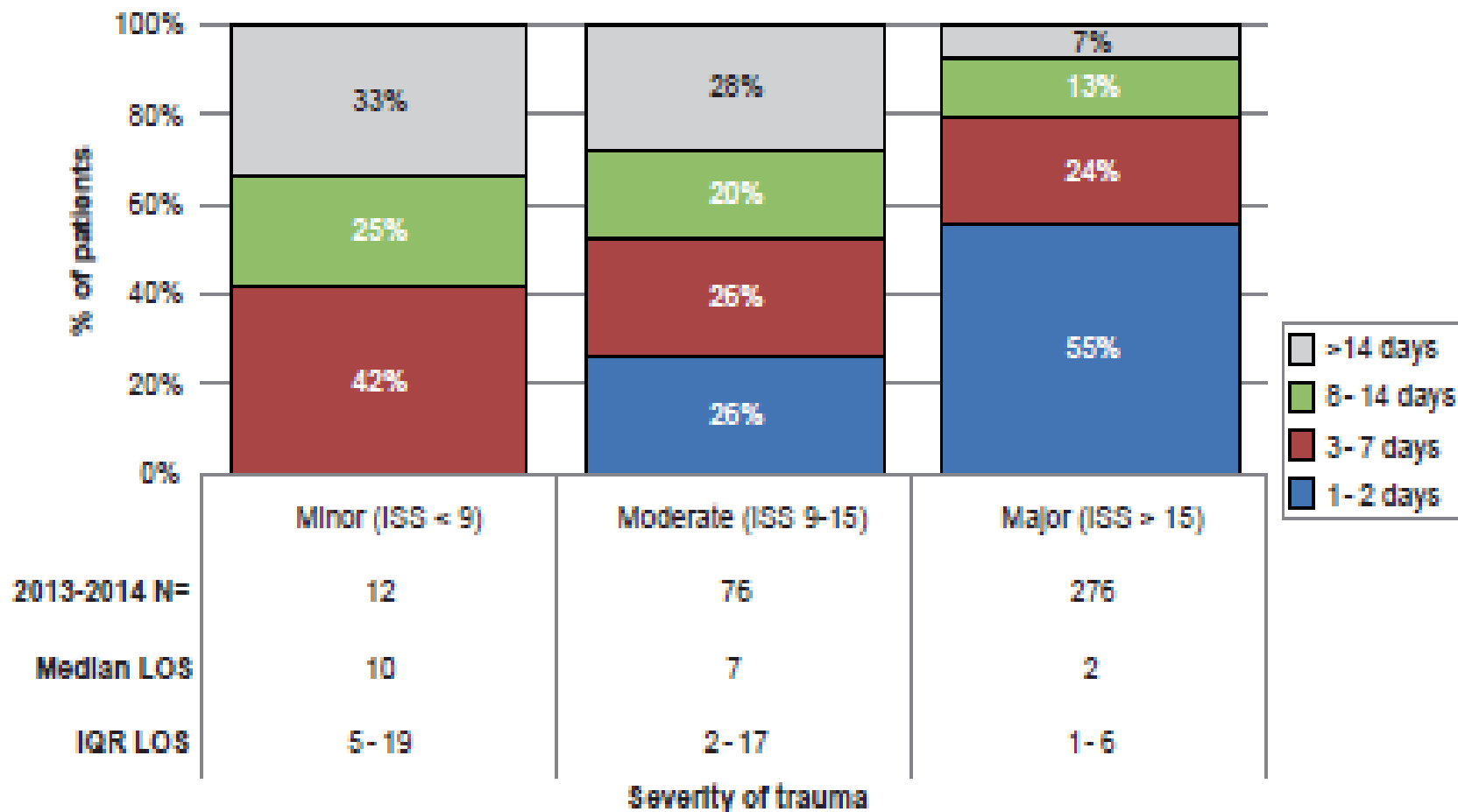
Note: 'Direct transfers' are those that occur directly from the receiving ED. 'Late transfers' are those that occur after the patient left the receiving ED. Internal transfers that occur within regional specialist centres (e.g. Ninewells ED to Ninewells Neuro) are not counted as transfers.

Figure 3.6.1 Length of inpatient stay, by severity of trauma, for patients who survived to discharge from hospital or up to 30 days



Note: STAG follow up patients to point of discharge or a maximum of 30 days.

Figure 3.6.2 Length of inpatient stay, by severity of trauma, for patients who died in less than or equal to 30 days

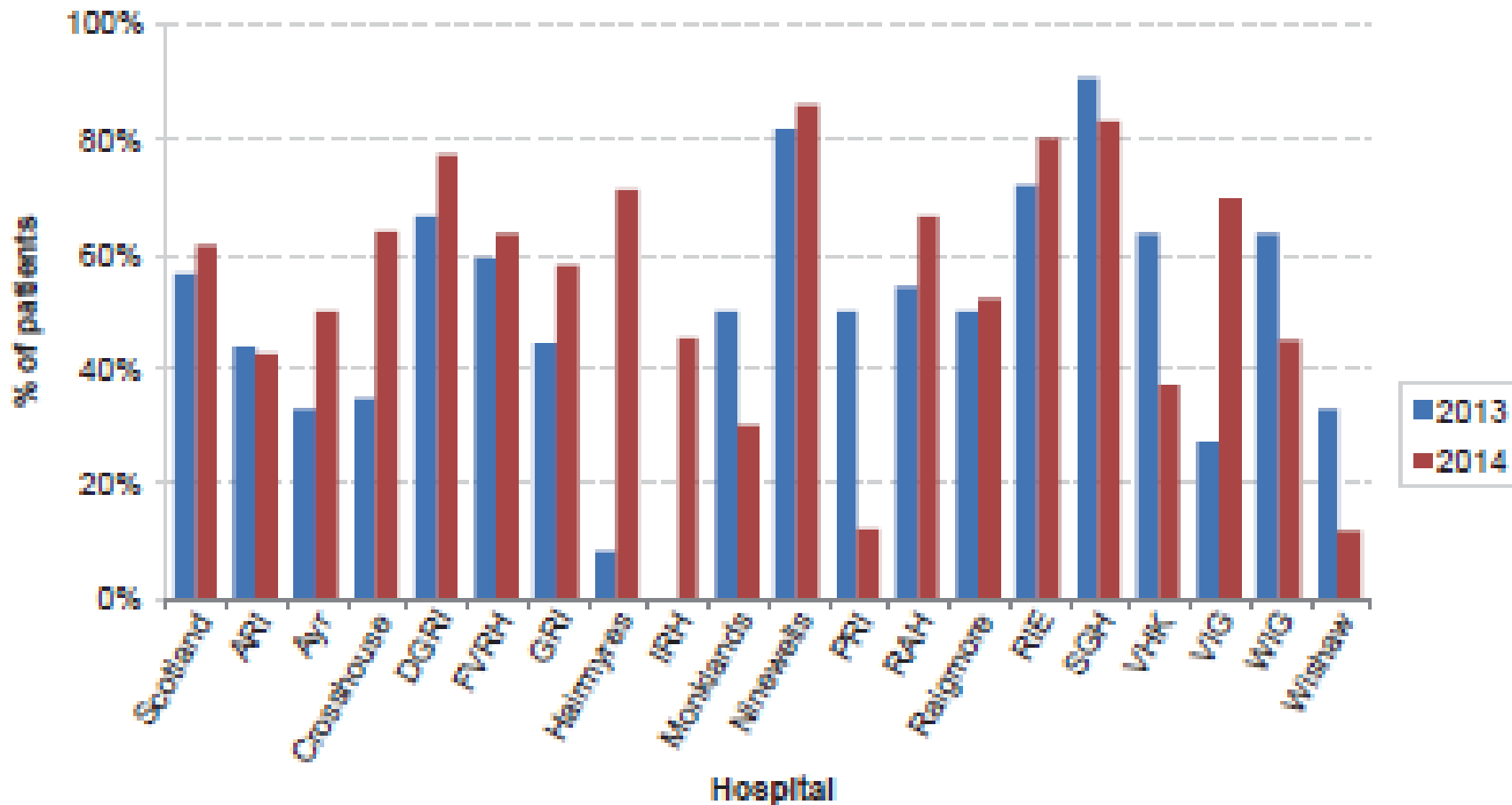


Note STAG follow up patients to point of discharge or a maximum of 30 days.

Quality Indicators

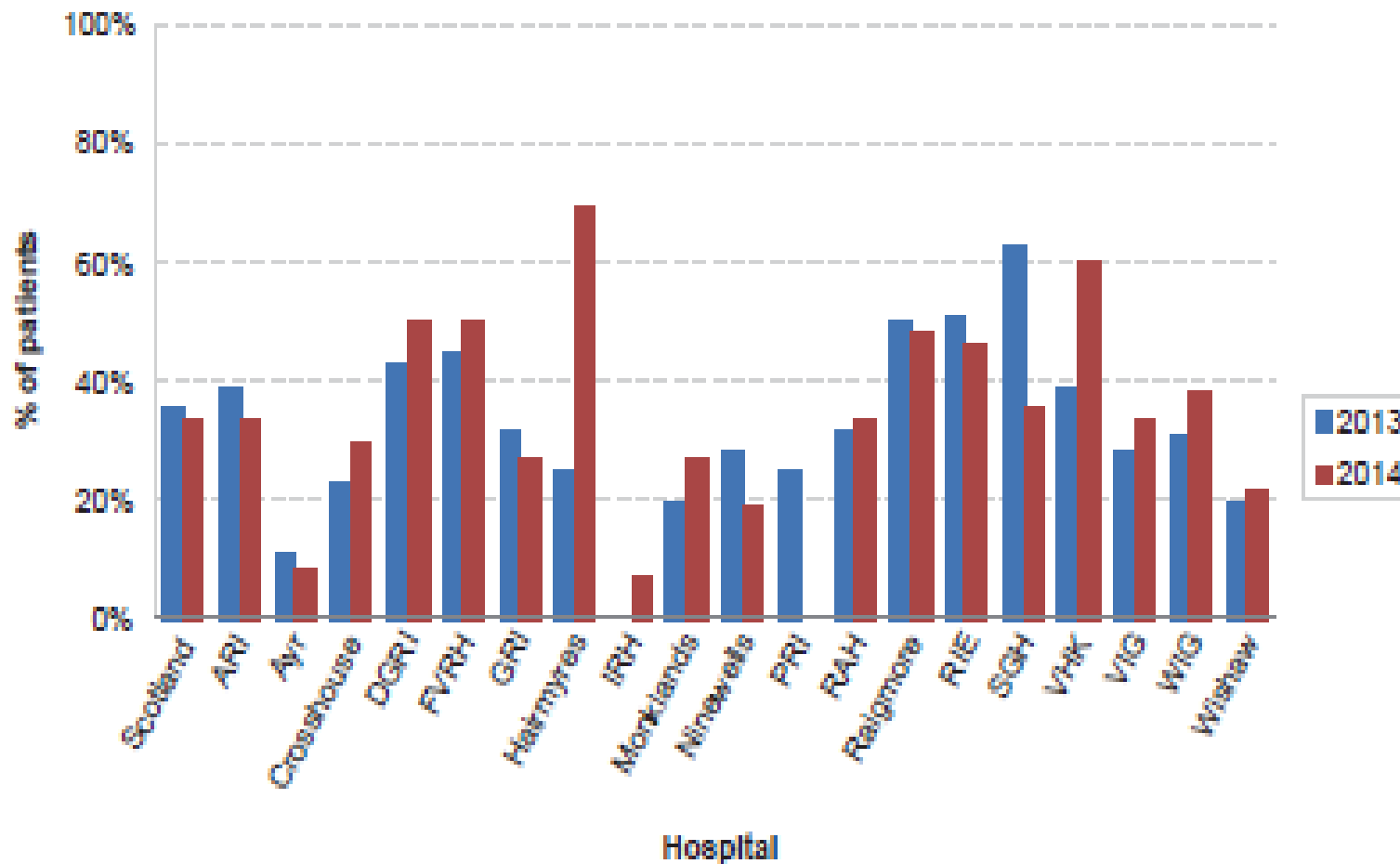
- 100% not realistic for most
- Huge amount of variation between sites
- There is room for improvement across Scotland
- QI's removed:
 - SpO₂ recorded in ED
 - ECG recorded in ED
 - EWS or other obs. chart present
 - GCS recorded in ED
 - Laparotomy <1 hr for AIS abdomen ≥3

Figure 4.3 Percentage of major trauma patients seen by an Emergency Medicine Consultant within one hour, by hospital



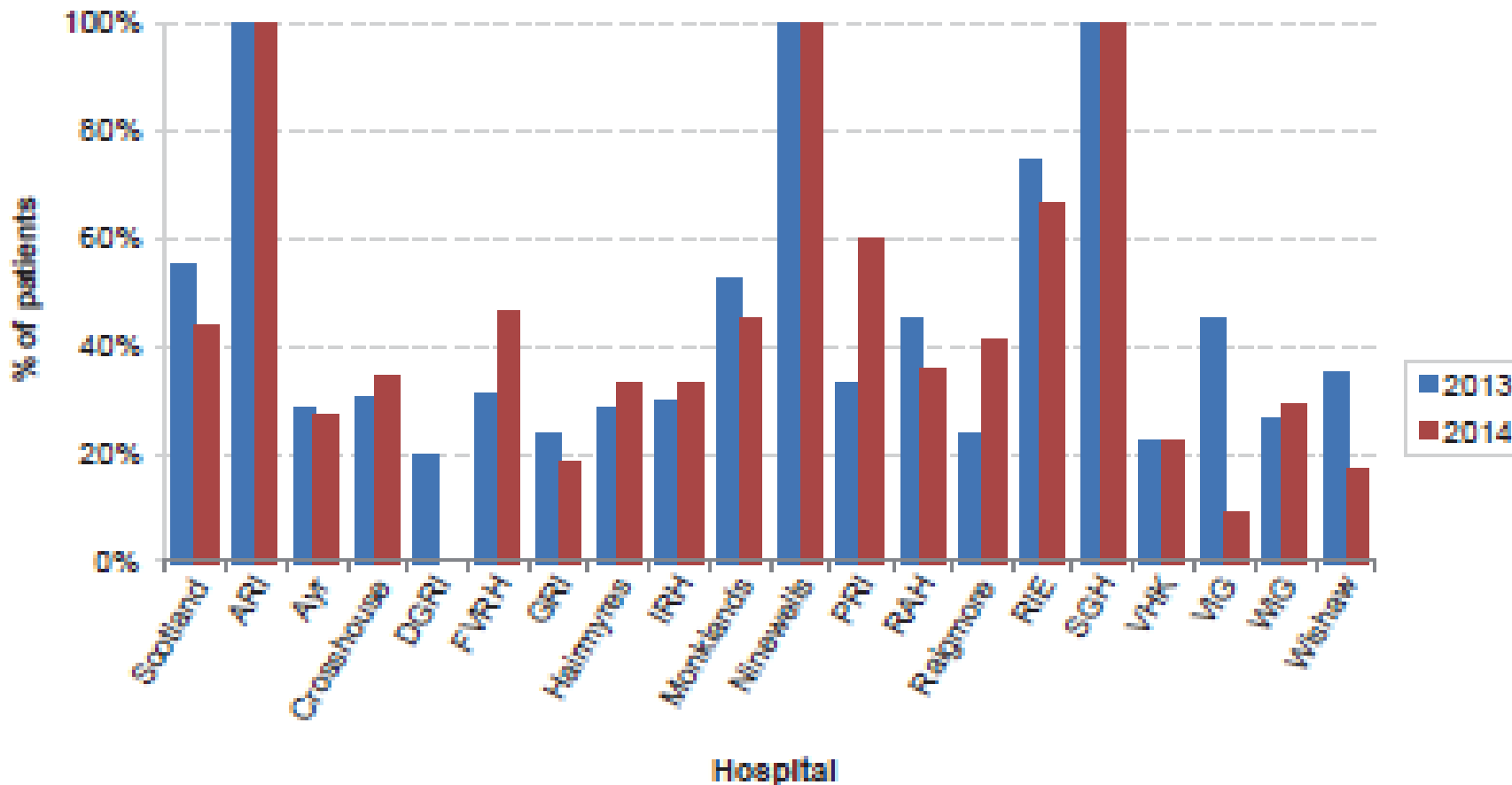
Note This definition is based on the current Quality Indicators used by STAG.

Figure 4.4.2 Percentage of patients with a GCS ≤ 8 and/or severe head injuries AIS (head) ≥ 3 who had a head CT scan within one hour, by hospital



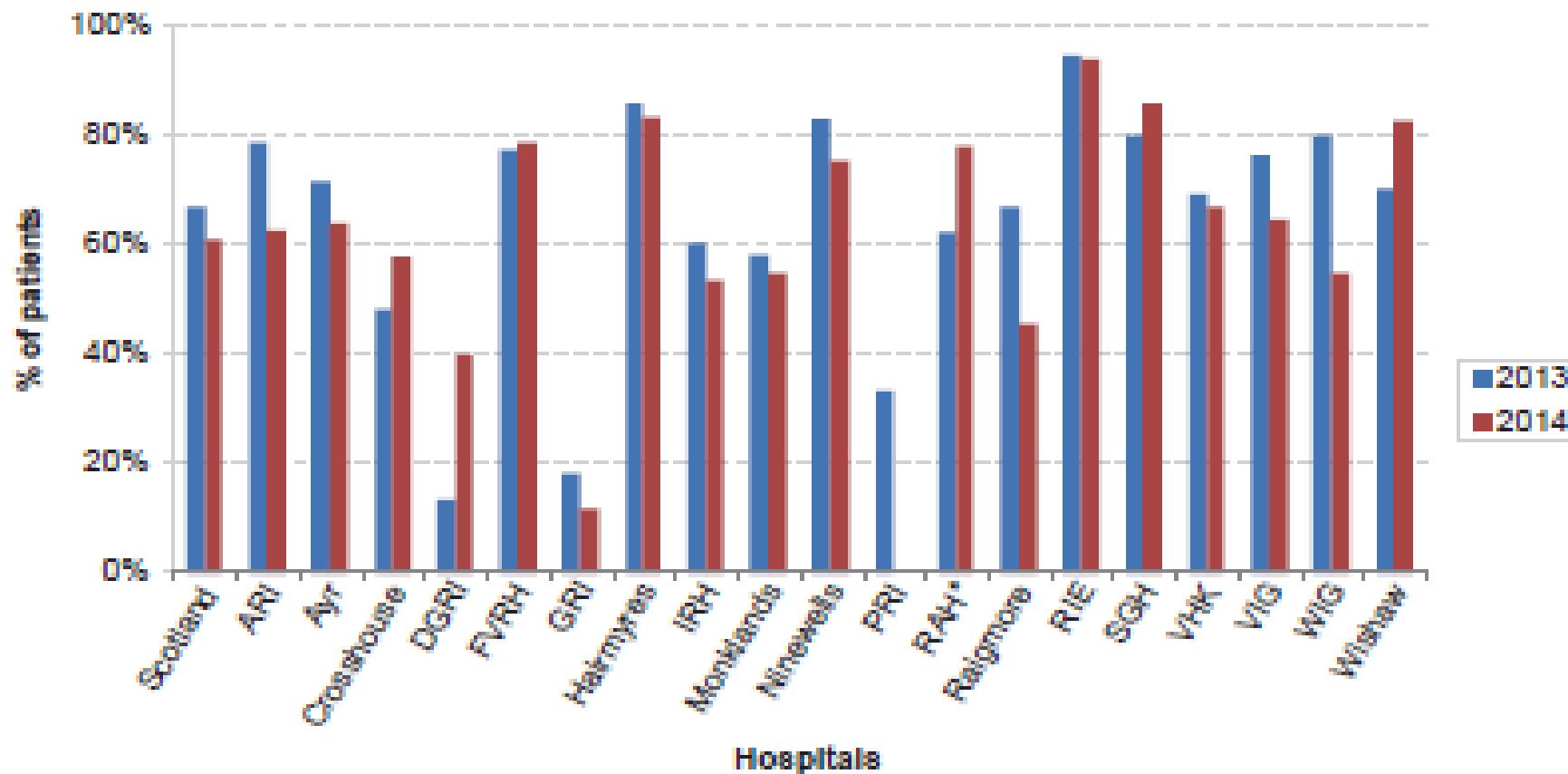
Note This definition is based on the new Key Performance Indicators (KPI) that will be introduced in 2016.

Figure 4.5.1 Percentage of patients with a severe head injury who are admitted or transferred to a setting with 24 hour access to a Neurosurgical ICU, by hospital



Note This definition is based on the current Quality Indicators used by STAG.
Severe head injury is defined as a patient with an Abbreviated Injury Score (AIS) (Head) ≥ 3 .

Figure 4.5.2 Percentage of patients with a severe head injury who have a neurological specialist referral whilst in the ED, by hospital



* 1 case removed in 2013

Note Please note this is not a QI but supplements the information in Figure 4.5.1.

How outcome prediction works

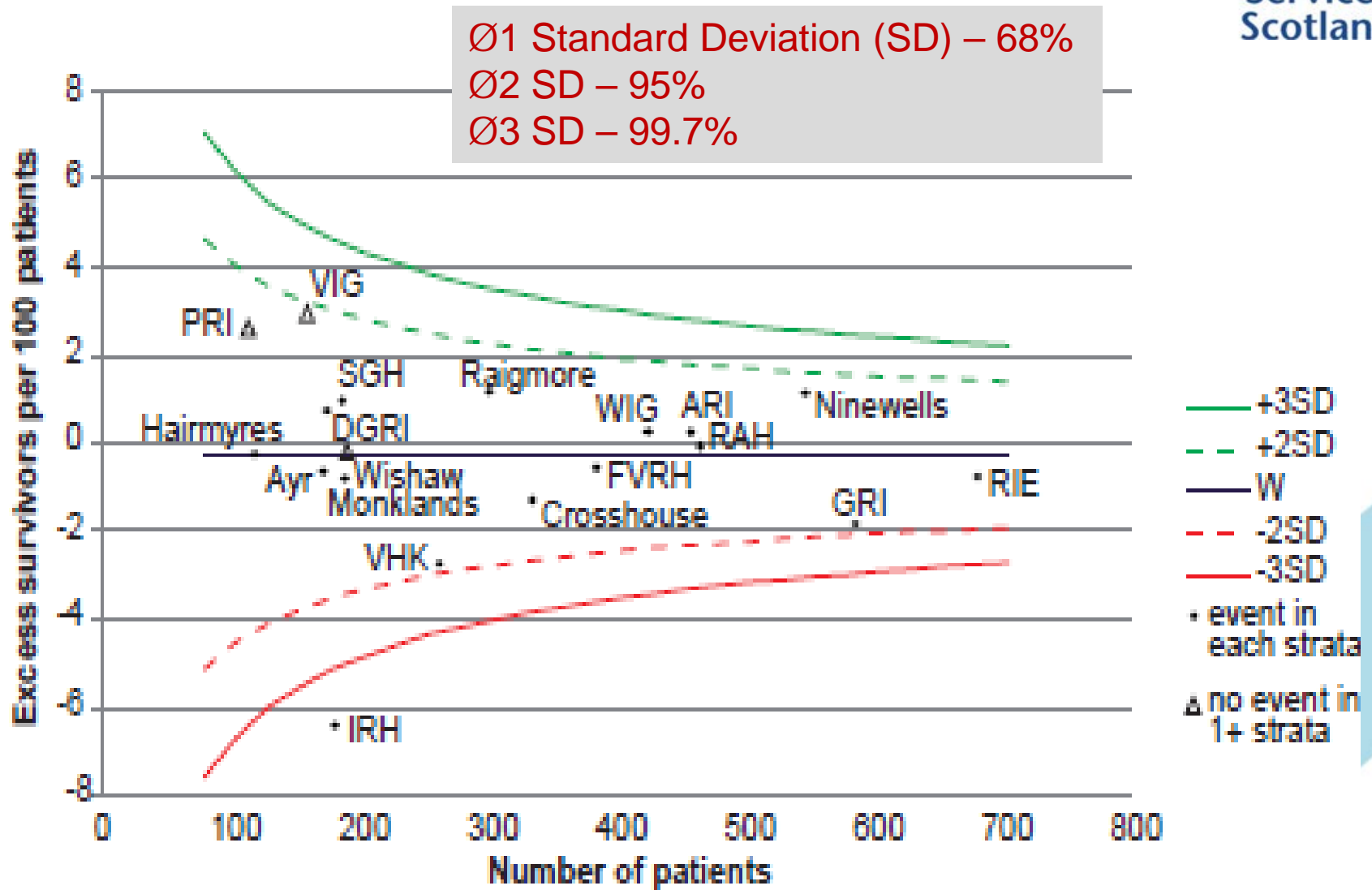
Ps12 TARN model

- Comparison with TARN data 2005 – 2011
- Problems with lack of physiological data
- Multivariable regression analysis:
 - Age
 - Gender
 - GCS
 - ISS
- Validity of sample comparison

Rate of Survival Breakdown Scotland, 2013-2014 combined

Survival band %	Number in group	Expected Survivors	Actual Survivors	Difference W	Adjusted Difference (Wstat)
0 - 25	66	11.16	11	-0.2	0.0
25 - 50	114	43.06	34	-8.0	-0.2
50 - 75	211	139.11	115	-11.4	-0.5
75 - 90	326	277.43	278	0.2	0.0
90 - 95	811	756.10	768	1.5	0.2
96 - 100	4422	4366.34	4379	0.3	0.2
Total	5950	5593.21	5585	-0.1	-0.2

Figure 5.1 Revised W-Statistic: by hospital (2013–2014)



Conclusions

- STAG has a high quality data set
- Significant variation in incidence of penetrating trauma across Scotland
- Alcohol consumption is a feature of trauma cases significantly more often in males
- 89% arrive by SAS resource
- Majority arrive out of hours
- There is huge variation in the process of care across Scotland
- There is evidence of improvement in the process of care
- The current standard of care of care in Scotland is very close to the reference database

Questions?



Congratulations!
You passed your driver's test.



TARN PS12 - Calculations

- Predictors & Coefficients

The second order fractional polynomial model for ISS, expressed as:

$$ISS_1 = \sqrt{\frac{10}{ISS}} - 0.8636, \quad ISS_2 = \log_e \left(\frac{ISS}{10} \right) - 0.2933$$

where \log_e is the natural logarithm.

The improved outcome prediction model is detailed below:

$$b = b_0 + b_1 \dots b_6 \text{ GCS} + b_7,8 \text{ ISS} + b_9,10 \text{ Gender} + b_{11} \dots b_{18} \text{ Age} + b_{19} \dots b_{26} \text{ Age} \times \text{Gender}$$

$b_0 \dots b_{26}$ are coefficients derived from regression analysis applied to data from TARN 2005 - 2011.

b_0 = constant 4.9146

b_1 = 0 and applies when the GCS = 13 - 15

b_2 = -1.27734 and applies when the GCS = 9 - 12

b_3 = -1.68936 and applies when the GCS = 6 - 8

b_4 = -2.52661 and applies when the GCS = 4 - 5

b_5 = -3.62339 and applies when the GCS = 3

b_6 = -2.31186 and applies when Intubated

b_7 = -3.000163

b_8 = -2.74522

b_9 = 0 and applies when gender = male

b_{10} = -0.024416 and applies when gender = female

b_{11} = -0.045908 and applies when Age = 0 - 5

b_{12} = 0.549181 and applies when Age = 6 - 10

b_{13} = 0.210467 and applies when Age = 11 - 15

b_{14} = 0 and applies when Age = 16 - 44

b_{15} = -0.557926 and applies when Age = 45 - 54

b_{16} = -0.995816 and applies when Age = 55 - 64

b_{17} = -1.74081 and applies when Age = 65 - 74

b_{18} = -3.01315 and applies when Age = > 74

b_{19} = -0.26133 and applies when Age = 0 - 5 and gender = female

b_{20} = 0.099246 and applies when Age = 6 - 10 and gender = female

b_{21} = -0.23219 and applies when Age = 11 - 15 and gender = female

b_{22} = 0 and applies when Age = 16 - 44 and gender = female (or male)

b_{23} = 0.003235 and applies when Age = 45 - 54 and gender = female

b_{24} = -0.085054 and applies when Age = 55 - 64 and gender = female

b_{25} = 0.081554 and applies when Age = 65 - 74 and gender = female

b_{26} = 0.299887 and applies when Age >74 and gender = female

The constant $e = 2.718282$ (the base of Napierian logarithms). The probability of survival is expressed as:

PS12 formulae:

$$Ps = \frac{e^b}{1 + e^b}$$