

# Scottish Trauma Audit Group



**Audit of Trauma Management in Scotland 2013  
Reporting on 2012**

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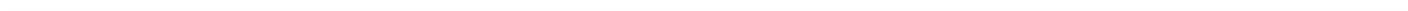
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## Foreword

The Scottish Trauma Audit Group (STAG) has now completed the collection and analysis of two full years of data detailing the patient journey and outcome for more than ten thousand patients who were admitted, transferred or died as a direct consequence of trauma in this country.

Over the last 20 years, since the inception of STAG, there has been an emergence of greater investigative and intervention options that have enhanced trauma care for our patients. Outcomes continue to improve as indicated both in last year's report and again this year, reporting on 2012 data.

Modern healthcare is a complex adaptive system. It is essential that teams work collaboratively, utilising learning from within pathways of care, underpinned by robust governance to assure the people of Scotland that they are receiving the best trauma care that can be provided. There is also a need to maximise learning from other healthcare systems to understand if further enhancements could be made to trauma care provision in this country.

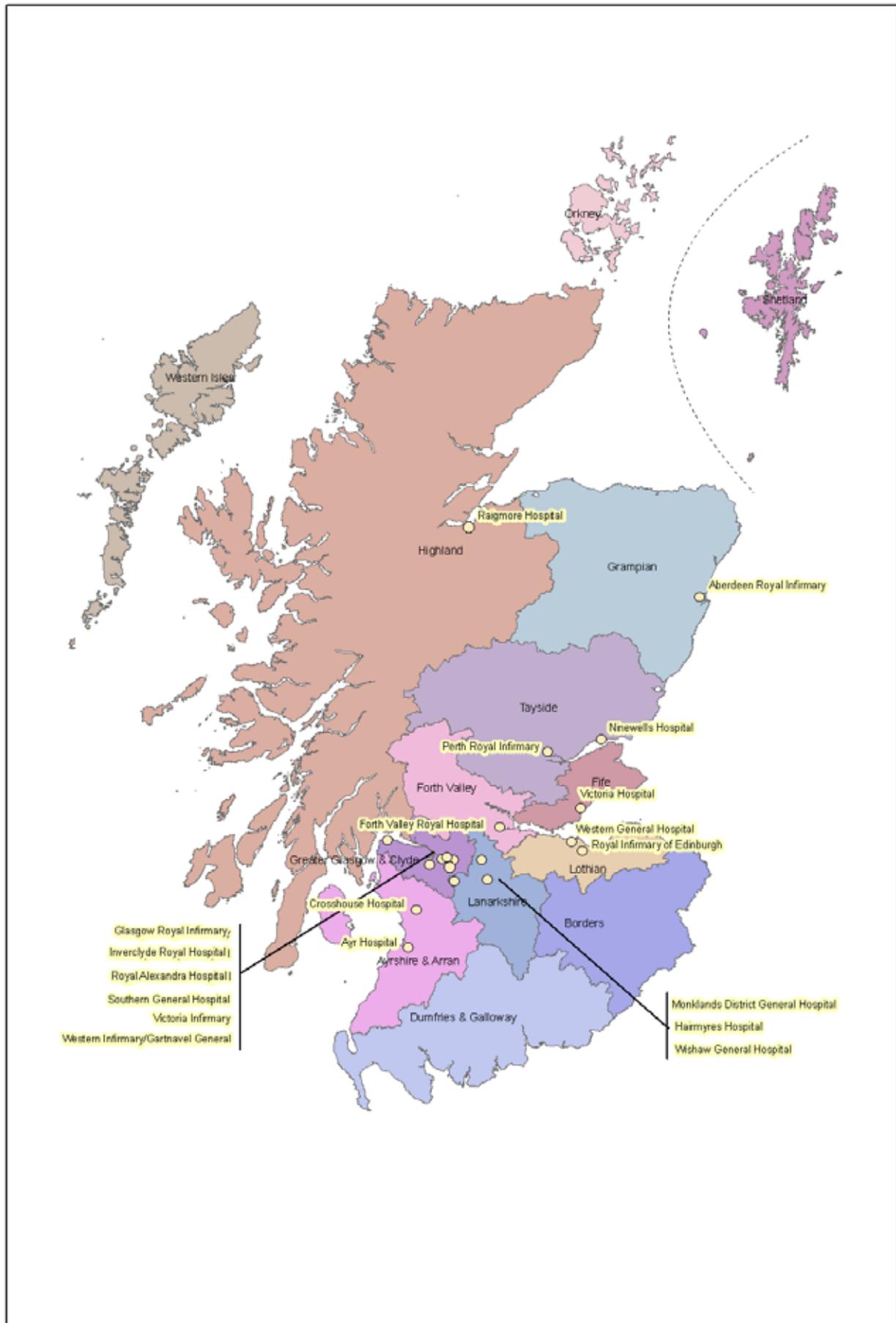
Quality improvement continues as the focus within the STAG audit, supported by a drive to complete the linkage with other audits. Over the next year, STAG will complete work with the Scottish Ambulance Service (SAS), facilitating the availability of whole patient journey information. This will allow more precise incident location as well as detailing the pre-hospital care provided. Clinical outcomes for trauma will be utilised by the SAS through their established clinical governance structures to promote improvement. Linkage with the Hospital Standardised Mortality Ratio (HSMR)<sup>1</sup> project will allow trauma outcome to be evaluated in the context of prior morbidity and social deprivation—a particular interest of mine.

The National Planning Forum Major Trauma Subgroup, involving senior clinicians from all specialties, was established following the report by the Royal College of Surgeons of Edinburgh in May 2012, entitled Trauma Care in Scotland<sup>2</sup>. The remit of the subgroup was to make recommendations around any potential changes that would further enhance the provision of trauma care in this country. The group concluded that STAG data should be used to confirm that the trauma care we provide continues to be as good as it can be.

**Sir Harry Burns**

Chief Medical Officer

## Location Map



## Introduction

The publication of the 2013 annual report, reporting on 2012 data, presents detailed information on the patient journeys of 5041 trauma patients that have passed through the Scottish trauma healthcare system. Thousands of healthcare providers have provided high quality care aligned with these patient journeys. The role of the STAG audit, and the dedicated audit professionals on each contributing hospital site that collect, verify and feedback outcome information to clinical teams, is to assure patients, families and clinicians that the care they provide is the best possible. Identifying areas where trauma care could be yet further improved and then achieving this improvement is paramount. This is our duty to our patients.

The outcome for trauma patients continues to improve within Scotland year on year and this report demonstrates that this is also the case in 2012. There is further qualitative information that there is greater use of audit data at an operational level for quality improvement purposes. A greater proportion of major trauma victims survived, with an associated rise in consultant involvement with this patient group. There is also an increase in patients with physiological derangement being triaged to the resuscitation room giving them access to a higher level of care.

The work of the National Planning Forum Major Trauma Subgroup, commissioned by the Cabinet Secretary for Health and Wellbeing, to explore possible ways to enhance major trauma services in Scotland, has progressed throughout 2013 and will report in the autumn. STAG has had a prominent role in these discussions, with the Subgroup recognising the importance of the high quality national clinical audit data that STAG provides. This data has been central in defining current trauma care, and will continue to be utilised both to facilitate ongoing quality improvement and to monitor any changes that are associated with the recommendations around further improvements to trauma pathways of care. The implementation of any suggested changes to the pathways of care need to be assured via STAG utilising accepted methodology and comparative analysis.

A focus for the subgroup was secondary transfers for major trauma patients, with a total of 30% of major trauma patients undergoing transfer from the initial receiving hospital in 2012. This secondary transfer burden can often significantly deplete the critical care resources of the source unit and suggests that there may be some benefit in more dynamic initial triage. Enhancements to pre-hospital care, decision making support for initial triage, greater clarity around trauma pathways of care and fewer secondary transfers are likely to be beneficial for patients.

Some local issues within the central co-ordinating team have contributed to delays with database linkage with the Scottish Ambulance Service and with Scottish Morbidity Record (SMR01) information. While these delays are disappointing, progress continues to be made in these areas and this work will ultimately result in a more comprehensive understanding of trauma care in this country.

This year, the outcome (W-stat) for each unit that contributes to STAG has been published (Appendix F). These outcomes are aggregated to give the final Scottish figure of two excess survivors per hundred patients entered into the database, using accepted methodology. The decision to publish this unit level information has been taken for improvement purposes. Some caution needs to be applied to interpretation of this information in view of patient numbers for each unit, trauma admission profiles and chance variation. Overall, the results are encouraging.

The care of the multi-system trauma patient or the major trauma patient is amongst the most complex provided and is multi-disciplinary in approach. High quality audit information is provided by STAG on a regular basis for each contributing site to facilitate reflection and improvement in practice. Moving forward, units that continue to receive these complex patients should be compelled to submit data to STAG for analysis and should demonstrate that they have robust systems in place for multi-disciplinary review of the care that is provided to facilitate improvement. This is what our patients would expect.

**Dr Crawford McGuffie**

Chairman, Scottish Trauma Audit Group

## Summary and Key Findings

- In 2012, a total of 19 hospitals submitted data to STAG on 5041 patients.
- The age and gender distribution of these patients is broadly comparable with 2011.
- The proportion of patients suffering major trauma has not altered.
- The proportion of penetrating trauma has fallen again this year (3%).
- There is evidence to suggest that alcohol is directly associated with 1 in 5 incidents of minor and moderate trauma, rising to 1 in 3 of all major traumas cases recorded in Scotland in 2012.
- The majority of trauma patients (79%) arrive by ambulance. This illustrates the importance of database linkage with the SAS and further enhancement of governance links between services.
- Significant recent developments in aero medical retrieval services have occurred which is reflected in the increasing number of major trauma patients arriving by air (7%).
- Almost 70% of major trauma patients are attended by consultants within the Emergency Department compared with 60% in 2011.
- In 2012, 70% of major trauma was initially triaged to the resuscitation room (resus).
- There is also further indication that patients with physiological derangement are being triaged to the resuscitation room with the provision of an associated higher dependency of care (85% of patients with any physiological compromise were triaged to resus, compared with 81% in 2011).
- 30% of major trauma patients underwent transfer to another hospital in 2012.
- The median age of the patients who died during 2012 has also increased to 74 years which compares with 70 years and 59 years for 2011 and 1992–2002 respectively.
- Any physiological compromise in the trauma patient is associated with a reduction in survival from 98% to 77%.
- A total of 85% of major trauma victims survived, which compares favourably to 2011 (83%) and 1992–2002 (75%).
- There are two excess survivors per 100 trauma patients entered into the STAG database, which shows an improvement trend on 2011, as well as on historical data.
- Evidence has been provided from participating sites confirming detailed local review for patients highlighted by the STAG Quality Indicators. This demonstrates that the use of high quality national audit data for quality improvement purposes continues.

## Methodology

### Data Collection

STAG has a team of Local Audit Coordinators (LACs) who are employed by the participating boards to identify patients, collect data and feedback results to their local sites. Data were collected by LACs in each of the 19 participating sites (Fig 1.1 and Location Map). All hospitals in mainland Scotland with an Emergency Department (ED) were eligible to contribute, however four hospitals did not have a LAC.

Data are recorded prospectively by clinical and administrative staff as part of the patient's routine care and are collected retrospectively by the STAG LACs. Data sources include patient's case notes, patient administration system and results of diagnostic imaging and surgical procedures.

Anonymised paper proforma are submitted to STAG central office at ISD for processing and conversion to electronic form by a third party contractor, who use dual data entry to ensure accuracy.

### Eligibility

All patients who attend participating STAG EDs are reviewed to determine the following criteria for inclusion:

- all patients aged >13 years and
- who have sustained injury requiring an inpatient stay of at least three days or
- who die during their inpatient episode or
- are transferred to another STAG hospital or regional centre (see location map)
- patients are followed for three months or until death or discharge
- Full details of inclusion/exclusion criteria are available on the STAG website: [www.stag.scot.nhs.uk/Projects/Trauma\\_Audit\\_Inclusion\\_Exclusion.pdf](http://www.stag.scot.nhs.uk/Projects/Trauma_Audit_Inclusion_Exclusion.pdf).

### Probability of Survival

STAG uses internationally validated TRISS methodology (Revised Trauma and Injury Severity Score)<sup>4</sup> to determine probability of survival for each patient. This is a population based statistic which uses physiological derangement and injury severity to determine whether a patient would normally be expected to survive.

The Revised Trauma Score (RTS)<sup>5</sup> is used to evaluate physiological derangement and the Abbreviated Injury Scale (AIS)<sup>6</sup> and Injury Severity Score (ISS) are used to code and score individual injuries and score overall severity of injuries. These measurements of physiological and anatomical derangement are combined and adjusted for age and whether the trauma was blunt or penetrating to give a resultant probability of survival for that patient.

The aggregation of all eligible trauma patients within a hospital gives a W-statistic for that hospital stated in terms of excess survivors per 100 trauma patients, relative to the reference database.

A more detailed description of the statistics used and the completeness of the data are provided in Appendix F.

## **Quality assurance**

All data are subject to a computer based validation process—queries are raised and LACs provide confirmation on correction to the query. In addition the AIS<sup>6</sup> coding on every patient has been quality assured by a member of the central STAG team.

Data collection processes are quality assured by regional coordinators during sites visits, this includes assessment of individual site's case ascertainment rate.



## Section 1: Demographics

**Figure 1.1 STAG trauma patient inclusion summary (2012)**

Key: Data submitted (full month)   
No data submitted 

Hospital	2012												Patients Included	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Aberdeen Royal Infirmary														359
Ayr Hospital														169
Crosshouse Hospital														312
Forth Valley Royal Hospital														256
Glasgow Royal Infirmary														272
Hairmyres Hospital														207
Inverclyde Royal Hospital														141
Monklands Hospital														169
Ninewells Hospital														491
Perth Royal Infirmary														113
Queen Margaret's Hospital*														15
Raigmore Hospital														215
Royal Alexandra Hospital														272
Royal Infirmary, Edinburgh														696
Southern General Hospital														208
Victoria Hospital, Kirkcaldy														271
Victoria Infirmary, Glasgow														249
Western Infirmary, Glasgow														376
Wishaw General Hospital														250
<b>Patients Included</b>	<b>403</b>	<b>371</b>	<b>426</b>	<b>362</b>	<b>417</b>	<b>398</b>	<b>378</b>	<b>474</b>	<b>393</b>	<b>417</b>	<b>430</b>	<b>572</b>	<b>5,041</b>	

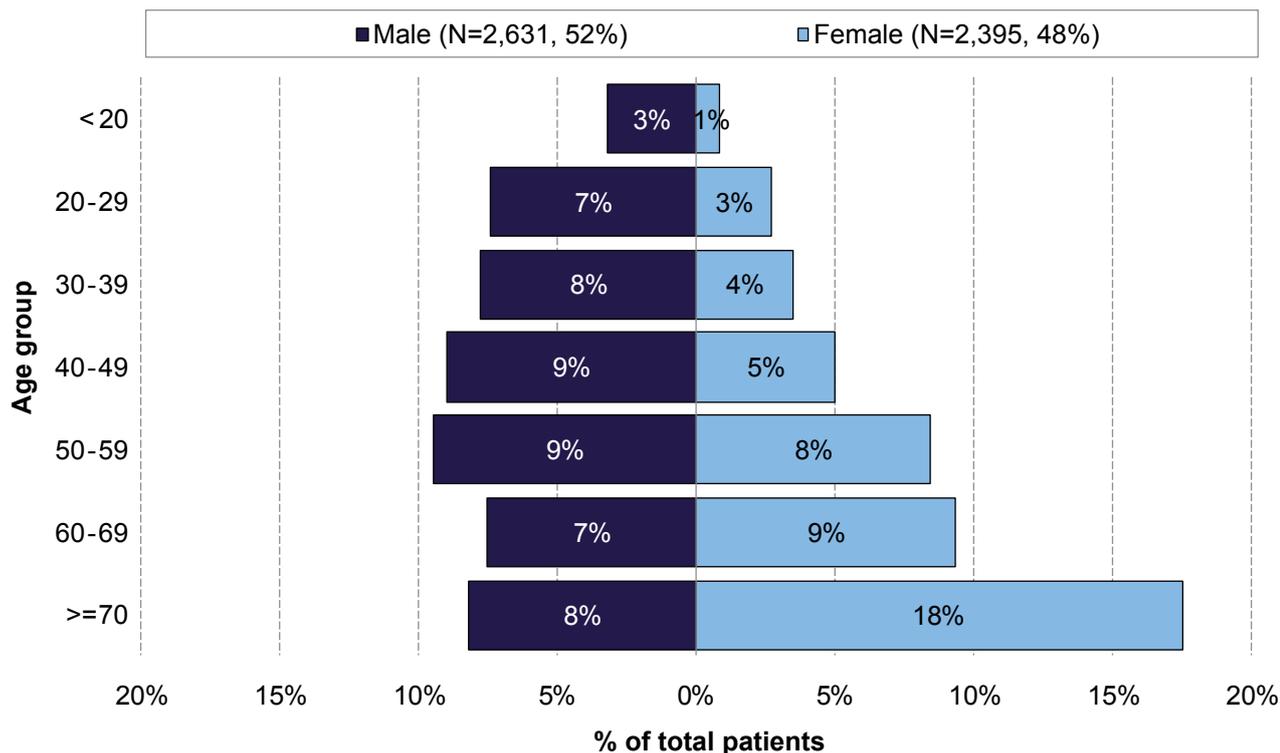
\* Queen Margaret's Hospital in Dunfermline became a minor injury unit in January, Victoria Hospital, Kirkcaldy is now the central ED unit for Fife.

Note: 14 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=5,027).

A total of 5,041 patients were included in the audit in 2012, this figure is similar to 2011 (5,065). In 2012, 19 hospitals submitted data to STAG (20 in 2011).

Local staffing issues in some centres meant that information was not available for the full year. The STAG team will continue to work with all boards to ensure Local Audit Coordinator vacancies are filled and support is provided to ensure ongoing data submission. This must be seen as a priority to all Boards as potential changes are made to further enhance trauma care in Scotland.

**Figure 1.2 Age and gender distribution of STAG trauma patients (2012)**



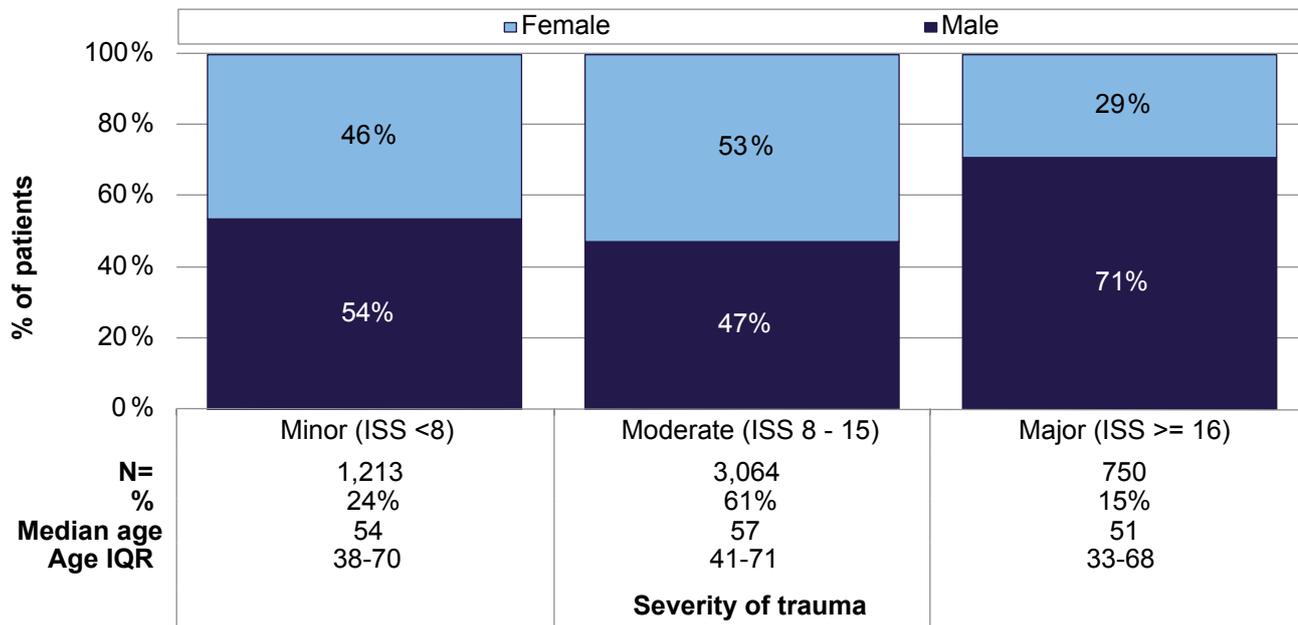
Note: The gender of one patient was not available for 2012 data.

The age and gender distribution of STAG patients is broadly comparable with 2011. Male patients tend to be younger (median 48 years compared to 63 years for female patients) with an overall median age of all trauma patients 55 years.

Additional information can be accessed on the STAG website [www.stag.scot.nhs.uk](http://www.stag.scot.nhs.uk).

## Section 2: Type and Severity of Trauma

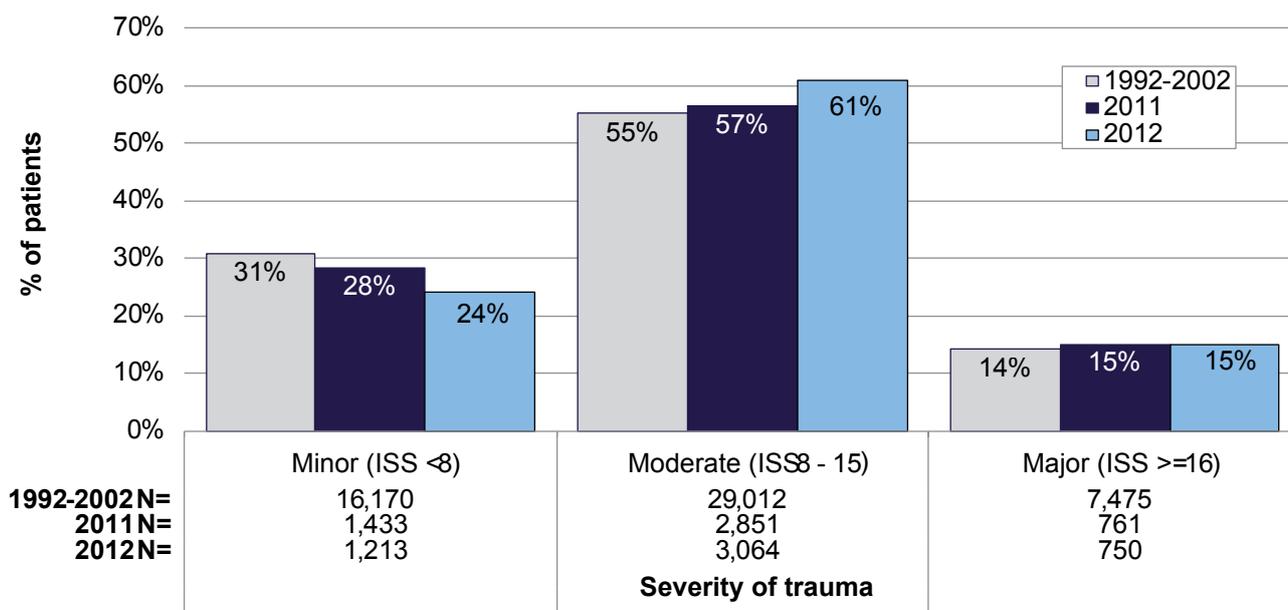
Figure 2.1 Percentage of male and female patients by severity of trauma (2012)



IQR: Inter-quartile range.

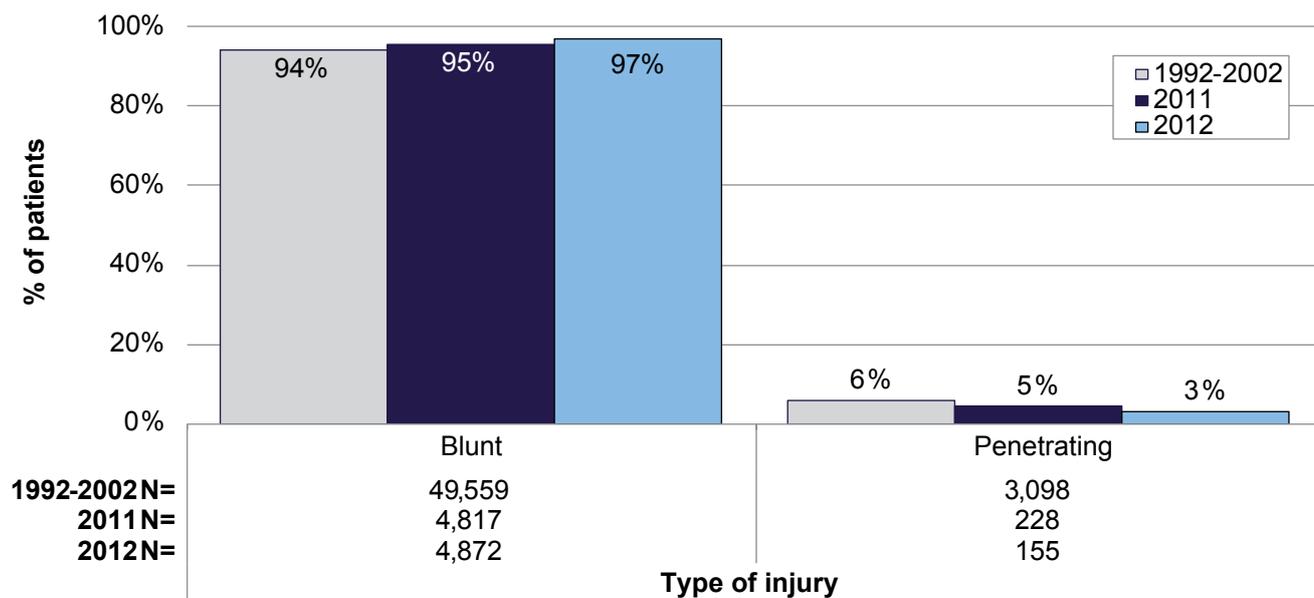
As with previous years, there remains a roughly equal gender split across minor and moderate trauma, with a clear male bias in the major trauma group. The major trauma group is younger with a median age of 51 and an inter-quartile range (IQR) of 33–68.

Figure 2.2 Percentage of patients with minor, moderate and major trauma (1992–2002 vs. 2011 vs. 2012)



Compared with previous years, in 2012 there is a downward trend in minor trauma, offset by an increase in the proportion of moderate trauma with the incidence of major trauma remaining unchanged. This may reflect changes in service provision with a greater emphasis on ambulatory care.

**Figure 2.3 Percentage of patients with blunt / penetrating injury (1992–2002 vs. 2011 vs. 2012)**

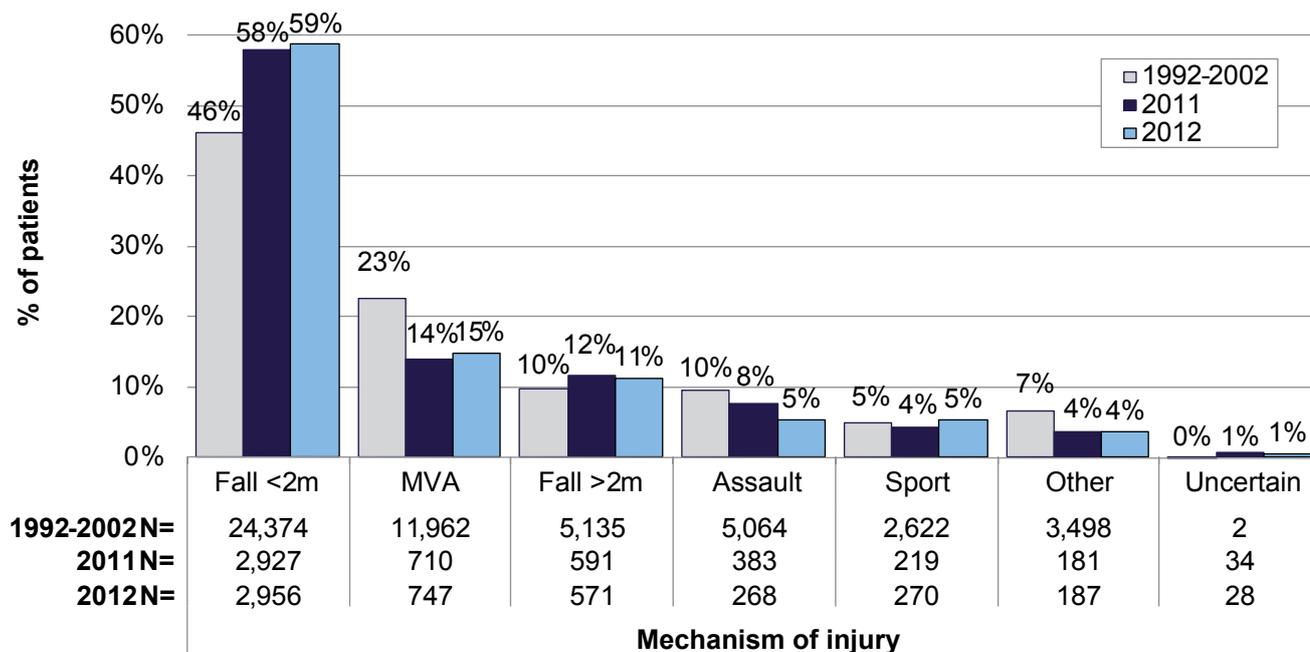


In 2012, 97% of patients sustained a blunt injury, with the remaining 3% classified as having sustained a penetrating injury. There has been a continual downward trend in the incidence of penetrating trauma from 6% in the period covering 1992–2002, to 5% in 2011 and now 3% in 2012. This may be a consequence of changing trauma patterns, data completeness or chance variation.

The penetrating trauma group is dominated by young males (93% male vs. 7% females, median age 32 and IQR 22–44), whereas the blunt trauma group was older with a more even spread between the sexes (51% males v 49% females, median age 56 and IQR 40–71).

Additional information can be accessed on the STAG website [www.stag.scot.nhs.uk](http://www.stag.scot.nhs.uk).

**Figure 2.4 Percentage of patients by mechanism of injury (1992–2002 vs. 2011 vs. 2012)**

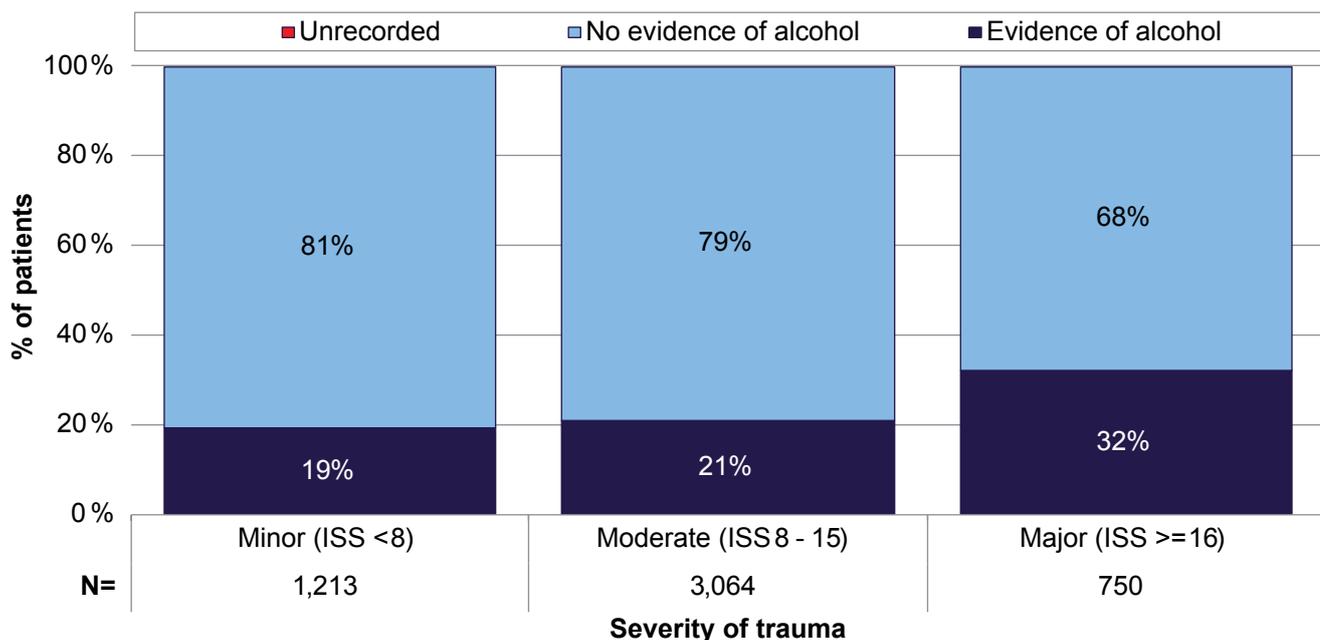


MVA: Moving vehicular accident

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

There is a reduction in patients included in the assault group from 8% in 2011 to 5% in 2012.

**Figure 2.5 Percentage of patients where there was evidence of involvement of alcohol by severity of trauma (2012)**



Data is collected on whether alcohol played a role in trauma injuries. It is recorded if evidence existed that either the trauma patient or another contributor to the trauma had ingested alcohol. Alcohol is associated with 1 in 5 incidents of minor and moderate trauma, rising to 1 in 3 of all major traumas cases recorded in Scotland in 2012. There has been no change in the overall rate of alcohol involvement for all trauma patients between 2011 and 2012 (22%).

Additional information can be accessed on the STAG website [www.stag.scot.nhs.uk](http://www.stag.scot.nhs.uk).

## Section 3: The Patient Journey

**Figure 3.1 Percentage of Scottish population living in urban/rural areas versus percentage of incidents taking place in urban/rural areas (2012)**

Population density	Population density at location of STAG incidents		Scottish population population*
	No. patients	% patients**	
Urban	4,098	88%	82%
Rural	546	12%	18%
Total	4,644	100%	100%

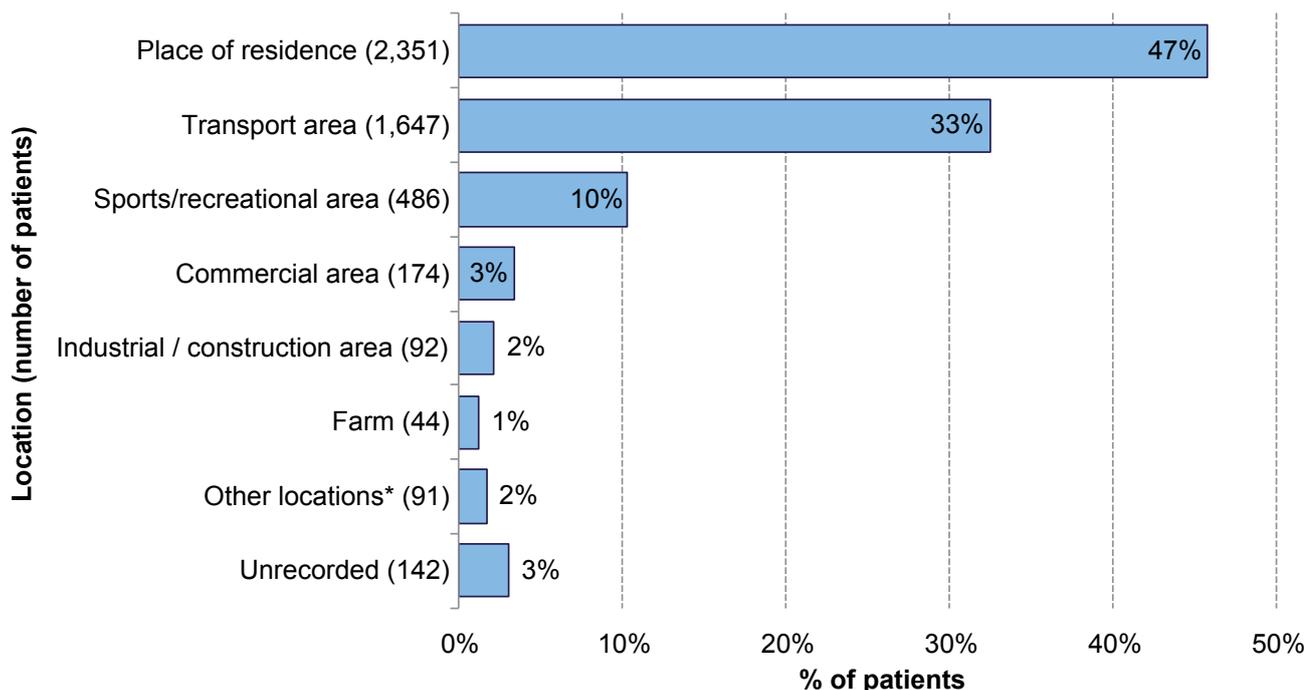
\* Source: <http://www.gro-scotland.gov.uk/statistics/theme/population/estimates/special-area/sape/2010/index.html> (published Aug 2012).

\*\* STAG patient percentages calculated using cases where the population density at the location of STAG trauma incident was recorded (N=4,644). Cases where this information was not available have been excluded (N=383).

Note: The percentage of cases where the population density was not recorded tends to be higher at the hospitals that treat the most 'rural' patients. It is possible that the percentage of 'rural' patients is under-reported in the above figure. We plan to link to the SAS database later this year and should be able to extract 'population density' information for these 'Not recorded' cases.

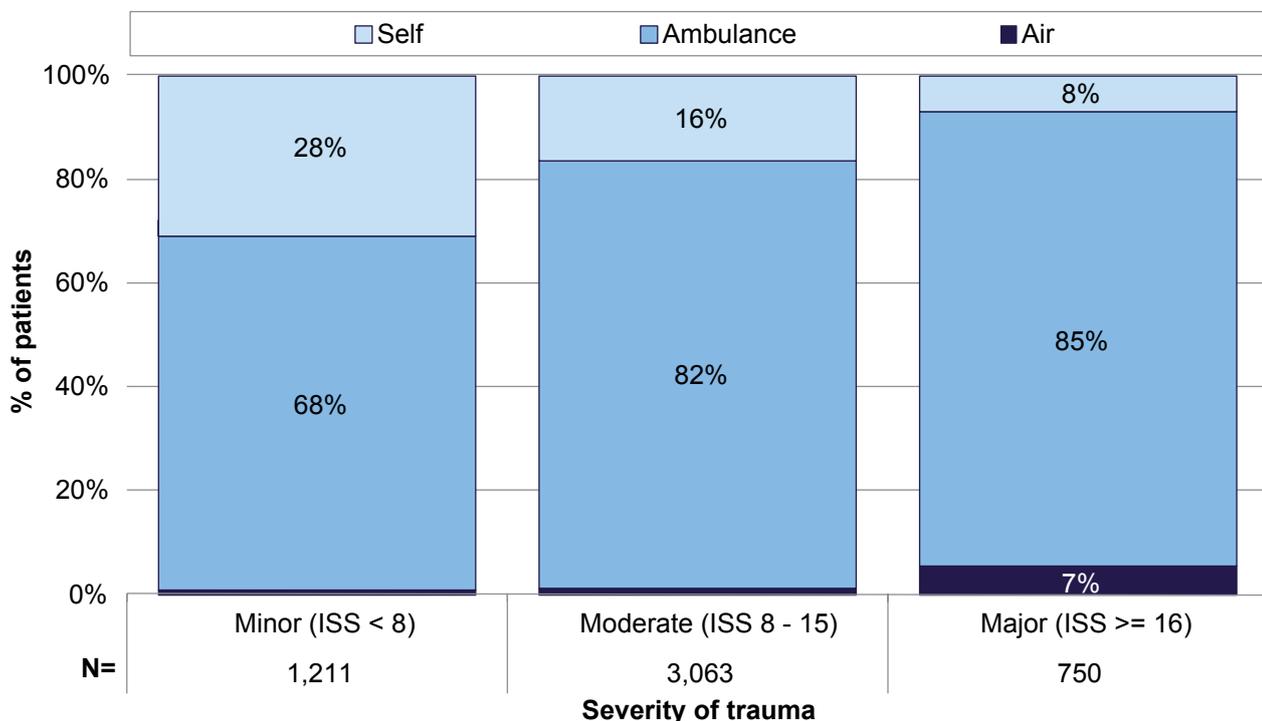
There is no change in these proportions in 2012. Future work to link STAG and SMR01<sup>3</sup> databases should provide a detailed understanding of the effect of rurality on trauma outcome.

**Figure 3.2 Percentage of patients by location of incident (2012)**



\* Other locations include 'Business area - non specific' (N=49), 'School/educational area' (N=12) and 'Medical service area' (N=30).

**Figure 3.3 Percentage of patients arriving by air, ambulance or self, by severity of trauma (2012)**

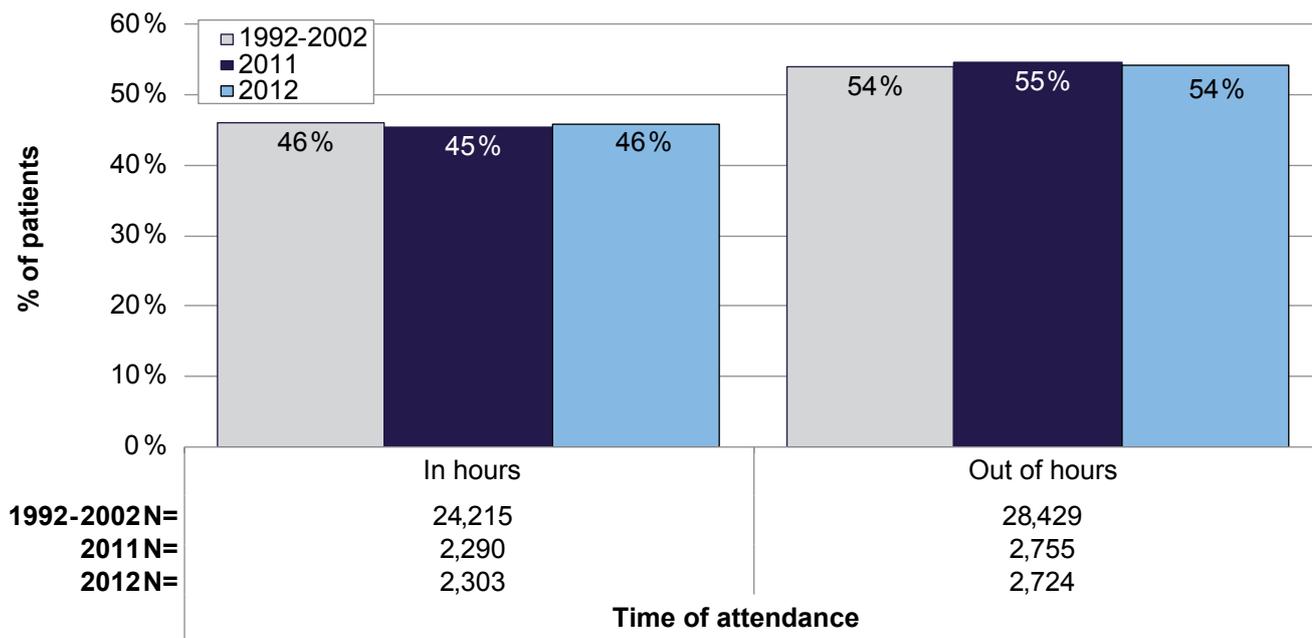


Note: For 3 patients it was not possible to determine the mode of arrival to the Emergency Department.

The majority of trauma patients (80%), regardless of severity, arrive by ambulance. This illustrates the importance of database linkage with the SAS and further enhancement of governance links between services.

Recent developments in aero medical retrieval services have occurred which is reflected in the increasing number of major trauma patient's arriving by air (7% in 2012 compared with 4% in 2011).

**Figure 3.4 Percentage of 'in hours' / 'out of hours' attendances\* (1992–2002 vs. 2011 vs. 2012)**



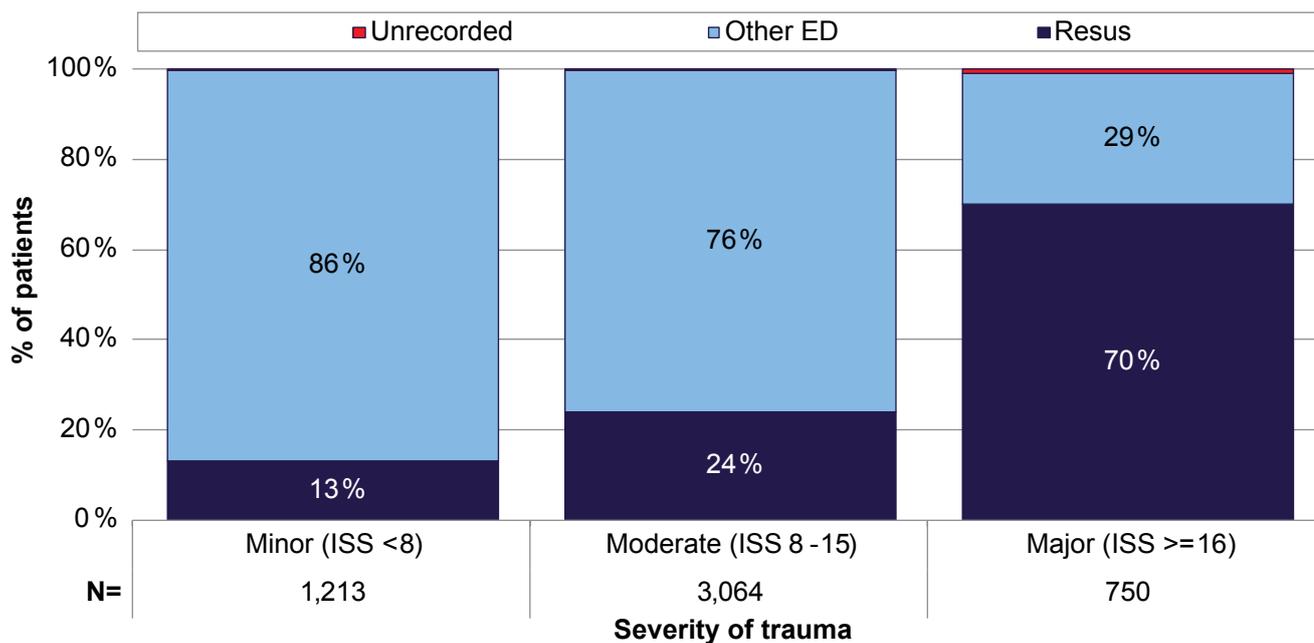
Note: 1992-2002 percentages calculated using cases where attendance time was recorded (N=52,644). Cases where this information was not available have been excluded (N=13).

'In hours' attendances are those that took place on a week day between the hours of 8:00am and 7:59pm.  
 'Out of hours' attendances are those that took place at any time at the weekend or on a week day between the hours of 8:00pm and 7:59am

Timing and severity of trauma information should be one of the considerations used to inform future workforce planning including rota management.

Additional information can be accessed on the STAG website [www.stag.scot.nhs.uk](http://www.stag.scot.nhs.uk).

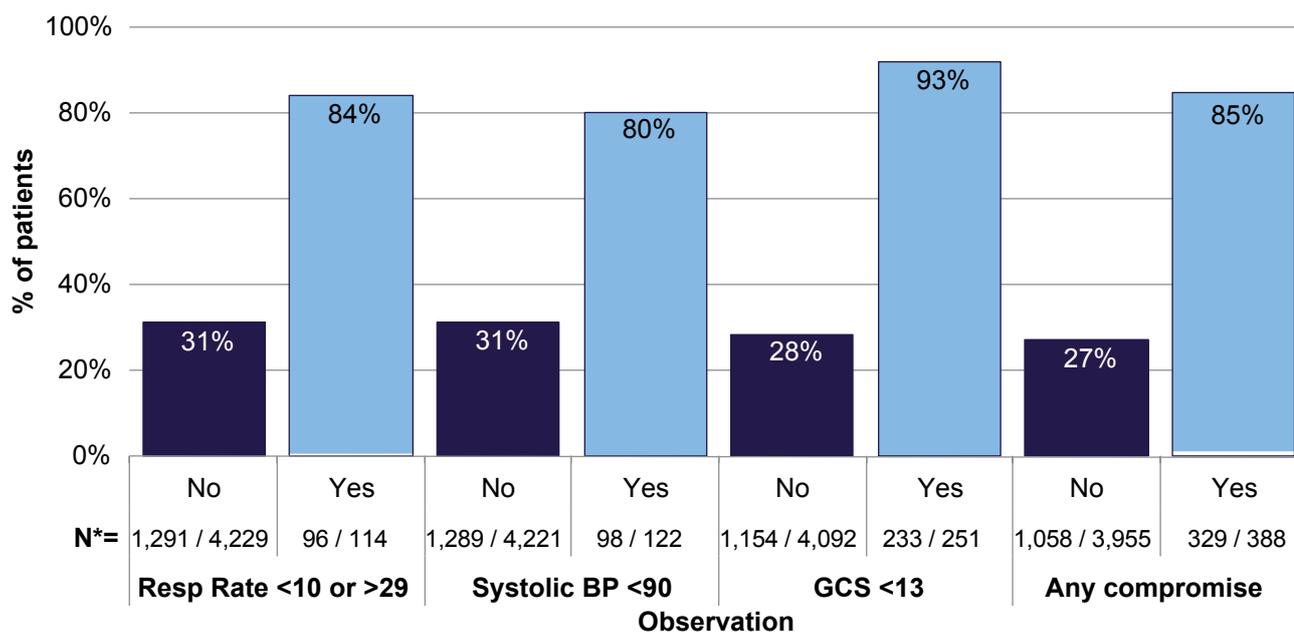
**Figure 3.5 Percentage of patients initially triaged to resus / other ED area, by level of trauma (2012)**



Note: 750 patients with major trauma were included in the audit. 526 (70%) were initially triaged to resus. A further 46 (6%) were retriaged to resus.

The majority of major trauma patients (70%) are initially triaged to the Resuscitation room (resus). The triage of a patient into resus elicits an immediate senior response and is likely to influence the resultant patient journey. This figure is unchanged from 2011 and reduced when compared to historical data from 1992–02 (78% vs. 70%). Local review of SAS pre-alert rates and ED triage may be appropriate.

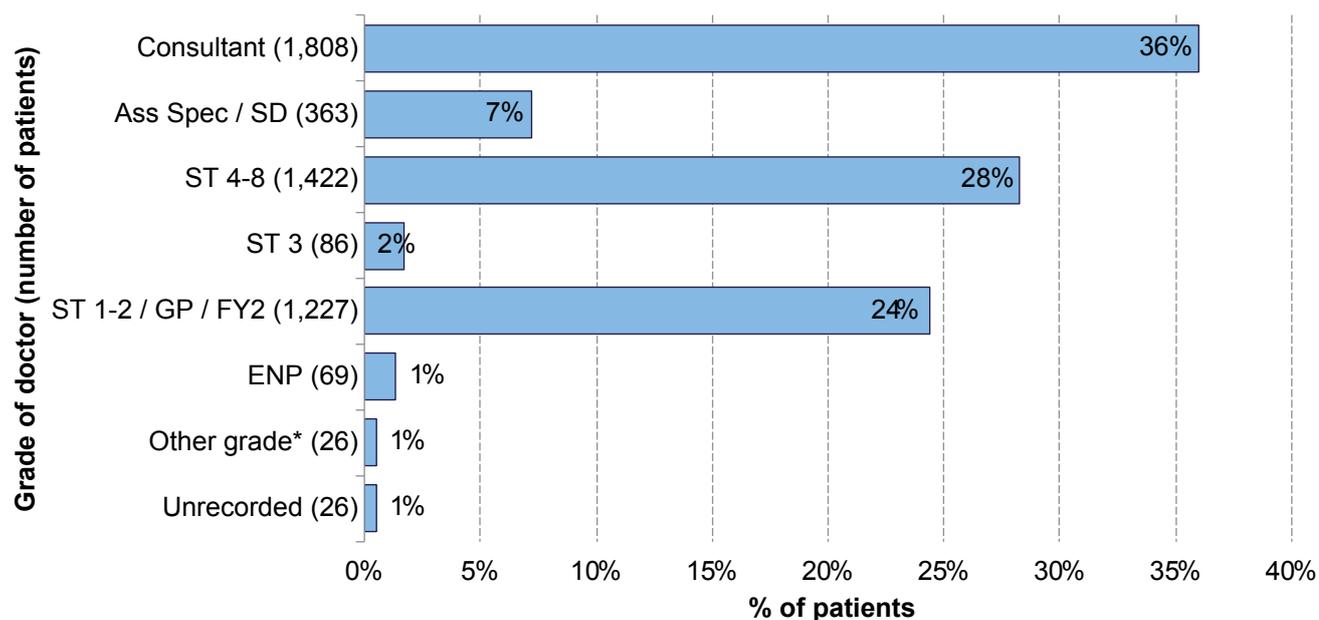
**Figure 3.6 Percentage of patients initially triaged to resus, by physiology on attendance (2012)**



N = number of cases where patient was initially triaged to resus / number of cases without or with compromised physiology.

Note: Percentages based on cases where respiratory rate, systolic blood pressure and Glasgow Coma Scale were available (N=4,343). Cases where these observations were allocated have been excluded (N=684).

A greater proportion of patients with a compromised respiratory rate, systolic blood pressure or GCS are initially triaged to the resuscitation room when compared with 2011 data, highlighting the importance of routine recording of physiology.

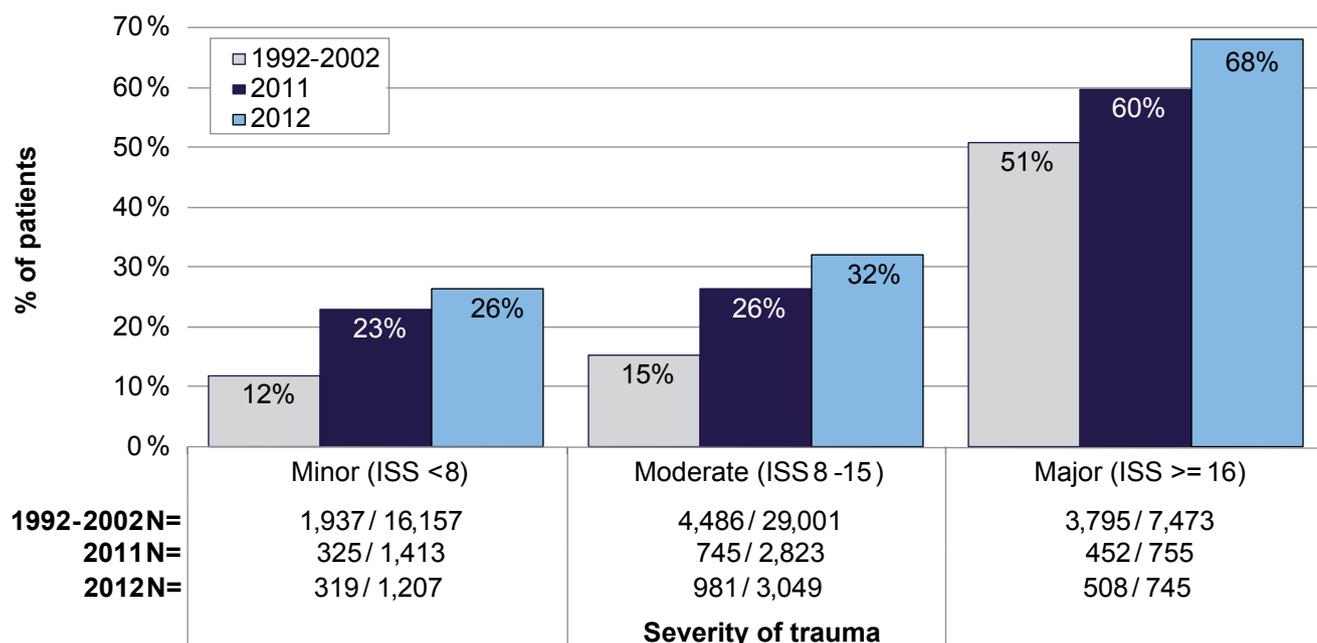
**Figure 3.7 Most senior doctor documented as attending in ED (2012)**

\* Other grade include Foundation Year 1 / Clinical Assistant (N=4) and Locum (N=22).

Key: Ass. Spec / SD: Associate Specialist / Specialty Dr      GP: General Practitioner  
 ENP: Emergency Nurse Practitioner      ST: Specialist Trainee  
 FY: Foundation Year

There is an increase in consultant management of all trauma patients within the ED to 36% in 2012 (30% in 2011).

**Figure 3.8 Percentage of cases where a Consultant attended in ED, by severity of trauma (1992–2002 vs. 2011 vs. 2012)**

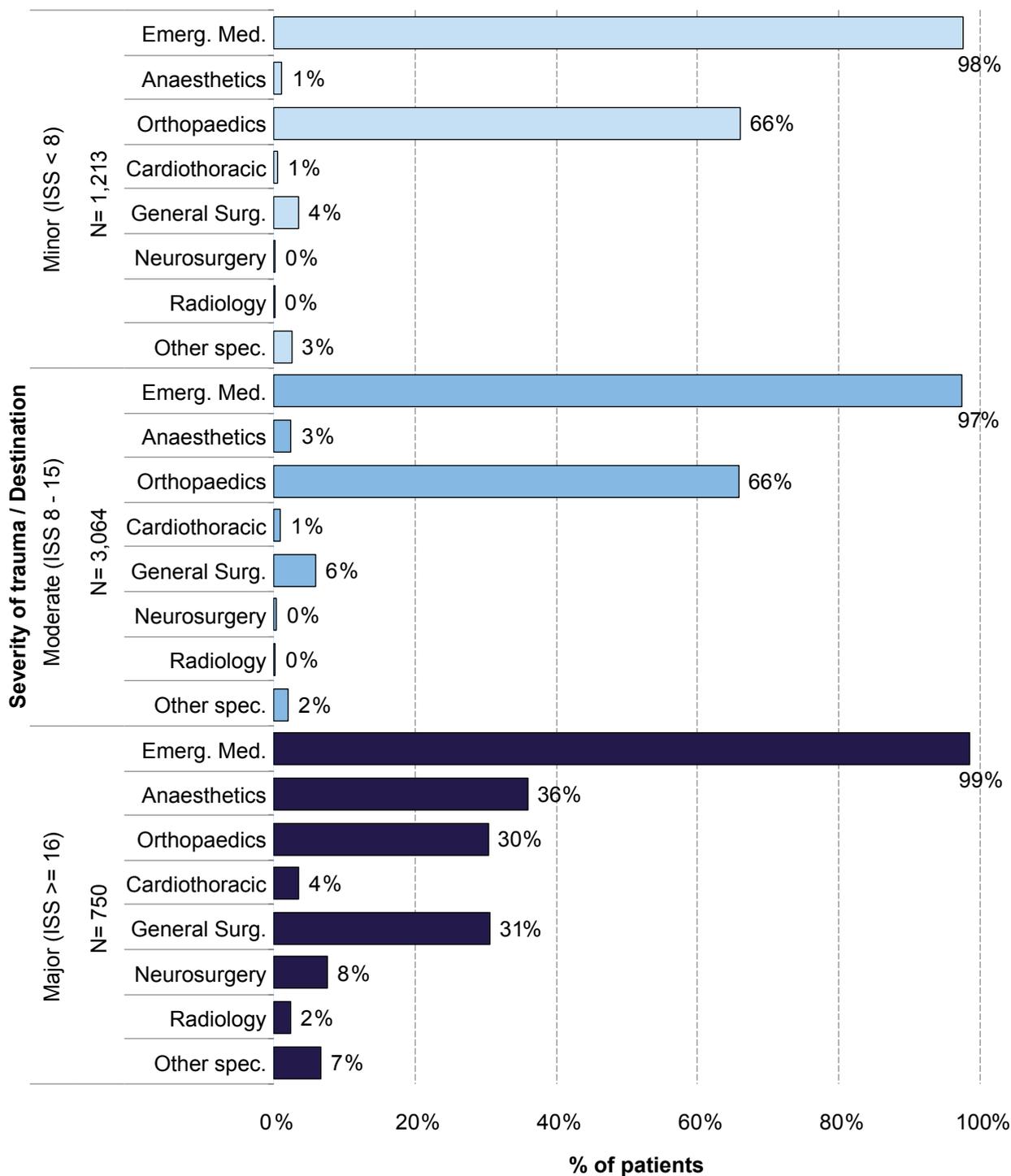


N = number of cases where patient was attended by a Consultant / number of cases with this level of trauma.

Note: Percentages were calculated using cases where most senior doctor was recorded (1992-2002: N=52,631, 2011: N=4,991, 2012: N=5,001). Cases where this information was not available have been excluded (1992-2002: N=26, 2011: N=54, 2012: N=26).

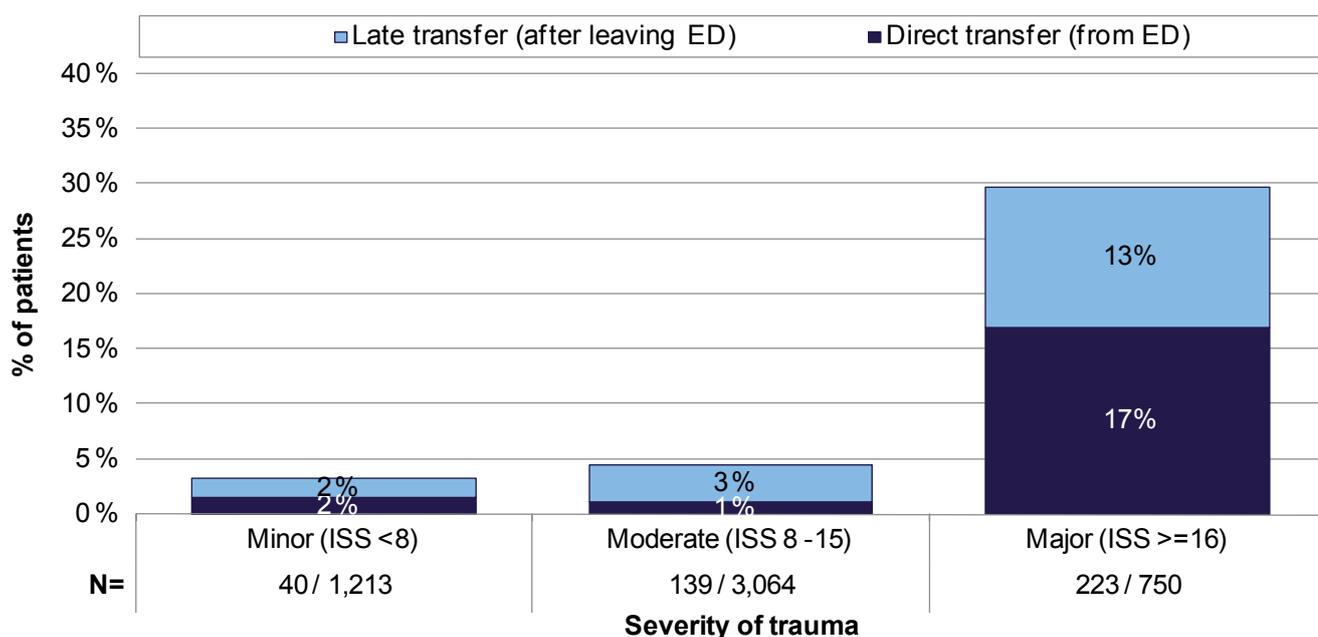
Management of trauma patients by a consultant continues to increase, most notably major trauma cases where almost 70% are documented as having a consultant present compared to 60% in 2011. Expansion in consultant numbers, new working patterns and improved documentation may have contributed to this with likely benefit to patients in terms of senior decision making.

**Figure 3.9 Percentage of patients who were attended by a particular specialty in ED, by severity of trauma (2012)**



The proportion of all trauma patients attended by Emergency Medicine is notable for all groups. As trauma severity increases, the mix of medical staff from various specialties increases. There is no notable change from 2011.

**Figure 3.10 Percentage of patients transferred to another STAG hospital or regional centre, by severity of trauma (2012)**



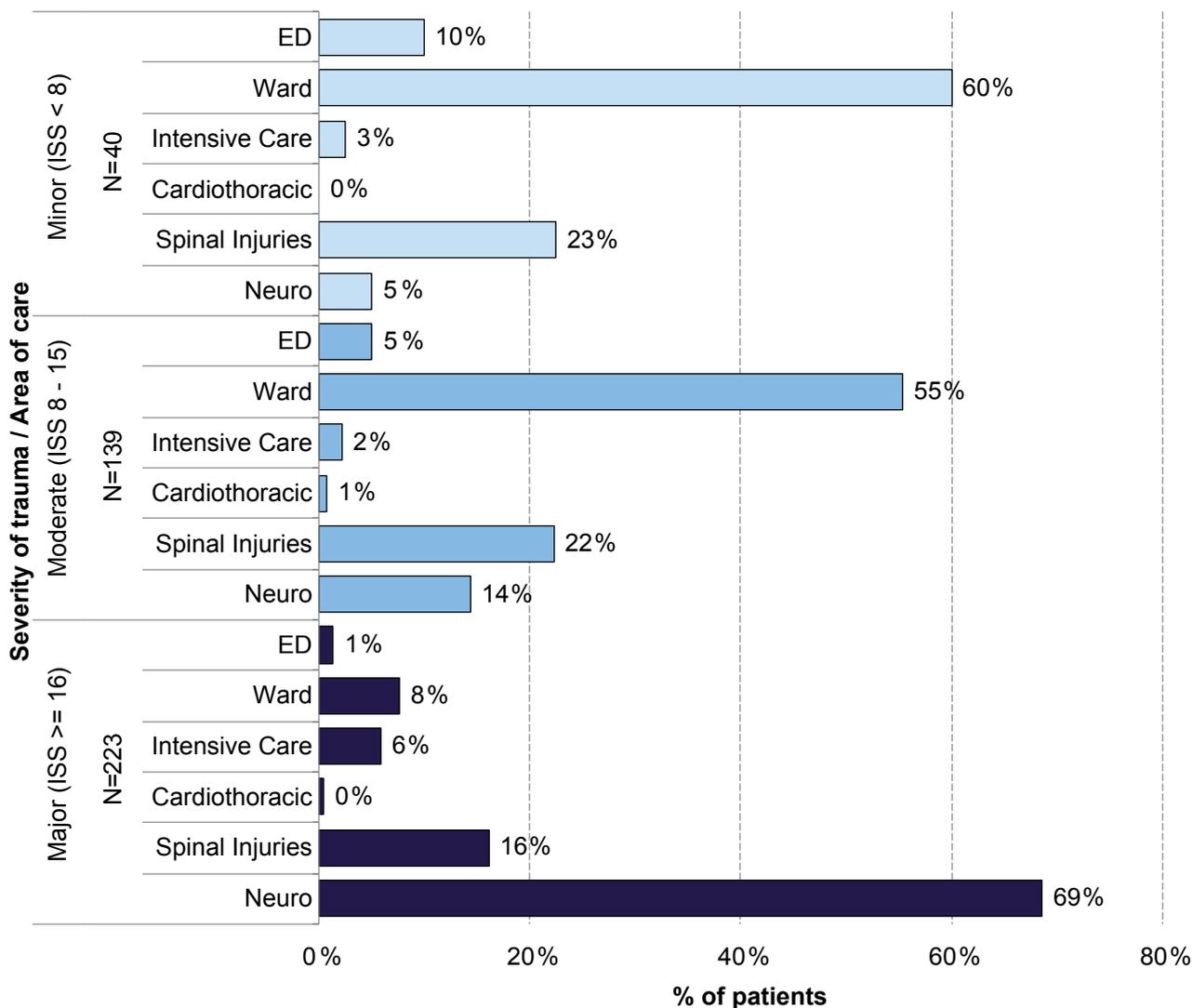
N = number of cases where patient was transferred / number of cases with this level of trauma.

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

Patients with major trauma are more likely to be transferred to another hospital from the ED of initial attendance, 17% of major traumas in 2012, highlighting the complex journey many severely injured patients have. Furthermore 13% major traumas are transferred to another hospital following admission (late transfer). In total 4% minor injuries were transferred, 4% moderates and 30% majors suggesting that the initial receiving hospital could not meet all of the healthcare needs of the patient, either for clinical or non clinical reasons.

Additional information can be accessed on the STAG website [www.stag.scot.nhs.uk](http://www.stag.scot.nhs.uk).

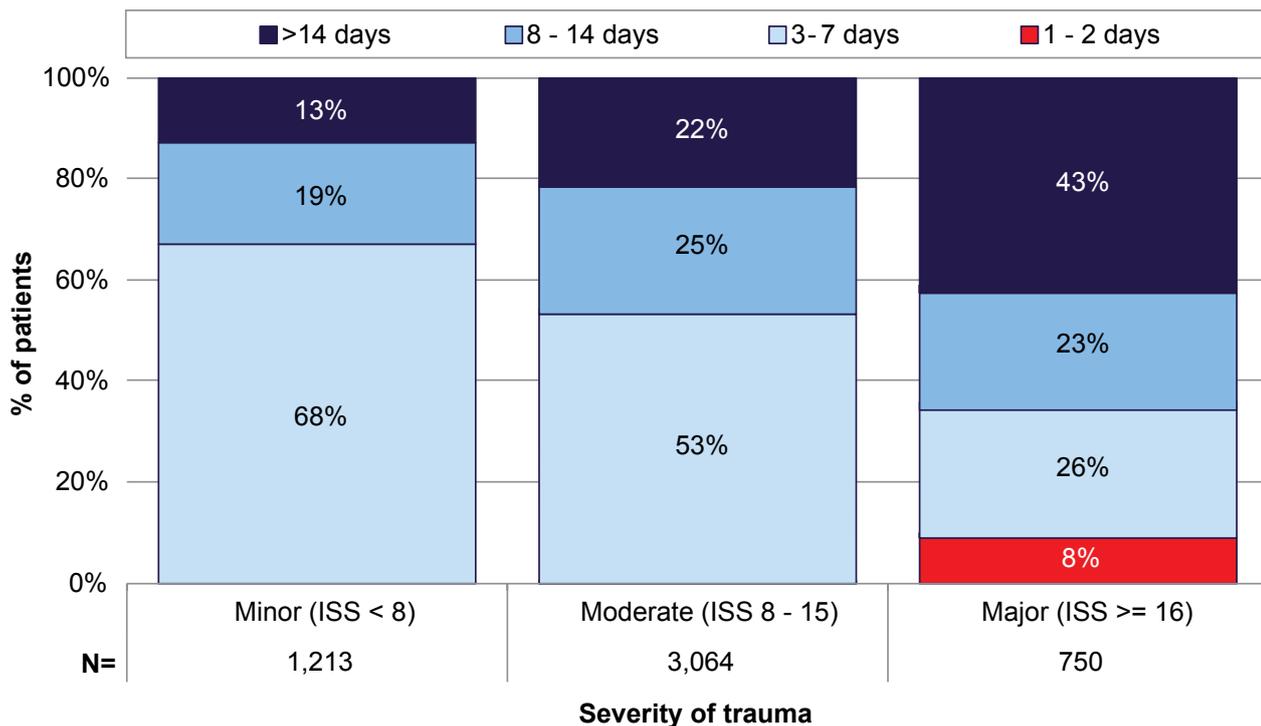
**Figure 3.11 Transferred patients only: specialist area of care that patients were transferred to in the receiving hospitals, by severity of trauma (2012)**



Note: Percentages were calculated using cases where the patient was transferred to another STAG hospital or regional centre (N=402).

Major trauma transfers are dominated by the requirement for neurosurgery.

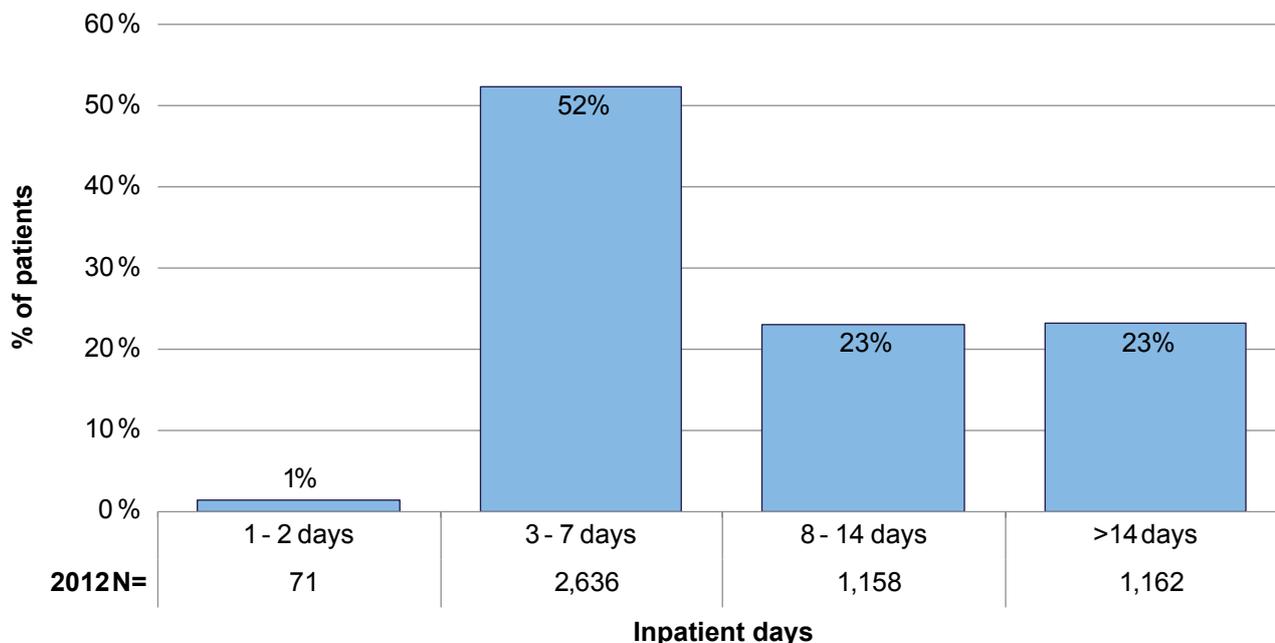
**Figure 3.12 Length of inpatient stay, by severity of trauma (2012)**



Note: All patients with an inpatient stay of < 3 days died. Patients with an inpatient stay of < 3 days who survived are not included in the STAG Trauma Audit.

Patients with major trauma injuries tend to stay in hospital for longer periods which equates to more than 14 days for 43% of cases.

**Figure 3.13 Length of inpatient stay (2012)**



More than 50% of trauma patients spend between 3–7 days in hospital, which is comparable to 2011.

## Section 4: Quality Indicators

In response to the requirements of the Quality Strategy<sup>7</sup> to ensure data is used for local improvement, the STAG Steering Group developed a set of Quality Indicators using either published guidance or evidence of best practice collated from the literature and quality improvement organisations (e.g. Healthcare Improvement Scotland<sup>8</sup>), see Appendix A.

The purpose of allocating indicators to the trauma patient journey is to identify patients for potential local review through departmental audit or morbidity and mortality meetings, thereby attempting to maximise learning and improve patient care through local use of the audit data.

Each indicator suggests a process or an intervention that may or may not have been beneficial at that particular point in the patient journey.

If an indicator has not been achieved, or the information required to determine this is not available, then the case should be reviewed locally where there is a comprehensive understanding of how trauma services are configured and individual patient information is available.

The fact that an indicator has not been met does not infer that the management of the patient has been sub-optimal. The number and severity of injuries sustained by a patient may not initially be fully apparent and may only become evident following further care or investigation.

The aggregation of national information on lessons learned and differing clinical approaches to the management of patients with specific trauma will provide a useful learning tool for all of those who are involved in managing this complex group of patients. The number of individual patient reviews performed as a direct result of STAG data increases year on year and is a continuing focus of STAG to encourage the local review of all patients who are highlighted by the indicators.

Each participating site was asked to report on how they use their monthly Quality Indicator reports to improve patient care in their centres and collated responses are detailed below. The full responses, in the clinicians own words can be accessed on the STAG website [www.stag.scot.nhs.uk](http://www.stag.scot.nhs.uk).

Clinical Audit Leads reported that Emergency Departments are using STAG data to improve patient care by:

- Reviewing care at clinical governance meetings, specific STAG audit monthly meetings and monthly morbidity and mortality meetings to identify areas of quality improvement and develop action plans.
- Increasing communications between specialities during the process of reviewing patients.
- Using learning points from these meetings to educate trainee clinicians and nursing staff at departmental teaching sessions.

Several specific clinical improvements have been made as a direct result of supporting evidence provided by STAG data. These include:

- Development of consultant call-out activation criteria.
- Clinical intervention such as the recording of venous gases on attendance now included as part of the routine treatment of trauma patients.
- Introduction of specific trauma admission documentation in three sites.
- Improvement of the patient journey and reduction in waiting times in two sites due to enhanced access to radiology facilities.
- Development of a case to support availability of on site staff to enable 24hr access to radiology investigation.
- Liaison with the Scottish Ambulance Service to increase the frequency of pre-alert calls to ED for trauma patients.

- Purchase of new medical equipment to enhance the care of specifically injured patients.

The development of local clinical protocols and on-site training has been supported. For example:

- Review of a major haemorrhage protocol.
- Introduction of a spinal injury treatment guideline.
- Advanced Trauma Life Support (ATLS) training for trainee Orthopaedic clinicians.
- Surgical High Dependency pathway.
- Guidelines to direct the usage of radiology investigation have been improved and updated in two sites.
- Training for ED nurses on care of trauma patients.

## Section 5: Outcome

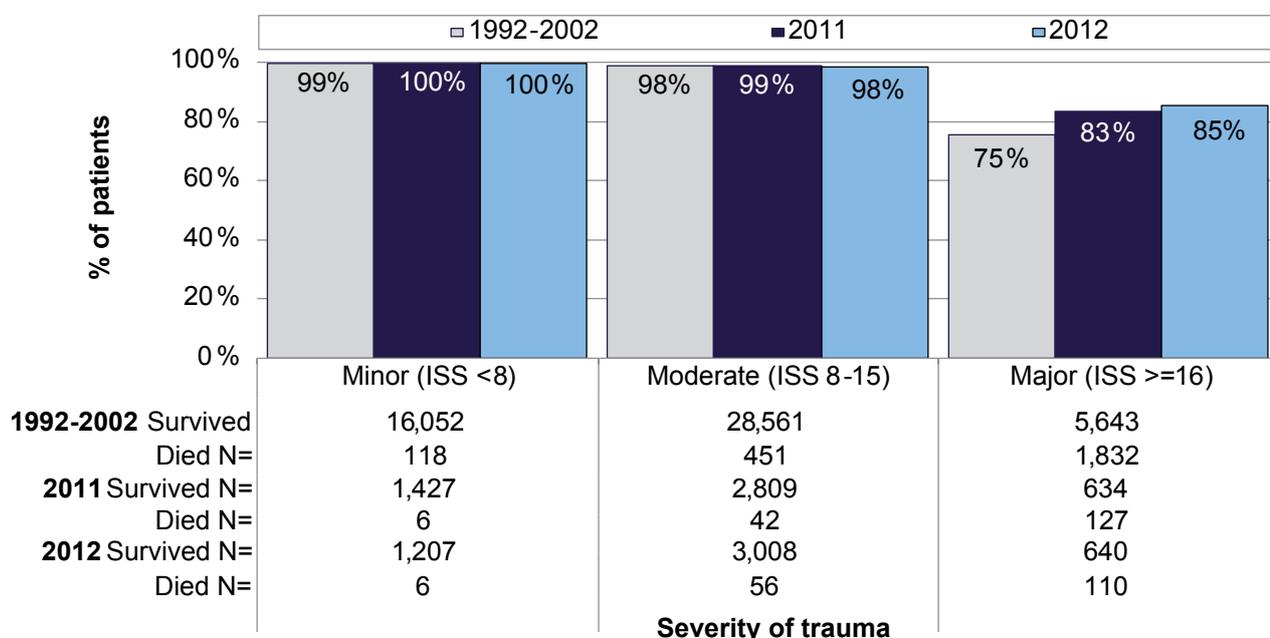
### Median age, by patient outcome (2012)

The overall median age for trauma patients in 2012 has risen to 55 years (54 years in 2011 and 49 years in 1992–2002). The median age of the patients who died during 2012 has also increased to 74 years which compares with 70 years and 59 years for 2011 and 1992–2002 respectively. This may be associated with changes in demographics and mechanisms of injury.

There is no precise cause of death recorded for patients on the STAG database. Work continues to achieve linkage with SMR01<sup>3</sup> and National Records of Scotland (NRS) data to provide this information. SMR linkage will also provide greater detail around prior morbidity and the association with trauma outcome.

Additional information can be accessed on the STAG website [www.stag.scot.nhs.uk](http://www.stag.scot.nhs.uk).

**Figure 5.1 Percentage of patients who survived, by severity of trauma (1992–2002 vs. 2011 vs. 2012)**



There is an increase in the proportion of patients surviving major trauma (ISS ≥ 16) from 83% in 2011 to 85% in 2012. This has been sustained for a second twelve month period.

**Figure 5.2 Percentage of patients who survived, by highest AIS\* Score (2012)**

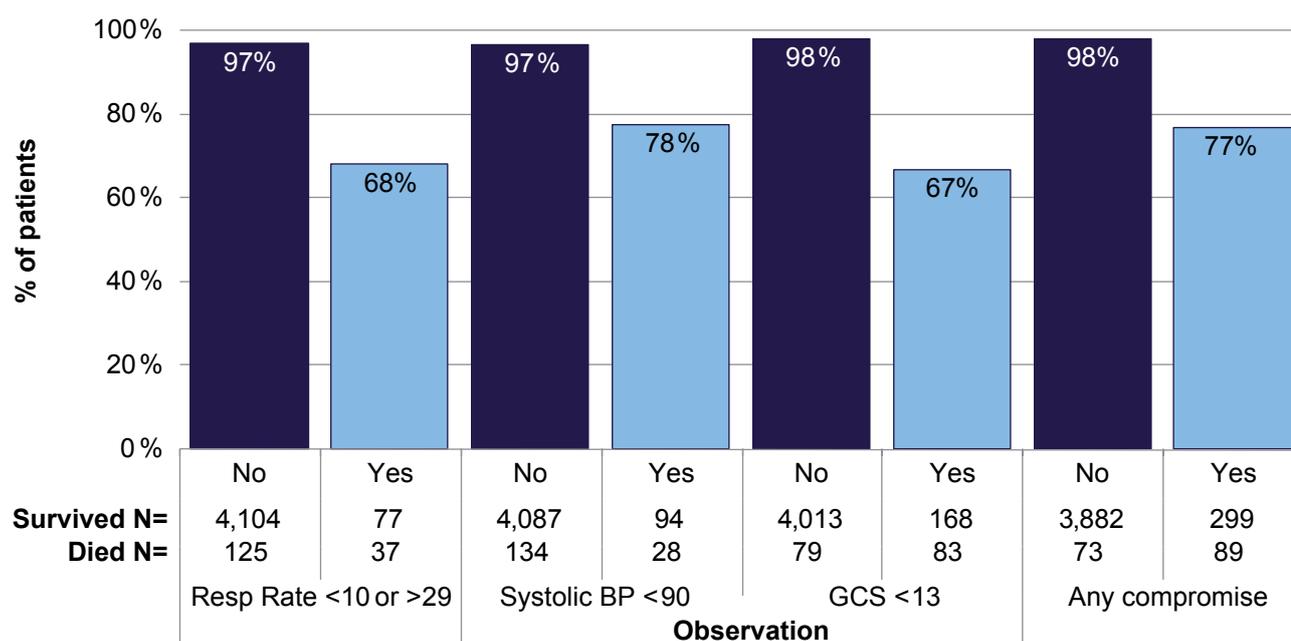
AIS Score 2012	No. patients			% of patients		
	Dead	Alive	Total	Dead	Alive	Total
Minor	0	25	25	0%	100%	100%
Moderate	8	1,263	1,271	1%	99%	100%
Serious	63	3,046	3,109	2%	98%	100%
Severe	27	368	395	7%	93%	100%
Critical/Maximum	74	153	227	33%	67%	100%
<b>Total</b>	<b>172</b>	<b>4,855</b>	<b>5,027</b>	<b>3%</b>	<b>97%</b>	<b>100%</b>

Chi-Squared test P<0.05

\* AIS: Abbreviated Injury Scale

The Abbreviated Injury Scale<sup>6</sup> Score is a component part of the Injury Severity Score (ISS). If patients are categorised by their single most severe injury improvement in survival at the severe end of the spectrum can be demonstrated. Results in 2012 are comparable with 2011.

**Figure 5.3 Percentage of patients who survived, by physiology on attendance (2012)**



Note: Percentages based on cases where respiratory rate, systolic blood pressure and Glasgow Coma Scale were available (N=4,343). Cases where these observations were allocated 'normal' values have been excluded (N=684).

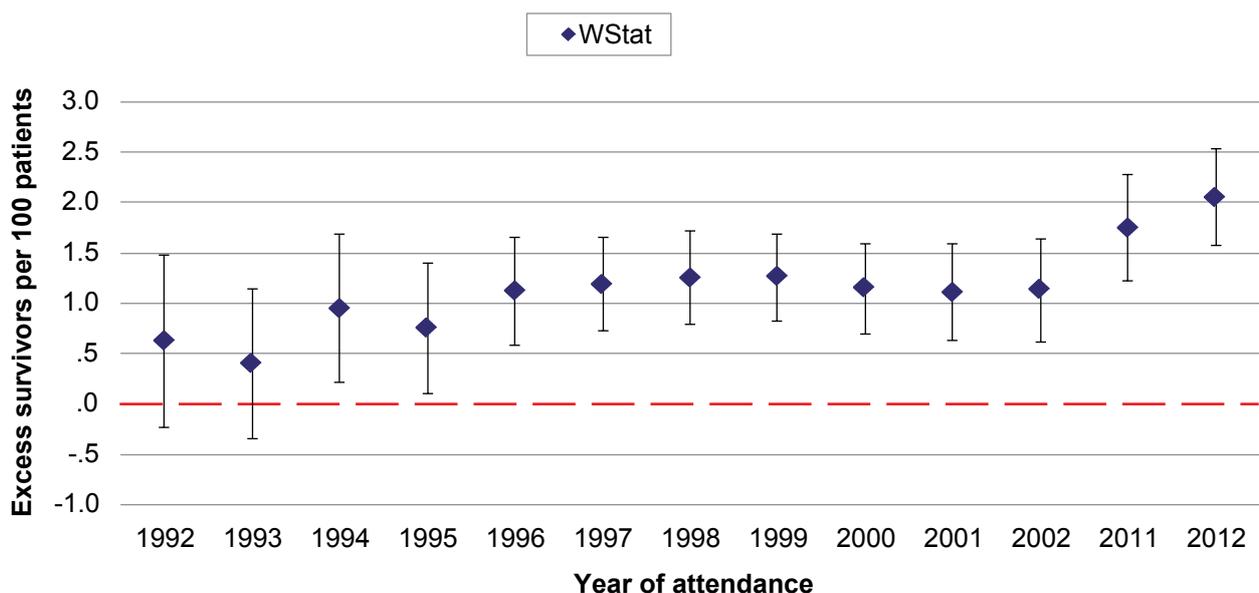
There is little change this year compared to 2011. Any physiological compromise results in reduction in survival from 98% to 77%. The group with the highest mortality are those with reduced conscious level (GCS <13). The 73 deaths that occurred in patients who did not have any physiological compromise on arrival are comparable with the number in 2011 (69 deaths).

**Figure 5.4 Percentage of patients who survived, by population density at place of incident (2012)**

Population	No. patients				% of patients				
	Dead	Alive	Not recorded	Total	Dead	Alive	Not recorded	Total	Total
Urban	147	3,951	0	4,098	4%	96%	0%	100%	100%
Rural	19	527	0	546	3%	97%	0%	100%	100%
Unrecorded	6	377	0	383	2%	98%	0%	100%	100%
Total	172	4,855	0	5,027	3%	97%	0%	100%	100%

The definition for urban and rural population densities has changed since the 1992–2002 dataset which precludes any direct comparison.

There is no difference in outcome if the incident location is rural rather than urban.

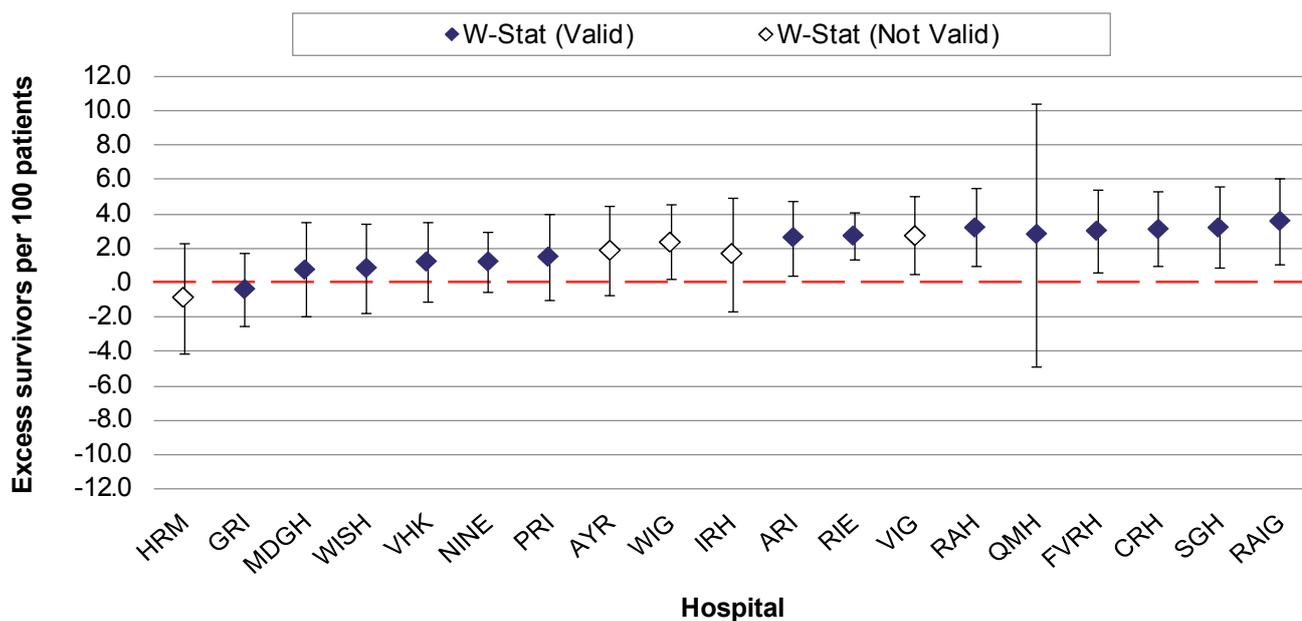
**Figure 5.5 Revised W-Statistic for patients with blunt trauma: Scotland, (1992–2002, 2011 and 2012)**

Note: Where observations were not available on attendance (N=675 blunt trauma cases) 'normal' physiological values are allocated in order to calculate the patient's probability of survival. For the purpose of this analysis, 'normal' values were defined as systolic blood pressure 120mmHg, respiratory rate 14 bpm, and Glasgow Coma Score (GCS) 15.

There is a trend towards overall improvement and the number of excess survivors per hundred patients. The figure for 2012 is calculated as two excess survivors.

Figure 5.6 shows a breakdown of this overall W-statistic for each contributing site. The coefficients used to calculate the blunt trauma W-statistics are derived from the UK based Trauma Audit & Research Network<sup>9</sup> (TARN) database. The W-statistic is 'revised' with respect to injury severity to allow for case-mix variation amongst hospitals and from the TARN database. It should be noted that the W-statistic shows excess survivors relative to the reference TARN database and not absolute survival. Confidence intervals that cross the zero line are not statistically significant.

**Figure 5.6 Revised W-Statistic for patients with blunt trauma: Hospital, (2012)**



Use of the Revised W-statistic is inappropriate ('Not Valid') for hospitals where the case-mix is significantly different from that of the reference database (TARN). See appendix F for further information.

## Section 6: Conclusions

Outcome for patients who have suffered significant trauma in Scotland continues to improve year on year. The data contained in this report confirm this and provide evidence of increased involvement of consultants in the care of all trauma patients as well as major trauma patients. The use of physiological information to guide the patient journey has improved and appears to be getting the right patient to the right place at the right time in order to elicit a specific healthcare response. The utilisation of audit data for quality improvement at a local level, where local systems understanding is maximal, has increased.

These reviews need to continue to be multi-disciplinary in nature as this is representative of the healthcare responses that are provided for patients. Excellent care can be provided by individual Scottish Ambulance Service crews and other pre-hospital services, Emergency Departments, Surgical Units, Orthopaedic Departments, Theatres and Intensive Care Units. However, it is also by further enhancing the boundaries between these individual services and engendering a greater understanding of the contribution that each service makes that care will improve. This is the purpose of multi-disciplinary review using high quality clinical audit data and Boards need to be assured that this is happening at a local level.

The national coverage that STAG provides for trauma, based on Emergency Department attendances<sup>10</sup>, continues at around 70%, and rises in view of bypass arrangements for certain hospitals and the onward transfer of patients from the original receiving centre onto higher care facilities that contribute information to STAG. The configuration of trauma services within Scotland remains under review in an attempt to further enhance the provision of care. Supporting evidence from the medical literature is heterogeneous in nature and often involves different healthcare systems that have distinct patterns of trauma. The case for change is not found in the literature but in the need to pursue continuous clinical improvement.

Importantly, of the patients who suffered major trauma in 2012, 30% were transferred from the original receiving hospital, compared with 37% in 2011. Transfers were again dominated by the requirement for neurosurgery although this overall figure needs to be better understood in terms of pre-hospital decision making, the impact of the whole patient journey on the resources of the original receiving unit, and, ultimately, on the quality of care that is provided for the patient. The Scottish Ambulance Service, working with pre-hospital partners, including pre-hospital medical practitioners with extended skills, pre-hospital medical trauma teams and Emergency Medical Retrieval Services, will be central to this and it may be that more dynamic pre-hospital support and triage could further enhance care. Any modifications to the patient journey need to be assured through STAG. Final completion of database linkages will enhance patient journey understanding.

Overall returns to STAG remain encouraging and representative of the national trauma care. There are still difficulties with complete data submission from some sites. The National Audit Office Report<sup>11</sup> into major trauma care in England made the explicit recommendation that all hospitals that receive unselected trauma patients must submit data to the national trauma audit both for quality improvement purposes and to inform the ongoing development of trauma care. This is a generic standard and ensuring that all acute sites that receive unselected trauma in Scotland submit data to STAG should be seen as a priority, and the necessary support to achieve this should be provided.

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## Appendix A: Quality Indicators

Note that the Abbreviated Injury Scale (AIS)<sup>6</sup> severity codes are allocated retrospectively so clinical assessment of the patient is the guiding principle in complying with these indicators.

1. **Major trauma—standby call**  
Where a patient has suspected major trauma a pre-alert (standby) call should be made by the Scottish Ambulance Service (SAS) to the receiving ED.
2. **Major Trauma—triage**  
Patients with major trauma should be managed in the resuscitation room.
3. **Seniority of Response**  
Patients with major trauma should be attended by an Emergency Medicine (EM) Consultant within one hour of attendance.  
Patients with an abdominal injury of AIS  $\geq 3$  should be attended by a Consultant surgeon within one hour of attendance.
4. **Thoracic Trauma**  
Part 1: Patients with a thoracic injury of AIS  $\geq 2$  should have a chest x-ray within 30 minutes of attendance.  
Part 2: Patients with a thoracic injury of AIS  $\geq 2$  should have a CT scan within one hour of attendance.
5. **Abdominal Trauma**  
Part 1: Patients with signs of shock (systolic BP  $< 90$  mmHg on attendance) and an abdominal injury AIS  $\geq 3$  should have a laparotomy within one hour of attendance.  
Part 2: Patients with signs of shock (systolic BP  $< 90$  mmHg on attendance) and an abdominal injury AIS  $\geq 3$  should have a CT scan within one hour of attendance.  
Patients who have an abdominal visceral injury should have a laparotomy within two hours of attendance.
6. **Head Trauma**  
Part 1: Patients with a head injury should have a GCS recorded on attendance.  
Part 2: Patients who are managed in the resuscitation room should have a GCS recorded on attendance.  
Patients with a reduced conscious level (GCS  $\leq 12$ ) and/or a base of or depressed skull fracture should have a head CT scan within one hour of attendance.  
Patients with a severe head injury (AIS  $\geq 3$ ) should be transferred (if no on-site availability) to a setting with 24-hour on-site access to a Neurosurgical Intensive Care Unit (NICU), regardless of whether surgical intervention is required.
7. **Spinal Trauma**  
The management of patients with spinal injuries AIS  $\geq 3$  should be discussed with the Spinal Injuries Unit (SIU) at the Southern General Hospital before leaving the first receiving STAG ED.
8. **Open Fractures**  
Part 1: Patients with open limb fractures should receive IV antibiotics within one hour of attendance.  
Part 2: Patients with open limb fractures should be surgically managed by a Consultant orthopaedic and/or plastic surgeon within 24 hours of attendance.
9. **Complex Pelvic Trauma**  
Patients with pelvic fractures should have a pelvic binder applied within 30 minutes of attendance.

**10. Major Trauma—immediate management**

Part 1: Patients with major trauma should have oxygen saturation measured in the ED.

Part 2: Patients with major trauma should have arterial blood gases (ABG) measured in the ED.

Part 3: Patients with major trauma should have 12-lead ECG performed in the ED.

Part 4: Patients with major trauma should have an Early Warning Score (EWS) chart commenced in the ED.

The supporting evidence for the Quality Indicators is described elsewhere ([www.stag.scot.nhs.uk/Trauma/Quality\\_Indicators\\_V2.0.pdf](http://www.stag.scot.nhs.uk/Trauma/Quality_Indicators_V2.0.pdf)).

## Appendix B: Quality Indicator Report Template

### STAG Quality Indicators Summary

The table below summarises your hospital's performance to date against each STAG Quality Indicator. For full information about each indicator and case selection criteria, a monthly breakdown of performance or details of national performance please see the remaining pages of this report. All cases where a patient did not comply with one or more indicator, or compliance is unknown/TBC, are flagged for local hospital review. Cases where the patient's outcome was not as expected are also flagged for review.

Indicator	Cases Selected	Compliant		To be reviewed		Unknown / TBC	
		XX	X.X%	XX	X.X%	XX	X.X%
1: Where patient has major trauma a pre-alert/standby call should be made by the Scottish Ambulance Service.	XX	XX	X.X%	XX	X.X%	XX	X.X%
2: Patients with major trauma should be managed in the resuscitation room.	XX	XX	X.X%	XX	X.X%	XX	X.X%
3a: Patients with major trauma should be attended by an Emergency Medicine Consultant within hour.	XX	XX	X.X%	XX	X.X%	XX	X.X%
3b: Patients with abdominal injury AIS $\geq 3$ should be attended by Consultant surgeon within hour.	XX	XX	X.X%	XX	X.X%	XX	X.X%
4 (part 1): Patients with thoracic injury AIS $\geq 2$ should have chest x-ray within 30 mins.	XX	XX	X.X%	XX	X.X%	XX	X.X%
4 (part 2): Patients with thoracic injury AIS $\geq 2$ should have CT scan within hour.	XX	XX	X.X%	XX	X.X%	XX	X.X%
5a (part 1): Patients with signs of shock and abdominal injury AIS $\geq 3$ should have a laparotomy within hour.	XX	XX	X.X%	XX	X.X%	XX	X.X%
5a (part 2): Patients with signs of shock and abdominal injury AIS $\geq 3$ should have CT scan within hour.	XX	XX	X.X%	XX	X.X%	XX	X.X%
5b: Patients who have an abdominal visceral injury should have a laparotomy within two hours.	XX	XX	X.X%	XX	X.X%	XX	X.X%
6a (part 1): Patients with head injury should have a GCS recorded on attendance.	XX	XX	X.X%	XX	X.X%	XX	X.X%
6a (part 2): Patients who were managed in the resuscitation room should have a GCS recorded on attendance.	XX	XX	X.X%	XX	X.X%	XX	X.X%

Indicator	Cases Selected	Compliant		To be reviewed		Unknown / TBC	
		XX	X.X%	XX	X.X%	XX	X.X%
6b: Patients with reduced conscious level and/or base of or depressed skull fracture should have CT scan within hour.	XX	XX	X.X%	XX	X.X%	XX	X.X%
6c: Patients with severe head injury should be transferred (if no onsite availability) to setting with 24-hour on-site access to Neuro ICU, regardless of whether surgical intervention is required.	XX	XX	X.X%	XX	X.X%	XX	X.X%
7: The management of patients with spinal injuries AIS $\geq$ 3 should be discussed with Spinal Injuries Unit.	XX	XX	X.X%	XX	X.X%	XX	X.X%
8 (part 1): Patients with open limb fractures should receive IV antibiotics within hour.	XX	XX	X.X%	XX	X.X%	XX	X.X%
8 (part 2): Patients with open limb fractures should be surgically managed by a consultant orthopaedic and/ or plastic surgeon within 24 hours.	XX	XX	X.X%	XX	X.X%	XX	X.X%
9: Patients with pelvic fractures should have a pelvic binder applied within 30 mins.	XX	XX	X.X%	XX	X.X%	XX	X.X%
10 (part 1): Patients with major trauma should have oxygen saturation measured in ED.	XX	XX	X.X%	XX	X.X%	XX	X.X%
10 (part 2): Patients with major trauma should have ABGs measured in ED.	XX	XX	X.X%	XX	X.X%	XX	X.X%
10 (part 3): Patients with major trauma should have 12-lead ECG performed in ED.	XX	XX	X.X%	XX	X.X%	XX	X.X%
10 (part 4): Patients with major trauma should have EWS chart commenced in ED.	XX	XX	X.X%	XX	X.X%	XX	X.X%
Total number of attendances to be reviewed by your hospital:	XX	(Details supplied in Report Appendix)					

## Appendix C: Steering Group Members

Name	Title	Organisation	
Mr Lee Barnsdale	Principle Analyst	Scottish Healthcare Audits	Information Services Division
Mr Stuart Baird	Service Manager	Scottish Healthcare Audits	Information Services Division
Mr Ian Colquhoun	Consultant, Cardiothoracic Surgery	Department of Cardiothoracic Surgery	Golden Jubilee Hospital
Dr Angus Cooper	Consultant, Emergency Medicine	Emergency Department	Aberdeen Royal Infirmary
Dr Alasdair Corfield	Consultant, Emergency Medicine	Emergency Department	Royal Alexandra Hospital, Paisley
Dr Colin Dewar	Consultant, Emergency Medicine	Emergency Department	Victoria Hospital, Kirkcaldy
Sarah Dickie	Nurse Consultant	Emergency Department	Ayr Hospital
Dr Neil Dignon	Consultant, Emergency Medicine	Emergency Department	Glasgow Royal Infirmary
Mr Michael Fitzpatrick	Consultant, Neurosurgery	Department of Clinical Neurosciences	Western General Hospital, Edinburgh
Dr Alasdair Gray	Consultant, Emergency Medicine	Emergency Department	Royal Infirmary Edinburgh
Mr Malcolm Gordon	Consultant, Emergency Medicine	Emergency Department	Southern General Hospital, Glasgow
Paul Gowans	Head of Clinical Governance	Clinical Directorate	Scottish Ambulance Service
Dr Gordon Houston	Consultant, Intensive Care Medicine	Intensive Care Unit	Crosshouse Hospital, Kilmarnock
Mr Jan Janssen	Consultant, ICM, Trauma Surgery	Department of Surgery	Aberdeen Royal Infirmary
Mr Mike Johnston	Consultant, Emergency Medicine	Emergency Department	Ninewells Hospital, Dundee
Helen MacGuire	Public Partner	N/A	
Dr. Crawford McGuffie	Consultant, Emergency Medicine	Emergency Department	Crosshouse Hospital, Kilmarnock
Sinforosa Pizzo	Senior Analyst STAG	Scottish Healthcare Audits	Information Services Division
Dr Dermot McKeown	Consultant, Intensive Care Medicine	Intensive Care Unit	Royal Infirmary Edinburgh

Name	Title	Organisation	
Kirsty Ward	Clinical Coordinator	Scottish Healthcare Audits	Information Services Division
Mr Tim White	Consultant, Orthopaedics	Department of Orthopaedics	Royal Infirmary Edinburgh
Dr Ian Zealley	Consultant, Radiology	Department of Nuclear Medicine	Ninewells Hospital, Dundee
Dr Rebecca Cranfield	EM Trainee Representative	Emergency Department	Royal Infirmary Edinburgh

## Appendix D: Participating Hospitals

Hospital	Lead Audit Consultant	Local Audit Coordinator
Aberdeen Royal Infirmary	Dr Angus Cooper	Kim Black
Ayr Hospital	Dr Teresa Hand	Elma Norwood
Crosshouse Hospital	Mr James Stevenson	Roselind Hall
Forth Valley Royal Hospital	Dr Ursula Mackintosh	Julie Watson
Glasgow Royal Infirmary	Dr Neil Dignon	Tricia Rose
Hairmyres Hospital	Dr Trish O'Connor	Helen Cameron
Inverclyde Royal Hospital	Dr Alasdair Corfield	Lorna Roberts
Monklands General Hospital	Dr David Litherland	Mhairi Forbes
Ninewells Hospital	Mr Michael Johnston	Susan Henderson
Perth Royal Infirmary	Mr Michael Johnston	Susan Henderson
Raigmore Hospital	Dr Noelle Murphy	Ishbel Trigg
Royal Alexandra Hospital	Dr Alasdair Corfield	Lorna Roberts
Royal Infirmary of Edinburgh	Dr Alasdair Gray	Rowena Conrad
Southern General Hospital	Mr Malcolm Gordon	Linda McKay
Victoria Hospital, Kirkcaldy	Dr Colin Dewar	Jacqui James/ Alison McRae
Victoria Infirmary, Glasgow	Dr Hannah Smith	Linda McKay
Western Infirmary, Glasgow	Dr Phillip Anderson	Lynn Ralph
Wishaw General Hospital	Dr Val McLean	Sharon Grierson

Regional support was provided by:

Ron Burges (Aberdeen Royal Infirmary, Ninewells Hospital, Perth Royal Infirmary, Raigmore, Hospital, Forth Valley Royal Hospital)

Deborah Murphy (Ayr Hospital, Crosshouse Hospital, Hairmyres Hospital, Inverclyde Royal Hospital, Monklands General Hospital, Royal Alexandra Hospital, Royal Infirmary of Edinburgh, Victoria Hospital, Kirkcaldy, Wishaw General Hospital.)

Lynn Ralph (Regional Transfers)

Margaret Winters – 2012 Acting Clinical Coordinator (Glasgow Royal Infirmary, Southern General Hospital, Victoria Infirmary, Western Infirmary.)



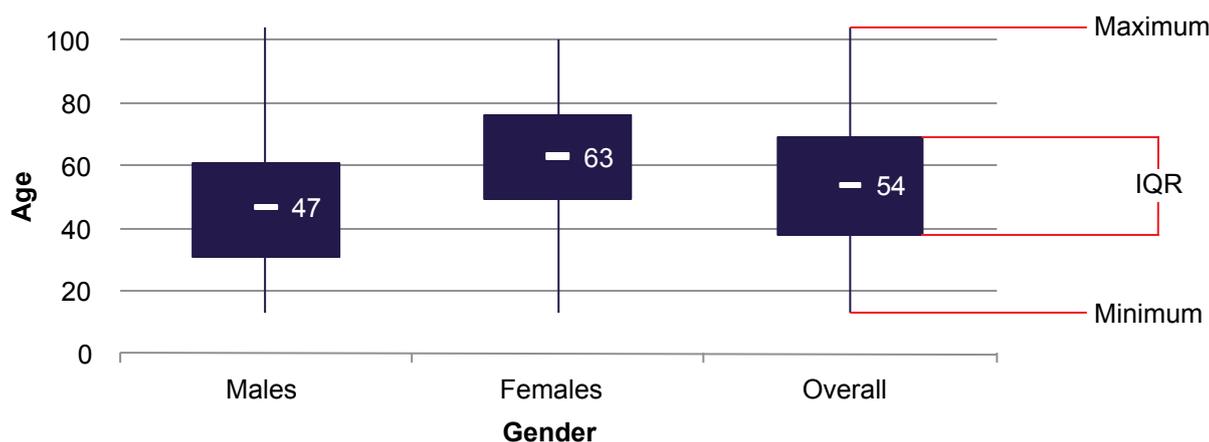


## Appendix F: Interpretation of Statistics

### Median and Inter-Quartile Range

Medians are used as a measure of central tendency. The median is simply the point at which, if values in the data range were sorted from high to low, the middle point would lie. Where median values are reported the inter-quartile range (IQR) is also given. The IQR represents the data range within which the middle 50% of values lie.

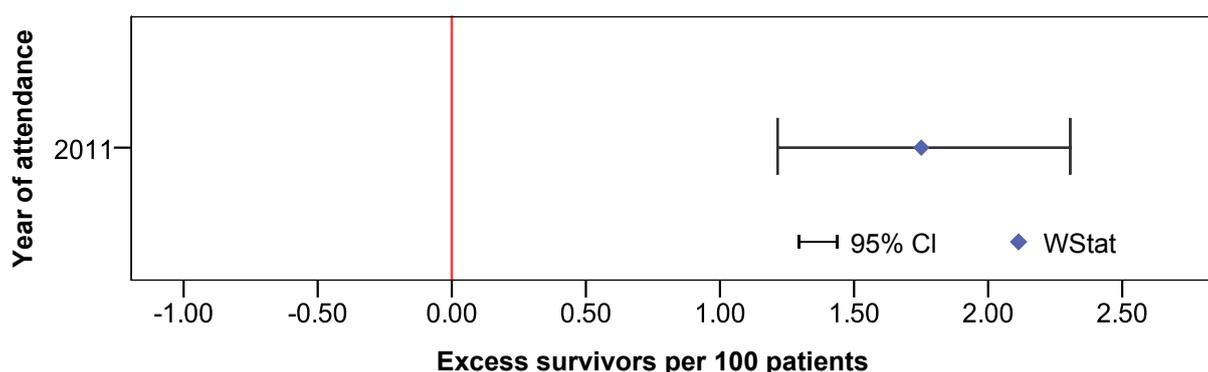
Example:



### Revised W-statistic

STAG use TRISS<sup>5</sup> methodology to determine the probability of survival for each patient. Observed survival is compared to expected survival using the Revised W-statistic and is expressed in terms of excess survivors per 100 patients either at a hospital or national level. A positive W-statistic indicates unexpected survivors, whereas a negative W-statistic indicates unexpected deaths.

Example:



The 95% Confidence Interval associated with the W-statistic shows whether the result is significantly different from zero; if the 95% CI crosses zero then the result is not statistically significant.

The coefficients used to calculate the blunt trauma W-statistic (Figure 5.6) is derived from the UK based Trauma Audit & Research Network (TARN) database. The W-statistic is 'revised' with respect to injury severity to allow for case-mix variation amongst hospitals and from the TARN database. It should be noted that the W-statistic shows excess survivors relative to the reference TARN database and not absolute survival.

## Missing Observations

The first observations (systolic blood pressure, respiratory rate and total GCS) recorded on arrival to the STAG ED are used to calculate the Revised Trauma Score (RTS)<sup>6</sup>. Where these are not available, the last observations recorded by the Scottish Ambulance Service (SAS), or the first within the first hour of arrival to the STAG hospital are used. In the event that any or all of these values are unavailable from these three sources, 'normal' physiological values are allocated. These 'normal' values are systolic blood pressure 120 mmHg, respiratory rate 14 bpm, and Glasgow Coma Score (GCS) 15. At least one normal value was allocated in 660 cases. This process allows the patient to be included in the audit but may introduce a degree of bias around the calculation of the probability of survival for these patients. Each instance of this was investigated by the relevant Local Audit Coordinator, including proactive education on the impact of the use of allocated values in an attempt to improve the availability of accurate observations.

## Coding Dictionaries

During the period described in this report the 1990 AIS dictionary (1998 revision)<sup>5</sup> was used to code and score patient injuries. STAG continued to use this version of the dictionary during 2012 to ensure a full years data be coded consistently. In order to facilitate future comparison with other trauma services in the UK and Europe, STAG began using the updated 2005 AIS dictionary from 1<sup>st</sup> January 2013. Use of the updated coding dictionary will also allow the change of probability of survival calculation to PS12<sup>9</sup>.

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During 2012 Margaret Winters was acting Clinical Coordinator.

Local audit staff collected, validated and quality assured the data. Regional coordinators participated in the quality assurance process and commented on drafts of the report.

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